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Community series: Expanding the science of compassion, volume II

Edited by
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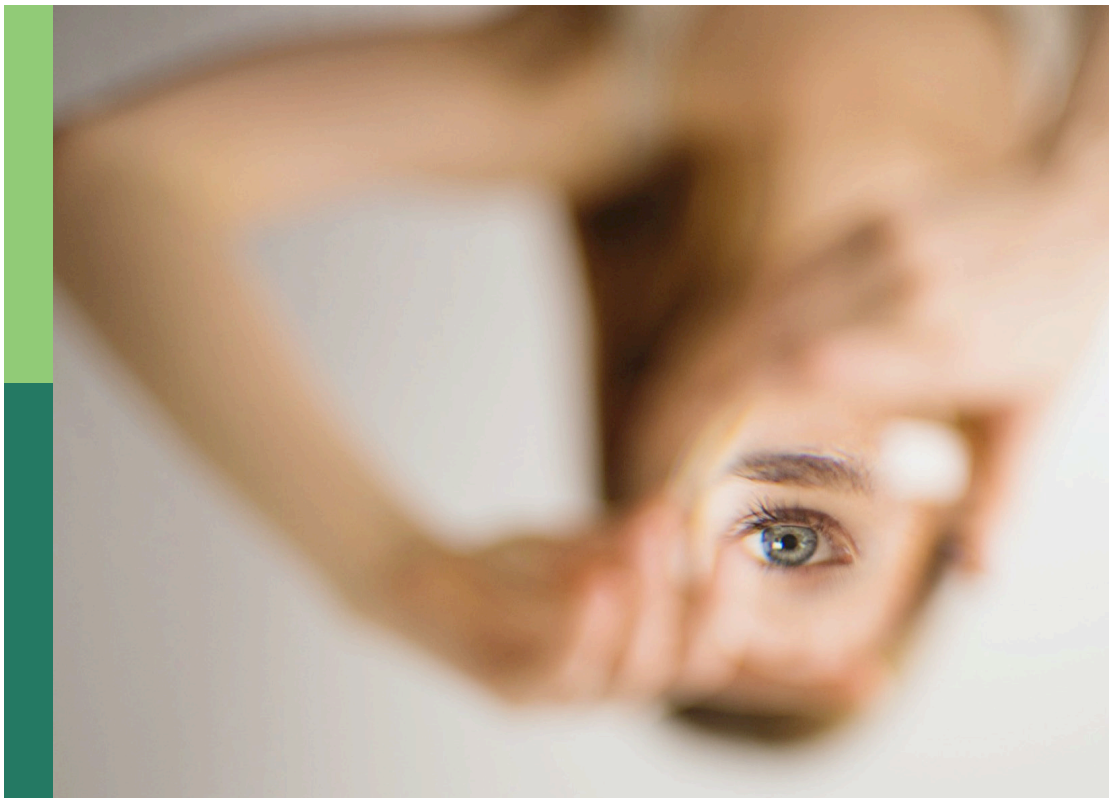

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Community series: Expanding the science of compassion, volume II

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Editorial: Community series: expanding the science of compassion, volume II

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Editorial on the Research Topic
Community series: expanding the science of compassion, volume II

What a pleasure to bring together this collection of articles from renowned researchers for this series on *The Expanding Science of Compassion*. We showcase research from neuroscience, epidemiology, experimental, developmental and social psychology. We also present novel contributions from the field of epi-genetics and meditative practices associated with compassionate behaviors. This collection helps illuminate the biopsychosocial angles from which we can understand compassion, and offers solutions toward a more compassionate world.

Ho et al. bridge three separate literatures that converge on the intra and interpersonal dynamics necessary for the transmutation of conflict into enduring peace. The path of "intuitive compassion" draws on a capacity to overcome the zero-sum mentalities, tit-for-tat strategies, and invalid beliefs that lead to afflictions, both on the personal and collective levels. Mahayana Buddhism over the last 2,000 years has emphasized the ultimate wisdom in merging personal and collective goals and transmuting conflict for the benefit of all sentient beings. In the prisoner's dilemma, the players of the game must also adopt a non-zero sum mindset to achieve optimal payoff over reiterated rounds. This strategy also referred to as "tit-for-tat with forgiveness" demonstrates how cooperation must be initiated and reciprocated for the beneficial outcome of both players. Processes within close relationships also illustrate how an atruistic and cooperative mindset reduces stress and benefits the individual. This literature is particularly relevant in recent geopolitical disruptions where "tit-for-tat" strategies have spiraled into ever increasing cycles of destruction. How could forgiveneness ever be introduced in such group conflicts?

Kirkland et al. use an experimental design to show that a pro- sharing group norm can inspire its members to behave more cooperatively toward other groups that have fewer resources. The research suggests that group dynamics and organizational culture can be influenced through the example of single members who demonstrate pro-sharing attitudes. This study found that the intervention involving a sharing model was more powerful than the condition involving the practice of compassion meditation at the individual level. Groups often fail to see the superordinate goal aiming at the benefit of all and superseding individual interests, particularly in contexts of inequality. This work has tremendous implications for the global community to orient groups dynamics toward the greater good through concrete examples in action.

Callaghan et al. show that we are less likely to give to members of lower socioeconomic standing compared to those within our own social standing. In their field experiment, the authors manipulated social status symbols worn by a confederate requesting money from pedestrians. Confederates wearing lower-class symbols were perceived more negatively and given less money than to those wearing symbols of higher social standing. The results remind us that we are more likely to be compassionate and generous toward those who are more "like us." Ironically, it is those who need the most help who may be judged as less deserving.

Addiss et al. provide one of the first epidemiological review including 82 studies to identify individual and situational factors quantitatively associated with compassion. Their findings indicate that individual demographic factors related to compassion include being female and being spiritual or religious. In the area of personal dispositions and skills, empathic concern was strongly related to compassionate responding as well as secure attachment. A strong association was also reported between eudaimonia, prosocial personality traits and compassion. Compassion was more likely to occur in domestic settings and more likely to be expressed toward close ones. On an organizational level, ethical and compassionate leadership was found to relate to compassion among employees. In fact, the perception of one's organizational unit as being fair and compassionate was associated with self-reported levels of compassion. The patterns emerging from this epidemiological study emphasize that organizational culture, and commitment to ethical principles that can help nurture compassion among the collective workforce.

Further evidence for the contribution of traits toward prosociality comes from Paz et al. who report a moderately stable disposition to help from toddlerhood to early childhood. They demonstrate individual differences that appear early (18 months!) in the spontaneous demonstration of concern for others' welfare. Prosociality was assessed through various experimental tasks that elicited helping, sharing, and comforting behaviors. These different aspects of prosocial behaviors were found to be inter-related and fairly stable in early childhood, demonstrating trait-like characteristics.

There are many reasons to prioritize compassionate responding, regardless of its moral or practical necessity. For one, Dobewall et al. using telomere biology report a connection between prosocial traits and longevity. The data was obtained from the Young Finns Study examining six birth cohorts from 1997 to 2011. The authors found significant links between helpfulness, cooperativeness, and compassion toward others with less accelerated aging. This requires replication as not all epigentic indicators were significantly related to compassion. Nonetheless, research into the biological pathways linking prosocial traits to longevity are both intriguing and worth pursuing.

Perhaps one reason why helping others may bring a long life has to do with sleep. Witvliet et al. tested interventions administered right before sleep that were designed to either cultivate compassion or stimulate rumination toward a perceived offender. Compared to the rumination condition, those who engaged in compassionate reappraisal of the offender in a personal offense fell asleep faster and had fewer sleep disturbances. The authors recommend this intervention to promote empathy and forgiveness, as well as calmer and more restorative physiological states.

Fraser et al. report that relational compassion among newly weds may also entail better sex. Their results show that women's and men's compassionate behaviors (including mindfulness, engagement, forgiveness and gratitude) contributed to their partner's sexual wellbeing over time. This is important given the role of sexual satisfaction and intimacy for the strengthening of relationships particularly in the early stages of marriage.

Gilbert et al. show that compassion training can enhance an individual's willingness to engage with the suffering of others' and increase compassion toward oneself as well. They report on a new compassion technique, using visualization and music to engage meditatively with the suffering in the world. After 2 weeks of regular practice, participants reported significant increases in compassion toward others as well as toward themselves. This study helps to broaden our understanding of the mechanisms that stimulate growth in individuals' compassionate skills and brings hope that this capacity for human goodness can be enhanced.

Shubair et al. remind us that self-care is necessary and integral to the provision of compassion. They employed qualitative methods to identify the factors necessary to maintain optimism and engagement while avoiding compassion fatigue. The sample was drawn from social work instructors in higher education who were interviewed in depth. Themes emerging from the qualitative analyses indicated the necessity for balance, appropriate boundaries, and self-care to maintain compassion and joyfully engage in a caring way.

Rodríguez-Nieto et al. add to the existing literature on the neural biological substrates of the cognitive and affective components of compassion. Their fMRI data replicate previous brain imaging studies on the brain regions associated with compassion. More interestingly, they report gender differences in the connectivity of brain areas corresponding to the cognitive and affective components of compassionate responding. Despite the extensive overlap in the brain areas activated, there were also distinct neurocognitive pathways for men and women in response to the compassion stimuli. The authors suggest that different routes may be employed by each gender to arrive at similar compassionate responses. The authors also note that a larger sample size is necessary to replicate these effects. However, this study represents an important starting point for future work on potential gender differences in the recruitment of cognitive vs. affective components underlying compassionate responding.

In conclusion, this Research Topic includes some of the latest advances in the research on compassion, using a wider range of methods to illustrate the genetic, neural, interpersonal, societal, and individual underpinings of this cardinal human ability. Facilitative conditions as well as situational hinderances in the expression of compassion are showcased. The papers in this Research Topic are generally consistent with the possibility that compassion can evolve through intentional effort and can serve to shape our culture and our future. We are facing challenges that will necessitate cooperative action over and above self-interest, and our collective task is clear. We need to prioritize compassion in all our human affairs in order to rejuventate and inject meaning into our lives and our most important goals. This series will hopefully inspire new

research and produce applications that inform our progress toward a kinder world.

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The influence of signs of social class on compassionate responses to people in need

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A field experiment (N = 4,536) examined how signs of social class influence compassionate responses to those in need. Pedestrians in two major cities in the United States were exposed to a confederate wearing symbols of relatively high or low social class who was requesting money to help the homeless. Compassionate responding was assessed by measuring the donation amount of the pedestrians walking past the target. Pedestrians gave more than twice (2.55 times) as much money to the confederate wearing higher-class symbols than they did to the one wearing lower-class symbols. A follow-up study (N = 504) exposed participants to images of the target wearing the same higher- or lower-class symbols and examined the antecedents of compassionate responding. Consistent with theorizing, higher-class symbols elicited perceptions of elevated competence, trustworthiness, similarity to the self, and perceived humanity compared to lower-class symbols. These results indicate that visible signs of social class influence judgments of others' traits and attributes, as well as in decisions to respond compassionately to the needs of those who are suffering.

KEYWORDS

compassion, emotion, social class, socioeconomic status, economic inequality, person perception, intergroup relations, prosocial behavior

Introduction

Individuals from various species signal their social status with non-verbal behaviors and social symbols. These status symbols assist them in avoiding costly aggressive encounters, and they signal the availability of resources and opportunities that facilitate thriving within groups (Krebs et al., 1993; Zeil and Hofmann, 2001). Generally speaking, a relative lack of opportunity, shorter life spans, and chronic stress accompany low status in various species, humans included (Sapolsky, 2004). Research in the social sciences also suggests that perceivers across the globe judge low-status individuals–especially those from denigrated groups, such as those experiencing poverty and homelessness–in

negative terms: as low in warmth (untrustworthy) and competence (incapable; Cuddy et al., 2002, 2008), as lacking traits typically associated with humanity and personhood and having traits associated with animality (Laughnan et al., 2014), and as possessing inferior genes (Kraus and Keltner, 2013). These types of perceptions motivate avoidance and ostracism directed toward lower-status groups and individuals (e.g., Bastian and Haslam, 2010). In the present research, we examined how visible symbols of status (in particular, those that communicate one's social class position in society; Kraus et al., 2009) influence compassionate responding in contexts of suffering and need.

Compassion is a complex prosocial emotion defined as concern for the suffering of others and the motivation to help ease that suffering (e.g., Goetz et al., 2010; Gilbert, 2017; Mascaro et al., 2020). Related to sympathy, empathy, and empathic concern, compassion is uniquely positioned as an affective state that tracks with the concern for reducing the suffering of another (Ekman, 1992; Nussbaum, 1996), and the presence of suffering is required to define prosocial or altruistic behavior as compassionate responding (Batson et al., 1989; Cialdini et al., 1997; Oveis et al., 2010).

Critically, however, theoretical analyses of compassion's origins posit that deservingness (broadly defined), combined with suffering, is central to compassionate responding (Goetz et al., 2010; Oveis et al., 2010). For instance, evolutionary accounts of compassion are rooted in theorizing on reciprocal altruism. Altruism is defined as selfless behavior that may or may not represent compassionate behavior, which requires acknowledgment of suffering; however, altruistic behavior is the primary expression of compassion (e.g., Goetz et al., 2010). These accounts of reciprocal altruism hinge on the assumption that altruists will choose to benefit those perceived as altruistic themselves (Trivers, 1971; Frank, 1988; Henrich, 2004), other kin (Hamilton, 1964), or others who are deemed trustworthy. Theoretically, from an evolutionary perspective, communities can most efficiently leverage the benefits of reciprocal altruism and cooperation if prosocial individuals tend to help other prosocial individuals and avoid those who might take advantage of or squander their kindness, such as dishonest individuals who feign suffering. For similar reasons, according to these accounts of compassion, those who are seen as responsible for their own suffering in the first place (and may thus be seen as blameworthy for their plight) are also seen as less deserving of help (Axelrod and Hamilton, 1981; Goetz et al., 2010). Overall, then, individuals tend to help others during their times of suffering and need based on whether those others are seen as "deserving": as genuinely suffering, not responsible for their suffering, and generally trustworthy and prosocial themselves (and thus likely to help others in the future, Goetz et al., 2010).

Our expectation that symbols of social class will influence compassionate responses synthesizes these prior theoretical accounts of the deservingness appraisals that precede compassion (Goetz et al., 2010) with several lines of evidence suggesting that others' social class (i.e., one's socioeconomic position in society, generally assessed in terms of education, income, and occupational status; Adler et al., 1994) can be gleaned from the recognition of status symbols. Consistent with theories of social comparison (Festinger, 1954), individuals are motivated to compare their economic standing to that of others in order to form opinions about their own performance and abilities in social domains; they are so motivated, in fact, that humans engage in social comparison even when it results in negative feelings of relative deprivation and perceptions of having reduced resources (e.g., Buunk et al., 2003). With respect to social class, these comparisons occur across a number of contexts, rapidly, and with little input. For instance, research on person perception reveals that individuals perceive social class with accuracy based on 60 s interactions with strangers (Kraus et al., 2009), photographs posted on social media (Becker et al., 2017), and pronunciation in brief speech (Giles and Sassoon, 1983; Labov, 2006; Kraus et al., 2019).

Perceptions of social class derived from such status symbols, in turn, inform the social perception and judgment of strangers. Prior research suggests that visual depictions of poverty can elicit perceptions of low warmth and competence in a given target (Harris and Fiske, 2009) and facilitate processes of alienation and dehumanization. These same visual depictions, for instance, also elicit perceptions that targets are dissimilar to the self (Harris and Fiske, 2009), and stereotypes of various lower-class social groups characterize their members as animalistic and lacking distinctly human qualities (Laughnan et al., 2014). Congruently, regions of the brain associated with person perception show less activation when middle-class perceivers view poor or homeless targets, as compared to middle-class ones (Harris and Fiske, 2006). Thus, the ability to perceive social class in others not only allows humans to identify social hierarchies–and their own place within them–but it also allows for patterns of social perception that implicitly justify these hierarchies, portraying those at the bottom as incompetent or undeserving.

As a result, these status-linked patterns of social perception may often direct compassion toward those exhibiting symbols of higher, compared to lower, social class. Several lines of research indirectly support this contention. Little prior research has directly and explicitly investigated the influence of status symbols on compassionate responding, though some research has investigated status signaling (or similar concepts) and its relationship to behaviors that might be considered compassionate responding or that represent constructs that are similar to compassionate responding in that they are other-focused and involve either placing trust in others (e.g., cooperation) or investing time or resources into others' wellbeing (e.g., prosocial behavior, helping behavior). For instance, people prefer to cooperate with individuals who are perceived to be both warm and competent (e.g.,

Anderson and Kilduff, 2012), and they exhibit contempt–rather than compassion–for those who appear to lack both these qualities (Cuddy et al., 2008; Goetz et al., 2010). Studies also suggest that individuals experience more compassion toward the suffering of others who are more, rather than less, similar to the self (Cialdini et al., 1997; Oveis et al., 2010). Finally, dehumanization processes elicit judgments that targets are less worthy of moral consideration (e.g., Bandura, 2002) and, therefore, compassion (Fiske, 2009; Goetz et al., 2010). As noted, each of these differential patterns of perception can be elicited by observable social class signals.

A smattering of early research has also investigated the relationship between perceived status (measured in a variety of implicit and explicit ways) and outcomes similar to compassionate responding. Using the "wrong number" technique (Gaertner and Bickman, 1971), Goodman and Gareis (1993) found that individuals were less likely to place a phone call on behalf of confederates who stated they had a low-status occupation (i.e., gas station attendant) as opposed to a high-status occupation (i.e., lawyer) or an unspecified occupation. Similarly, in the context of assessing donation behavior at an Indian university, Pandey (1979) found that professors (a high-status role) who had identified themselves as such were more successful at eliciting donations for victims of a recent flood than student counterparts. In another study, women were more likely to receive help packing a dropped bag of groceries when the make and model of their cars reflected high, rather than low, status (Solomon and Herman, 1977). In these instances, status was not manipulated through the use of visible status signals and the status in question does not necessarily reflect socioeconomic status (SES). However, this prior research does suggest that those of higher status (variously defined) often receive more aid than those of lower-status, whether in the form of help (e.g., by receiving a favor) or money.

Other evidence for visible status symbols, in particular, influencing behavior similar to compassionate responding (i.e., costly behavior that benefits others) comes from research into analogous behaviors of ceding resources or engaging in cooperation. Bickman (1971), for instance, found that individuals were more likely to return a dime left in a phone booth to confederates dressed in upper social class sartorial symbols (i.e., business attire) as opposed to low status ones. In a more recent experiment involving a negotiation game, the largest differences in monetary concessions emerged between targets manipulated to wear similar symbols (i.e., a business suit purchased at Macy's) and perceivers wearing their own clothing, with perceivers tending to make concessions to counterparts signaling higher social class (Kraus and Mendes, 2014). In another set of experiments, participants who received a greater initial endowment with which to play repeated rounds of a cooperative economic game tended to exacerbate initial inequalities by cooperating exclusively with other "wealthy" players–but only when these inequalities were visible (Nishi et al., 2015).

Taken together, these lines of research suggest that observable symbols of heightened social class influence the help or resources one decides to concede to or share with others. By extension, the expression of upper social class symbols–perhaps particularly if they match those expressed by perceivers (cf., Pandey, 1979; Goodman and Gareis, 1993)–might elicit more compassionate responding, especially when combined with suffering and need on the part of the signaler.

Though the above indicates conditions where high status symbols elicit preferential treatment, there are certainly conditions where people demonstrate other-focused behavior that is at least similar to compassionate responding toward those lower, rather than higher, in status. For instance, past research has found that knowledge of an individual's relatively lower status–combined with lay conceptions of fairness, which dictate helping those most in need (Adams, 1963; Tyler, 2012)–can elicit increased prosocial behavior in the absence of clear suffering (e.g., Van Doesum et al., 2017), a tendency that represents a commonly used metric of compassion when undertaken in the presence of suffering (Goetz et al., 2010). Similarly, an analysis of donations given through the website Kiva.org (a micro-lending service designed to generate capital for small businesses in developing countries) also found that requesters who adopted expansive postures (a cross-culturally recognized signal of high status and pride) received less in the way of eventual donations (Tracy et al., 2018). Thus, signals of need communicated by lower social status might potentially outweigh countervailing signals communicated by higher social status under certain circumstances. The contexts investigated in this prior research, however, are impersonal (taking place in online settings) and may thus allow potential helpers to rely more on reasoned cognitive processes or normative expectations–processes that might not necessarily hold sway in contexts where individuals need to respond rapidly in an interpersonal context. Moreover, this prior research was not designed to investigate responses to need or suffering specifically. Research showing a predilection toward helping lower-status targets has often investigated helping behavior toward targets, in the absence of need or suffering (e.g., Van Doesum et al., 2017) or, more generally, where help was requested for a variety of specific reasons across a number of different contexts (Tracy et al., 2018).

In the current research, we investigate how compassionate responses are influenced by status signaling, and we do so in the context of aiding those suffering from homelessness. Prior research provides a precedent for using exposure to homelessness as a context for eliciting compassion that still allows for significant variability in responding: compassion toward such individuals, for instance, is contingent on feelings of empathic concern for Batson et al. (1989) or self-other overlap with (Cialdini et al., 1997) targets, which can differ from one perceiver to the next. The particulars of the

situation can also shape compassionate responding. Even when normative prescripts that dictate helping those in need are made salient, individuals often overlook the suffering of unhoused individuals–especially in the face of competing demands (Darley and Batson, 1973). Instead of leveraging variation in individual differences or the experimental context, the current research manipulates status signals emitted by individuals themselves, while maintaining this context of need and suffering. Theoretically, these signals guide inferences of warmth, competence, similarity, and humanity, which determine whether those making such inferences see individuals as deserving of compassion in the first place. We hypothesized that observable symbols of high, relative to low, social class would elicit increased behavior indicative of compassionate responding on the part of perceivers.

We tested our hypothesis in a field study in urban areas situated in two large metropolitan cities in the United States. A confederate solicited donations for the homeless while wearing symbols of lower or upper social class on consecutive days. This context–of soliciting donations on public streets–is likely to elicit perceptions of suffering and low baseline social class regardless of the manipulation of status signaling, but our central prediction was informed by expectations that higher social class symbols in this context would elicit greater compassion due to heightened perceptions of the confederate's warmth, competence, humanity, and similarity to the self. We then assessed whether targets based on this confederate differentially elicited these same patterns of social perception in a follow-up experiment. Notably, and especially given past research on the influence of status perceptions on behavior in related domains of prosocial (Van Doesum et al., 2017) and altruistic (Tracy et al., 2018) behavior–which typically find that lower perceived status is associated with higher perceived need and greater generosity–support for our hypotheses in the current study would suggest that, ironically, there are contexts in which those who signal lower status (and thus might need help more or be perceived as in greater need) actually benefit less from the compassion of others. Data, analyses, and materials used in both experiments are available at https://osf.io/bxw7g/?view_only=7d6eac8f51cd4a819e829ba386fdcf46.

For reasons detailed below (see Section "Procedure"), we avoided intentionally misleading participants by telling them that the donations were for the confederate himself or that the confederate was unhoused. Given the brief nature of these interactions and the relatively commonplace occurrence of panhandlers within urban areas, we assume that most participants in this study approached this situation in much the same manner they would approach other such individuals soliciting money–in which case, donations would presumably be given to the ostensibly unhoused confederate, under the understanding that the confederate himself would keep them (i.e., the confederate was seen as the ultimate recipient of compassionate responding). In such an instance, the observed behavior of donating to the confederate, on the part of passersby, maps straightforwardly onto accepted definitions of compassion within the literature, as a "feeling that arises in witnessing another's suffering and that motivates a subsequent desire to help" (Goetz et al., 2010, p. 352).

However, we acknowledge that not all individuals may have perceived the confederate in this manner and that there may be differences, based on condition, in tendencies to perceive the confederate otherwise: for instance, participants may have inferred that the funds would be sent elsewhere to third-parties suffering from homelessness or to charities aimed at alleviating such suffering, making the confederate a facilitator of compassionate responding rather than a direct recipient. In this case, the confederate may have been viewed as trustee for the donated funds or a stand-in for those suffering from poverty and homelessness generally.

For this reason, we refer specifically to contexts of poverty and homelessness that activate perceptions of need and suffering rather than assume that participants perceive the confederate himself as experiencing said need and suffering. Likewise, our hypotheses are constrained to refer to status signaling within that same context, broadly defined. In other words, the only assumption we adopt with respect to donation behavior on the part of participants is that donations given were intended to alleviate suffering stemming from poverty and homelessness. Such a definition still reflects compassionate responding, regardless of how the confederate was viewed with respect to such responding (i.e., as recipient or facilitator): it is appropriate, at least, insofar as one might define donations given after watching an advertisement for a charity as compassionate responding–even if donors likely know that donations would not benefit the precise individuals pictured suffering in such an advertisement–because such exposure "motivates a subsequent desire to help" within a specific context. By necessity, however, we adopt a somewhat looser definition than those that require "witnessing another's suffering," strictly speaking. Therefore, we acknowledge that while the suffering to which participants responded is defined and circumscribed by the experimental context, it may not be perceived as the suffering of the confederate himself. Moreover, while we operationalize donations to the confederate as compassionate behavior regardless of participants' interpretation of the situation, the precise manner in which participants enacted compassion and construed their behavior toward the confederate (e.g., as helping him or placing their trust in him to help others) may have differed across conditions.

As is the case in everyday instances of those responding to individuals soliciting money on the street (even outside of a research context), individual donors may have perceived the confederate and the impact of their own donations in a multitude of ways, the full extent of which are impossible to know. Thus, we can only draw firm conclusions about the influence of status signaling on compassionate responding

within contexts of need and suffering (rather than conclude that donors were attempting to alleviate the pain and suffering of a specific individual). While our predictions are informed primarily–though not exclusively (see, e.g., Pandey, 1979)–by research focusing on the influence of status signals emitted by direct beneficiaries of compassionate behavior, we caution that the current experiments can only allow firm conclusions about compassionate responding itself (the observed behavioral responses of participants in the field study, assuming that donations are intended to alleviate suffering in the context of poverty and homelessness) and to perceptions of the target (in the perception study) that are elicited by status signaling. Given the precise ways in which participants interacted with the individual (shown) soliciting money in the two studies, we refer to him as the "confederate" in the field study (a term that is inclusive of seeing the individual as a recipient or facilitator of compassionate responding) and as the "target" in our follow-up study (because all perceptions measured in this study were with respect to him specifically). We also consider the issue of whether participants saw themselves as donating to the confederate himself or not, and the implications of this distinction, in the General Discussion.

The field study methodology we employ in our primary experiment represents a key strength in relation to recent research on the topic because it examines compassionate responses, indexed by donation behavior in a real-world giving context, rather than measuring intentions to donate to hypothetical targets or actual donations in computer-mediated interactions. In comparison to much of the prior research investigating similar topics, this methodology also indexes an unambiguous sacrifice on the part of those who respond compassionately (donating one's own money, cf., Bickman, 1971) in a way that allows for more precise estimation of the degree of differences in generosity (cf., Solomon and Herman, 1977; Goodman and Gareis, 1993), at least in the aggregate. Finally, the context of this field experiment more closely mirrors most of the actual contexts in which individuals have opportunities to enact compassion on a day-to-day basis (but see, Tracy et al., 2018 on the rising relevance of online giving behavior).

Study 1: A field study of social class signals and compassionate responding

We first tested our central hypothesis in a field experiment that sampled pedestrians on public streets of two major cities. Specifically, we expected passersby in six busy locations in downtown urban areas of the United States to donate more money to a panhandler signaling relatively high status, compared to relatively low status, through clothing (a highly salient method of status signaling employed in previous research; e.g., Bickman, 1971; Kraus and Mendes, 2014).

Materials and method

Participants

Participants for this study consisted of pedestrians in New York City, NY and Chicago, IL that happened to pass a confederate during the course of the study. Spotters, research assistants for the study, were present at each location to record the number of pedestrians (inter-rater reliability $r = 0.99$, $p < 0.001$), defined as individuals passing the confederate on the same sidewalk ($N = 4{,}536$). In total, 1,996 and 2,540 individuals passed the higher status and lower status confederate, respectively. We arrived at this eventual sample size in an effort to collect as much data as possible. We determined, before each trial began, how long each trial would last, based on the availabilities of the confederate and research assistants. We collected data only during those trials and over the course of the entire trial, except in one instance when the trial was cut short: in one of the higher status trials (Location #4, See **Supplementary Figure 1**) the confederate was asked by security to leave his position early, and the confederate complied without incident. We excluded one participant, and their second donation, from the analysis because they happened to encounter the confederate during both conditions.[1] Because we had little control over the eventual number of participants included in the study, we did not designate a target sample size; however, a sensitivity analysis (Faul et al., 2007) determined that the resulting sample size was sufficient to detect a small effect, expressed as a difference in independent means according to an independent-samples t-test ($d = 0.10$), with 95% power and a false positive rate of 5% ($\alpha = 0.05$).

Procedure

A single confederate (the study first author) stood at locations where panhandlers and unhoused individuals were previously observed. The confederate wore high or low status

1 That this individual was exposed to both conditions only became clear when they approached the confederate during the higher status trial (after encountering him during the lower status trial) and asked why he was dressed differently and what he was doing. The confederate then told this participant the truth regarding the study. We retained this participant for the purposes of the low status trial, both because it was not possible to determine which participant they were and how much (if any) money they donated and because they had not yet become aware that they were taking part in a psychological study. No other individuals approached the confederate in this manner, so we cannot be certain that this participant was the only one who was exposed to both conditions; However, given the number of participants within each trial and the fact that no two trials occurred in the same location on the same day, it would seem unlikely that the number of individuals who encountered the confederate twice–much less those who happened to encounter the confederate once in each condition–would be numerous enough to appreciably influence the results.

FIGURE 1
The confederate (the study first author) wearing low (left) and high (right) status symbols at W. Jackson Blvd between S. Michigan and S. Wabash streets. Images are intended for demonstration purposes only (i.e., they do not represent exactly what participants saw). Bennett Callaghan served as stimuli for the study itself.

clothing–depending on social status condition–and held a cardboard sign with a message about the number of unhoused people in New York or Chicago (depending on location). He used a paper coffee cup for collecting donations and occasionally said "Collecting money to help the homeless" in order to draw attention from pedestrians. Otherwise, the confederate was instructed not to engage with or speak to any passersby (unless they spoke to him first) and to maintain a natural facial expression and tone of voice. The confederate did not display any overt signs of suffering in either condition. The cardboard sign and collection cup were intended to further reinforce a context of low social class and homelessness across conditions (Cuddy et al., 2002). In the lower status condition, the confederate wore jeans and a t-shirt, and in the higher status condition, he wore a business suit, dress shirt, and tie. Additionally, and in order to both amplify the impact of status signaling and make the confederate's personal appearance more congruent with the relatively higher status signals communicated by a business suit, the confederate in the higher status condition also used pomade to slick back his hair (see **Figure 1**).

To control the experimental setting as tightly as possible between conditions, data were collected for similar amounts of time, on similar days, and in the same locations in the higher and lower status conditions (see **Supplementary Table 1**). The locations used in New York City were as follows: (1) East 17th street and Broadway, (2) St. Mark's Place and Avenue A (near the entrance of Tompkins Square Park); (3) Central Park West between 62nd and 63rd streets; and (4) 56th street and 8th Avenue. In Chicago, they were (5) South LaSalle street between West Lake street and West Wacker Drive and (6) West Jackson Blvd between South Michigan and South Wabash streets. All of these locations were accessible by public transit, and they were sufficiently busy that, in each, very few generalizations can be made regarding those who happened to pass the confederate. For instance, because such locations were public and easily accessible, it cannot be assumed that all passersby tended to share particular sociodemographic characteristics. While we did not record such characteristics, we expect that this procedure sampled a wide spectrum of those one might encounter in a busy section of a major American city. Thus, we expect that these participants represented a diversity of racial, gender, and, importantly, socioeconomic backgrounds. Perhaps with the exception of one (Location #2), however, we do note that each of these locations was situated in or near commercial districts, which may have biased our sample slightly toward those of a somewhat higher SES than average.

In total, the higher status and lower status trials did not differ in terms of the number of participants, $t(10) = 0.54$, $p = 0.60$, duration, $t(10) = 0.30$, $p = 0.77$, start time of the trials (measured in seconds since midnight), $t(10) = 0.46$, $p = 0.66$, the ambient temperature at the start of the trials, $t(10) = 0.20$, $p = 0.85$, or the day of the week on which they fell, $\chi^2(3) = 2.67$, $p = 0.45$. Finally, there was no correlation between the amount given per participant (the total amount within a trial divided by the number of donors, to account for the fact that later trials contained more participants) and calendar date (with August 5th coded as 0 and subsequent days coded as days since August 5th), $r\ (10) = 0.43$, $p = 0.16$. Thus, any incidental differences among the trials–other than the status manipulation–are unlikely to account for observed differences. We should note, however, that all trials took place on weekdays, and began between 2:45 PM (at the earliest) and 7:45 PM (at the latest). This is important context to keep in mind, as participants in trials conducted during a typical workday (9:00 AM–5:00 PM) may have been more likely to infer that the confederate himself did not himself have a typical (or perhaps any) job. **Supplementary Table 1** in the **Supplementary Information** provides full trial-level data.

The confederate was assisted at all locations by two trained spotters: research assistants who were tasked with maintaining the safety of the confederate, counting pedestrians crossing on the same side of the street as the confederate (to determine participation in the study), counting the number of people donating, counting the number of people who interacted with the confederate beyond giving money (such as saying something to him, regardless of whether they donated), and handling any interactions with public law enforcement or security. All collected funds were subsequently donated to a local homeless shelter. To comply with Institutional Review Board guidelines, the confederate did not lie to any of the participants by telling them that he was specifically collecting money for himself, but he also did not reveal his status as a researcher and that they were participating in a study. Upon completion of the study,

donations in New York were sent to the Bowery Mission[2] and donations in Chicago were sent to the Chicago Coalition for the Homeless.[3]

Spotters showed high consistency in their coding of relevant variables. Overall pedestrian counts conducted by spotters were identical in all cases, save for one trial (the low status condition for Location #2) where the counts differed only by one. Counts for the number of those who donated (coded as seeing a participant physically give money) were identical for all trials, and the counts for the number of interpersonal interactions differed by one in two trials (the high status condition for Location #5 and the low status condition for Location #6).

Overall generosity in each trial was determined by counting up the total amount donated in United States dollars. In each trial, spotters kept a count of the number of people who donated. When possible (i.e., if participants donated an amount in a large denomination), the research team also kept track of the amount donating in each transaction. When this was not possible, donations where the amount was ambiguous were assigned a constant value calculated based on all the remaining money donated, with these large donations subtracted from the total trial amount, for certain analyses. Interestingly, all of the highest donation amounts of $5 United States (twice, at Location #4) and $10 United States (twice, once at Location #4 and once at Location #6), which could be recorded as discrete donations, occurred in the high status trials.

For the purposes of this study, we define compassionate responding as both the monetary amount and the frequency of donations that the confederate received in each condition. However, we also report on the number of large donations (defined as those $5 and above) and (in the Chicago trials) the number of people who went out of their way to interact with the confederate, whether they donated or not. We kept track of large donations and interaction instances because differences by condition in these two variables could suggest qualitative differences in how participants approached the two confederates. The latter measure also disentangles, to some extent, the degree to which differences in generosity are due to intentions to engage specifically in compassionate responding, rather than general tendencies to approach and interact with the confederate–perhaps due to the potential novelty of a panhandler wearing a suit.

Results

To test our hypothesis about status symbols and compassionate responding, we first examined the total amount donated to the confederate as a function of social status condition. Given the nature of data collection, we do not have access to individual donation amounts; thus, we first analyze the total distribution of donations across conditions because such an analysis requires the fewest assumptions about the underlying distribution of the data. In total monetary value (i.e., collapsing across trials and without making assumptions about the size of individual donations), the higher status confederate received more than twice as much (2.55 times) money as the lower status confederate over all trials: $54.11 (over the course of a cumulative 3.5 h) compared to $21.15 (over 4 h). A chi-square goodness-of-fit test determined that this distribution differed from that expected by chance, $\chi^2(1) = 14.44$, $p < 0.001$. The **Supplementary Information** also provides an additional test, using a general binomial linear mixed model framework, to analyze donations (using an approximate method of apportioning donations) while accounting for the random effect of location. This analysis yielded similar results.

We also examined mean differences as a function of individual donations, using the apportionment strategy described above. While this method imposes additional assumptions, compared to the analysis reported above, about the distribution of the underlying data, it is nonetheless instructive. The mean difference amounted to an average of three cents-per-participant (passerby) across high-status trials (M = $0.027, SD = $0.37) compared to less than one cent (M = $0.008, SD = $0.10) across low-status trials. Because these data were unlikely to be normally distributed, we conducted a Wilcoxon ranked-sum (i.e., Mann–Whitney) test with a continuity correction, W = 2,521,391, p = 0.06, r = 0.03 [95% CI: 0.002, 0.06] to compare these means. The **Supplementary Information** provides an additional test (assuming normality) accounting for the potential moderating influence of city; this analysis did not show any evidence that this effect differed for participants in New York and Chicago.

Follow-up exploratory analyses revealed results that were–though weaker (likely owing to the infrequency with which the focal events occurred)–in line with our hypotheses for the number of donors and the distribution of large donations. For number of donors, we used a 2 × 2 contingency table analysis accounting for the number of participants who did and did not donate within each condition (frequency of donations and percentage of donors, relative to total condition sample, reported in parentheses). Though overall donation rates were low, a Fisher's exact test (which is suited to dealing with small or unbalanced cells within a contingency table; Fisher, 1922) on this table suggests a greater number of donors in the higher (N_{donors} = 25; 1.25%), as compared to lower (N_{donors} = 18; 0.71%), status trials. Directionally consistent with our hypotheses, this analysis revealed that higher status trials had a marginally significant higher proportion of donors than lower status ones, p = 0.066. We used the same contingency table analysis to examine the distribution of large donations of $5 and $10, which occurred only four times in total (all in the

2 https://www.bowery.org/

3 https://www.chicagohomeless.org/

high-status condition). The degree to which the higher status trials dominated these large donations also differed significantly from what would be expected by chance, $p = 0.04$. However, the same analysis applied to the number of interactions with the target (e.g., saying something to him, regardless of whether they donated) did not differ by condition, $p > 0.99$, suggesting that the observed differences in donations are not solely attributable to people noticing and approaching the higher status confederate more often. Pedestrians interacted with the higher status ($N_{interactions}$ = 12; 0.60%) and lower status ($N_{interactions}$ = 15; 0.59%) confederate at roughly equal rates. Thus, we find some evidence that the higher status confederate not only collected a larger total amount than the low status confederate, but we also find some evidence that individuals were more likely to donate to the former than the latter, especially with respect to large single donations of $5 or more.

Discussion

In Study 1, signaling relatively high, compared to low, status drew both more and greater donations to a panhandler from passersby in major urban areas. This advantage amounted to a more than two-fold increase in overall donations (according to an analysis that imposes the fewest assumptions) and emerged despite equivalence across conditions on important variables such as the length of the trials, the number of participants per trial, and the ambient temperature. Thus, this field study supports our hypothesis that symbols of higher social class (expressed through sartorial displays) influence compassionate responding. Notably, preliminary evidence suggests that these signals did not operate simply by way of increased noticeability or approachability, as indicated by the lack of a difference in tendencies to approach and interact with the panhandler.

The strongest result obtained in this study is that the confederate collected more money, in aggregate, while signaling relatively higher SES. As noted, this investigation of aggregate effects–assessed by analyzing the degree to which the total distribution of donations across the two conditions differed from one expected by chance–was simultaneously well-powered to detect such an effect and imposed the fewest assumptions about the underlying structure of the data (which was, due to the nature of data collection, unobservable). However, some of the specific analyses (i.e., an analysis approximating individual donations assuming fixed variance within trials and the analysis for total number of donors) fell short of conventional cutoffs for statistical significance (Cohen, 1994).

One explanation for why these analyses fell short of these cutoffs is that they lacked statistical power due to the (in)frequency of the focal events themselves: for instance, fewer than 2% of the roughly 2,000 participants in each condition (fewer than 20 donors per condition) actually donated to the confederate. Thus, even though we collected a large sample, instances of compassionate behavior that are operationalized by counting discrete events, such as donation, may require an even larger sample to detect robust differences using the current methodology. Future researchers, then, may attempt to collect larger samples in a similar experiment, either by conducting more trials or by lengthening the trials themselves. Alternatively, future researchers might employ more salient methods of attracting attention from passersby (provided they remain constant across conditions) in order to increase engagement from passersby and, hopefully, increase overall donation rates. However, the mere rarity of these events likely does not fully explain why some analyses produced stronger effects than others. For instance, only four individuals, in total, donated amounts of $5 or larger. However, the distribution of these donations was so extreme, that analyses on these donations nonetheless produced significant results. Unquestionably, these large donations represent outliers, which likely further shifted the distribution of donations away from normality and informed the decision to adopt a non-parametric, rank-based test for comparing donations at the individual level. Such a test is robust to outliers, as compared to a more standard parametric one (e.g., one assuming a t distribution; Zimmerman, 1994), but it also necessarily lessens the distance between common donation amounts and larger donations, which also likely contributed to the lack of statistically significant results in this analysis.

Other methods of modeling these data (such as the negative binomial linear mixed regression reported in the **Supplementary Information**, which also accounts for the random effects of trial location) may lead to more statistically robust results, but they also require unverifiable assumptions about the underlying data. Thus, the conclusions one might draw from these results likely depends on how one treats these large donations and apportions the remaining donation amounts among remaining donors. It is also likely that the significant differences we observe are in large part driven by these large donations. As evidenced by the fact that all of these donations occurred in the higher status trials, we see these donations as carrying meaningful information about the compassionate responding of participants (rather than reflecting mere statistical noise). However, as discussed more in depth in the General Discussion, their presence also raises interesting questions about how and for whom status signaling might impact compassionate responding. For instance, it is possible that our manipulation of status more precisely influences extreme instantiations of compassionate responding or that its influence is confined to particular individuals (e.g., those who are predisposed toward more extreme compassionate responding in the first place, or wealthier individuals for whom a larger donation represents less of a sacrifice).

Study 2 was designed to investigate the potential mechanisms by which high status signaling may have elicited greater generosity. In particular, it tests the plausibility of the theoretical account posed at the outset: that relatively low

status signals create a pattern of social perceptions that dampen compassionate responding.

Study 2: Appraisals for targets of compassionate responding

An online follow-up experiment examined the perceptions associated with targets based on the confederate employed in the field experiment. Study 2 tested whether those signaling relatively low status were also seen as less competent, less warm, less similar to the self, and less human–all qualities that decrease compassionate responding and would comport with our proposed social perception account for the field study results. In addition, this follow-up study further assessed an alternative, novelty-based explanation for these results: that a target asking for money while signaling relatively high status simply attracted more attention than his counterpart.

Materials and method

Participants

We recruited 504 online participants from Amazon's Mechanical Turk (51% self-identified as male, one participant did not self-identify). Roughly 75% of participants identified primarily as White/European-American, 8% as African-American, 9% as Asian-American, and 6% as Latino/a. We collected at least 100 participants per condition in order to detect an effect size of d = 0.40, the average effect size in social psychology (Richard et al., 2003) with 80% power. We attempted to exceed this benchmark, while remaining within financial constraints. We intentionally recruited a larger sample size than that which is required to detect an effect of d = 0.40 in order to detect smaller effects, should they arise, to provide more precise point estimates of any effect size, to account for potential attrition, and because we measured multiple dependent variables–which can inflate the family wise error rate.

Three participants did not complete an attention check, and 15 were excluded after failing an attention check. Specifically, we showed participants pictures of the confederate from Study 1 (see **Supplementary Figure 1A** and Procedure for more details) and asked them to indicate what the target wore out of the following four options: (A) "Business suit," (B) "T-shirt and jeans," (C) a "Hawaiian shirt," and (D) none of the above. As expected, the majority of those in the relatively low and high status conditions, respectively, chose options (B) and (A). Because they were obviously incorrect, we excluded one participant in the lower status condition who chose option (A), two participants in the higher status condition who chose option (B), and six participants who chose option (C). However, we perhaps overestimated the consistency with which people would describe the sartorial choices of the target, as 29 and four people in the lower and higher status conditions, respectively, chose option (D). We did not exclude participants who chose this option because doing so would introduce differential attrition and because participants may have subjectively considered the target's clothing to be something other than a t-shirt and jeans or a business suit while still recognizing that the two wardrobes signaled differential status (as was later confirmed by a manipulation check). Nonetheless, the results remain largely similar with participants who chose "none of the above" excluded (see **Supplementary Information**). Thus, we analyzed responses from 492 participants in total and did not exclude any other participants, except in cases of missing data.

Procedure

All participants completed a survey that ostensibly aimed to investigate "perception" and that involved "looking at images. . . and giving us your feedback." After providing informed consent, participants viewed images of the confederate from Study 1 and responded to a set of questions concerning him. The target signaled higher or lower status by appearing dressed in a business suit or jeans and a t-shirt, as in Study 1 (see **Supplementary Figure 1A**). Participants in this study were first briefly (3 s) exposed to a wide-shot photograph of a street in Champaign, IL that depicted the confederate panhandling on a populated street while signaling higher or lower status. The images were manipulated such that everything except the clothing of the target was identical across conditions (see **Supplementary Figure 1B**). Participants were subsequently asked to list up to five things they saw in the photograph.

After listing these items, participants saw a second, larger photograph of the target in high or low status clothing (see **Supplementary Figure 1A**). Participants then made social perception judgments regarding stereotype content and person perception based on this latter image, which appeared and remained at the top of each page to assist in making judgments. In randomized order, participants were asked to judge the target, absent all other information apart from his physical appearance, on a number of social attributes, including his perceived competence, warmth, interpersonal closeness, and humanity. These constructs were chosen due to their relevance to both status and compassionate responding on the part of others (descriptive statistics, overall and by condition, for each of these variables is available in the **Supplementary Information**; see **Supplementary Table 2**). The design of this study was fully between-subjects and the status condition of the target was consistent across the brief exposure and perception tasks, meaning that participants only saw the high status or low status target throughout.

To determine the success of our social status manipulation, participants also ranked the target they saw on a ten-point scale of subjective SES used in prior research (Adler et al., 1994; Kraus et al., 2013) wherein participants ranked the target on a 10-rung

ladder representing ascending levels of education, income, and occupation status in the United States. Based on this measure of social status position in society–and consistent with our expectations–the higher status target (M = 3.53, SD = 1.89) was judged as considerably higher in social status than the lower status target (M = 2.44, SD = 1.65), $t(482.34) = 6.82$, $p < 0.001$, $d = 0.61$ [95% CI: 0.43, 0.80]. However, and consistent with the experimental context of poverty, both the relatively high and low status targets were judged to be low in status relative to the scale midpoint $t(246) = -12.20$ and $t(244) = -24.24$, respectively, both $ps < 0.001$.

Materials

Noticing the target

We designed the brief exposure task as a way to determine whether the higher status target was more novel or attracted more attention than the lower status one (perhaps due to expectation violations of a denigrated group member being dressed in higher status clothing). The first author used the responses to the brief exposure task to determine whether or not each participant noticed the target (the coder was blind to condition except in cases where their answer referred to what the confederate was wearing, in which case the fact of the participant noticing the confederate is unambiguous). To do so, the coder read the (up to five) things that participants listed having seen, and judged whether or not they referred to the target; if a participant acknowledged the target at least once over the course of their responses, that participant was given a score of 1 (and a score of 0 otherwise). For example, responses such as "tree" or "man with backpack" would not substantiate noticing the target, whereas responses such as "man asking for money" or "panhandler" would. The third author (also blind to condition) independently coded a random subset of 99 responses and scored them in the same manner. The two coders showed adequate (Landis and Koch, 1977) reliability ($\kappa = 0.61$).

Warmth and competence

In making their social perception ratings, participants were asked to indicate how much a number of words described the target on 0 (Not at all) to 100 (Totally) slider scales. We expected participants to see the lower status target as less warm (i.e., "friendly," "trustworthy," "good-natured," "well-intentioned," "warm," and "sincere") and competent (i.e., "competent," "intelligent," "capable," "confident," "efficient," and "skillful") than the higher status target, according to measures drawn from previous research (Cuddy et al., 2002, 2008). Both of these scales displayed strong reliability ($\alpha = 0.95$ and 0.94, respectively).

Similarity to the self

Given our prediction that participants would tend to "other" the target–especially the lower status one–and distance him from the self, we measured self-other similarity using the Inclusion of Other in Self (IOS) scale (Aron et al., 1992). Participants indicated which pair of seven increasingly overlapping circles labeled "Self" and "Other" most closely resembled their "relationship with people like the person pictured above"; higher scores indicate greater self-other similarity.

Ascribed humanity

We hypothesized that participants would also tend to see the lower status target as less human than the high status target–that is, lacking traits typically associated with humanity and personhood and having traits associated with animality (Laughnan et al., 2014). Consistent with previous research, we refer to this construct as "ascribed humanity" (Martinez et al., 2011). An ascribed humanity index consisted of (a) a shortened version of a humanity scale, asking participants to indicate how much they thought a number of words (e.g., "person," "citizen,") described the confederate, (b) a reverse-coded shortened animality scale (e.g., "wild," "untamed") and (c) their agreement with how much the target embodied personality traits typically considered to be uniquely human: openness to experience (e.g., "open to new experiences, complex") and conscientiousness (e.g., "dependable, self-disciplined"). These items were drawn from previous research and averaged into a single scale, also consistent with this previous research (Martinez et al., 2011). These items were measured on the same 0–100 sliding scale used to assess perceived warmth and competence, and the scale displayed strong reliability ($\alpha = 0.84$).

Results

Brief exposure task

Participants were more likely to notice the target in the lower status (87.35%) than in the higher status (74.49%) condition, $\chi^2(1) = 13.15$, $p < 0.001$, as determined by the coding of their responses and a chi-square test of association. These results echo those from Study 1 in that the higher status target was apparently not more noticeable than the lower status target. If anything, the former was less noticeable than his counterpart.

Social perceptions

A Multivariate Analysis of Variance (MANOVA) revealed that the social status manipulation influenced the hypothesized perceptions of the target in the expected manner, Wilk's $\lambda = 0.95$, $F(4,486) = 5.96$, $p < 0.001$. Specifically, participants judged the higher status target as more competent, $F(1,489) = 21.35$, $p < 0.001$, $d = 0.42$ [95% CI: 0.24, 0.60], warmer, $F(1,489) = 13.42$, $p < 0.001$, $d = 0.33$ [95% CI: 0.15, 0.51], more similar to the self $F(1,489) = 5.05$, $p = 0.025$, $d = 0.20$ [95% CI: 0.02, 0.38], and more human, $F(1,489) = 9.20$,

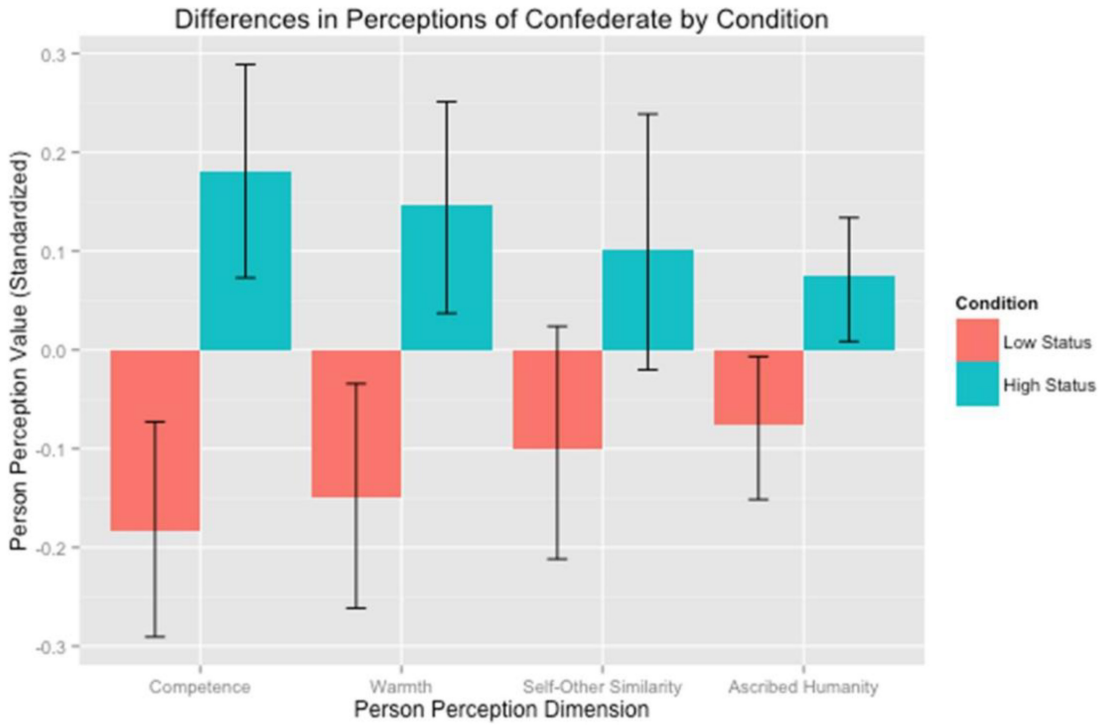

FIGURE 2
Standardized mean perceptions of higher and lower status targets on dimensions of competence, warmth, self-other similarity, and ascribed humanity. Error bars represent bias-corrected and accelerated (BCa) bootstrapped 95% confidence intervals with 5,000 replications. Bennett Callaghan served as stimuli for the study itself.

$p = 0.003$, $d = 0.27$ [95% CI: 0.10, 0.45] than the lower status one (see **Figure 2**; **Supplementary Table 2**).

As might be expected given our theoretical background, each of these perceptual variables also correlated positively with subjective SES, which was the manipulation check and the measure of perceived status for the target (see **Supplementary Table 3**).

Discussion

Study 2 builds upon the results of Study 1 by outlining the patterns of social perception that guide preferences to share resources with individuals signaling higher social class in interpersonal contexts. Specifically, participants judged the relatively low status target to be less warm, less competent, less human, and less similar to the self than the relatively high status one. Consistent with initial expectations, however, both targets were seen as generally low in status. The results of Study 2 also further reduce the likelihood of a mundane explanation for the tendencies observed in our field experiment: that the higher status confederate drew more compassionate responding simply by appearing more novel and drawing more attention. That participants were more likely to indicate noticing the lower status target runs counter to such an explanation and perhaps suggests greater vigilance of low status targets, who are often seen as potentially threatening (Major and O'Brien, 2005).

Instead, the social perceptions engendered by the lower status target were largely consistent with research showing that people perceive extremely low status groups in society, relative to their high status counterparts, as less warm, less competent (Cuddy et al., 2002, 2008), less similar to the self (Bastian and Haslam, 2010; Kraus and Keltner, 2013), and less human (Laughnan et al., 2014). Thus, these results provide evidence for the multiple psychological perceptions that arise from status symbols and commonly precede expressions of compassion.

General discussion

As economic inequality rises in many parts of the world, and countries such as the United States roll back social safety net programs (Piketty, 2014), the responsibility for dealing with inequality's deleterious impacts (Wilkinson and Pickett, 2009) has increasingly fallen to economically precarious individuals themselves or to private citizens exercising compassion, defined as concern for the suffering of others and the motivation to help improve their circumstances (e.g., Goetz et al., 2010;

Gilbert, 2017; Mascaro et al., 2020). Building on prior research and theorizing in the rich tradition of research on sympathy, empathy, and compassion (Batson et al., 1989; Cialdini et al., 1997; Oveis et al., 2010), the current research examined the tendency for people to respond compassionately (or not) in the presence of those who were apparently suffering or, at least, made salient a concern with suffering related to poverty and homelessness (i.e., a panhandler), in two cities in the United States. The current research suggests that people respond more compassionately, and perceive such individuals more favorably, when they signal higher–relative to lower–social status through physical appearance. This pattern of results arose even though all confederates and targets appeared to be generally low in status, and it arose in an experimental, but ecologically valid, context where participants shared their own money.

This research also contributes to a longstanding body of research suggesting that non-verbal status cues influence behavior on the part of others (e.g., Bickman, 1971; Tracy et al., 2018). That symbols of high social class more than doubled the donations of pedestrians over a 4-h period indicates their power in shaping initial judgments of others' basic human traits and in eliciting compassionate responses in everyday life. Importantly, our results align with past theory and research suggesting that high status signaling provides many direct benefits to individuals, including grooming and mating partners in non-human primates (Sapolsky, 2004). This research adds received generosity, among humans, to this list of benefits.

Interestingly, mere novelty and noticeability of the higher status confederate do not seem to explain observed differences in generosity. In the field experiment, the mere frequency of the interactions did not differ by condition; in Study 2, in fact, participants were in fact more likely to attend to the lower status target. Instead, the quality of these interactions and their outcomes (as indicated by the analysis of extreme donations) differed. Anecdotally, this qualitative distinction bears out. When people did go out of their way to speak to the confederate, the higher status one received comments such as "I usually don't give money to people on the street, but you seem like a nice guy." In one case, a pedestrian (also donned in a business suit) even dropped a business card into the higher status confederate's collection cup–a tacit invitation for the confederate to seek employment, rather than a trivial one-time donation.

As discussed, the large donations of $5 or $10, given their size and exclusive presence in the relatively higher status trials, likely contribute substantially to some of the effects we observe in the field study. Much like the interactions sketched above, these donations might also represent a qualitative shift in how donors approached the situation: they may have donated $5 or $10 in the hopes of more effectively meeting the confederate's immediate perceived needs, as such an amount would be more appropriate than more common donation amounts (e.g., $1 or less) for most self-care and survival needs, such as purchasing a meal. Thus, these donations might be particularly representative of compassionate responding insofar as they are intended to effectively and (depending on participants' construal of the situation) immediately alleviate suffering. However, they also suggest the possibility of theoretical accounts we did not fully theorize. For instance, it is possible that status signaling is most effective at eliciting high-variance responding; in other words, signaling higher status might not strongly impact tendencies to engage in compassion in general, but, rather, impacts tendencies to engage in extreme–as defined in relation to more typical donation amounts–acts of compassion (again, however, use of the word "extreme" might be misleading, as these donations might also be described as simply independently sufficient to meeting the goals at hand).

It is also possible that this pattern of results reflects an unobservable moderation effect. Perhaps, for instance, the effects of status signaling are most pronounced among those who are more inclined to acts of extreme generosity to begin with. Alternatively, this effect might be attributable to the presence of stronger effects among participants who are higher in SES themselves. The design of the field experiment study did not allow us to assess the SES of passersby, and, thus, whether participants' own social class characteristics contributed to decisions to respond compassionately to the confederate. As indicated by the overall low levels of subjective SES attributed to the target in the perceptual study, it is likely that the higher status confederate was perceived as closer to participants, in terms of socioeconomic standing, than the lower status confederate across the board (excluding those who are themselves poor or unhoused). Still, however, the perceptual study does suggest meaningful differences in self-other similarity according to status signaling condition, and the possibility that signalers who better "match" the status of perceivers benefit from even greater compassion than those who merely signal higher status has received mixed empirical support (see, e.g., Goodman and Gareis, 1993). Thus, it is possible that high status signals appealed specifically to passersby of particularly high SES and who, due to greater access to financial resources, may have stood to lose less through larger donations or simply regarded higher amounts of money as an appropriate default for donation (as a proportion of the money they had on hand, for instance). Though it may be difficult to measure individual differences such as predispositions toward extreme generosity in a field study context, future replications of this research might employ methods of subjectively coding participant SES (e.g., Bickman, 1971) or systematically varying the SES characteristics of the research sites (e.g., Goodman and Gareis, 1993) in order to determine the regularity with which these extreme donations occur and whether they are given disproportionately by those of higher socioeconomic standing.

Together, these qualitative experiences and extreme donation profile provide some support for the general pattern observed in Study 2, and support a central tenet of theories

of compassion: that compassionate responding hinges on the reputation of targets, especially with respect to their likelihood of engaging in reciprocal cooperation with other prosocial individuals (Goetz et al., 2010). The present research adds signals of social class as a possible cue that reliably elicits such reputational perceptions.

Moreover, high status signals increased specific judgments of competence, trustworthiness, humanity, and self-other similarity. Thus, the results of the current studies suggest that poor individuals who adopt these symbols might be seen as more effective at converting gifts into intended outcomes (such as personal advancement or care), as less likely to engage in behaviors that might be seen as making them blameworthy for their plight (e.g., drug or alcohol use; see Goetz et al., 2010), and as more likely to use those gifts for intended means rather than as a strategy to accrue undeserved wealth. In short, such signals may make one appear more deserving of compassion (Goetz et al., 2010).

A closely related alternative explanation for the current set of results, which more strongly emphasizes the perceived ability (rather than the inclination) to engage in future prosocial behavior by the confederate, is that participants were more likely to see the higher status confederate's need state as temporary, rather than chronic. Consistent with certain evolutionary accounts of reciprocal altruism (e.g., Sugiyama and Sugiyama, 2003; Tracy et al., 2018), the perceived combination of high temporary need and high baseline competence may have biased individuals toward helping the higher status confederate in his time of need because he was perceived as more able to help others, or "pay it forward," when he had the opportunity to do so. Given that the high and low status targets were strongly discriminated along the lines of competence, this alternative explanation is plausible. Future research is needed, however, to determine whether such perceptions of ability to engage in future acts influence compassionate responding independent of perceptions of deservingness.

In a similar vein, our field study operationalizes compassion as costly helping behavior–a common method of doing so within the social-psychological literature and one that avoids many of the biases inherent in self-report measures (Mascaro et al., 2020). Our second study also includes a number of social perceptions that index deservingness, an antecedent to compassion in prevailing theoretical accounts of the construct (e.g., Goetz et al., 2010). While this research demonstrates the influence of status signaling on theoretically important perceptions of a target (Study 2) and responses toward a confederate (Study 1), this research does not measure compassion, as a subjective psychological state, directly. Nor does the second study measure compassionate responding directly, as in Study 1. Thus, the two studies taken together show a pattern that is consistent with a theoretical account emphasizing compassion: one in which status signaling affects particular theoretical antecedents of compassionate responding (i.e., warmth, competence, self-other similarity, and ascribed humanity), which then influence compassion and compassionate responding. However, these results do not necessarily confirm that status signaling directly influences perceptions linked to deservingness and, subsequently, compassion and compassionate responding.

To address this theoretical gap, future research might attempt to measure compassion directly and demonstrate that signaling relatively higher (as compared to lower) status–by way of heightened perceptions of deservingness–heightens self-reported compassion for those suffering in the relevant context as well as subsequent compassionate responding (i.e., donations). In doing so, researchers should be mindful of best-practices in the measurement and definition of this complex emotion (Gilbert, 2017; Mascaro et al., 2020). For instance, such research might attempt a multi-method approach to conceptualizing and measuring compassion that synthesizes quantitative reports of one's own and others' mental states, physiological measurements, and observations of behavior (e.g., Mascaro et al., 2020). Additionally, such research might take care to distinguish compassion from subjective and emotional states–such as distress, sadness, and love–that are sometimes used interchangeably with compassion in the literature (e.g., Goetz et al., 2010; Gilbert, 2017). Second, in order to test the full theoretical model we have proposed here, future research should manipulate status signaling and measure both the antecedents we propose and compassion (or compassionate responding) within the same study. Such a study could at least determine whether the key variables related to deservingness mediate the effect of status signaling on compassion. Ideally, future research could also manipulate these mediators to establish a truly causal chain of effects (Spencer et al., 2005).

It is also possible, however, that conditional differences in confederate behavior contributed to differences in generosity on the part of passersby. The confederate was not blind to condition or hypotheses, and previous research suggests that donning high status sartorial signals can change the behavior of even naïve participants (Kraus and Mendes, 2014). Though this is a possibility, we minimized this likelihood by having the confederate behave consistent with standardized instructions. Moreover, that a follow-up study elicited theoretically relevant patterns of perception from passive observers suggests that the effect of status signaling on generosity observed in the field is at least partially driven by perceiver judgments. Finally, even if the behavior of the confederate did subtly differ between conditions, such subtle differences would need to compete with the cacophony of stimuli that individuals normally encounter when walking down a busy street in New York or Chicago, so the context in which we chose to conduct our field experiment also mitigates concerns with experimenter effects.

Indeed, it was partially because we expected multiple competing demands on the attention of passersby that we chose

to manipulate comparatively obvious visual cues (combined with spoken statements to draw attention), rather than other cues that also signal status, such as vocal pitch (e.g., Gregory and Webster, 1996), accent (e.g., Labov, 2006; Kraus et al., 2019), or cultural signifiers of aesthetic taste (Bourdieu, 1984). Nonetheless, these other modalities represent interesting potential avenues for future research.

Similarly, those who did attend to visual cues of status also likely perceived other superficial but potentially important characteristics, such as those that indicate membership in particular social identity groups. It is interesting to speculate about how these other characteristics of the confederate (i.e., an individual generally perceived to be White and male) may have impacted the effect of status signaling on compassionate responding. For example, membership in other social categories might modify the results observed in these experiments. Theoretical accounts suggest that symbols of social status influence perception similarly across race and gender (Major and O'Brien, 2005), but previous research also finds that social status and race or gender may interact in subtle ways to produce marked differences in status-linked outcomes, such as health and mortality rates (Case and Deaton, 2015) or experienced bias and discrimination (e.g., Goff and Kahn, 2013; Rivera and Tilcsik, 2016). Future research would need to determine if high status symbols confer the same benefits to members of other intersecting social groups as they apparently do for White men.

Future research might also measure how different characteristics of the giving context moderate how status symbols influence outcomes. For instance, some research has found that in contexts where individuals are already motivated to engage in prosocial behavior and are deciding how to distribute their resources, symbols of high status are negatively related to the receipt of altruism (Tracy et al., 2018). These researchers suggest that opposite patterns of effect with respect to status and altruistic behavior might arise depending on whether potential actors are deciding to engage in altruistic behavior in the first place or are deciding how to engage in such behavior. We echo these researchers' calls for further investigation into this distinction as a potential moderator of the effect of status signaling on compassionate responding (p. 527). We also note that our results regarding the influence of status signaling manipulations on compassionate responses are perhaps bounded to compassionate responding in contexts involving the alleviation of suffering related to poverty and homelessness and to such responses enacted through brief, interpersonal exchanges. Thus, we caution generalizing these results to compassion directed toward other ends or within impersonal contexts, such as online behavior (see, e.g., Tracy et al., 2018).

Finally, we also acknowledge some ambiguity with respect to how participants themselves interpreted donating in the field experiment. As noted, the confederate only told participants that collected funds would be donated to charity if they had asked; few people interacted directly with the confederate in this way, and this pattern did not differ by condition. However, because we were constrained by ethical considerations in terms of what we could tell participants and the field context of the experiment made us unable to probe participants about their inferences regarding the confederate at the time they decided to donate (or not), we still do not know (as discussed) whether individual participants perceived the confederate as the primary benefactor of their donations or as an intermediary.

Even for participants operating under the latter assumption, however, the relevant behavior of donating nonetheless reflects the broader construct of compassionate responding, as those who donated were either donating directly to the target or helping him in his objective to raise money for charity (a goal that is aligned with the reduction of suffering). To this point, previous research has treated explicit contributions to third-party charities as an index for helping behavior directed toward a confederate (Pandey, 1979), and even those who donated under the assumption that the funds would be donated placed significantly more trust in the higher status than the lower status confederate–despite the lack of any guarantee the money would go to charity. Again, such a result is consistent with our overall theoretical expectation that relevant compassionate responding would be directed toward those presumed to be more honest and prosocial themselves, and it would at least appear that signaling status influenced decisions to engage in costly helping behavior (likely driven by differential patterns of social perception) regardless of how participants interpreted the situation. Still, the influence of status signaling on compassionate responding might depend on whether those signaling higher status themselves or third parties are the primary beneficiaries. Future research might investigate this distinction more explicitly.

These limitations and open questions notwithstanding, this research adds to existing models that highlight compassion, sympathy, and perceptions of deservingness as primary causes of compassionate responding (e.g., Goetz et al., 2010). Importantly, our results suggest that social status–and its accompanying interpersonal judgments–enters prominently into such processes. Ironically, low status individuals who appear to need the most help may end up receiving less of it than those who appear higher in status and more abundant in resources.

These results also have direct implications for rising levels of economic inequality in society. Given research suggesting that economic inequality and its negative consequences increase when social status is more visible (Nishi et al., 2015; DeCelles and Norton, 2016), the current findings suggest that status symbols expressed through sartorial displays or other non-verbal behaviors are potential mechanisms for the perpetuation of economic inequality. We found that even among those engaging in ostensibly selfless behavior, individuals were more likely to enter into economic relationships with

others who appeared higher, rather than lower, in social status. Given the high degree to which neighborhoods, professional networks, and daily life are stratified by social class, behaviors guided by status signaling can accrue and concentrate wealth and opportunity among a privileged few–further perpetuating inequality (see also Kraus et al., 2019).

These results may also hold implications for addressing economic inequality on a broader societal scale. As indicated by similar research in this domain, cross-status interactions in everyday life can perpetuate inequality by impacting support for social policy aimed at addressing it (Sands, 2017). Nonetheless, such policies are arguably likely to garner the most efficient redistributive outcomes, especially when one considers the alternatives. If subtle interpersonal cues, like clothing or similar indicators of status, shape the behavior of individual actors outside the context investigated in the current research, mechanisms of redistribution that rely on idiosyncratic preferences or the behavior of well-meaning individuals more broadly–such as large donations from wealthy donors to particular individuals or organizations–may be inefficient or underserve those who need the most assistance, whether such needs are met directly or through intermediaries (e.g., charities).

Those from denigrated groups, such as those suffering from homelessness, need monetary assistance despite lacking the ability to transmit status symbols that, as our results suggest, may make certain forms of compassionate responding (i.e., spur-of-the-moment donations) more likely. Moreover, not all charitable organizations aimed at helping such individuals may be equally adept at appealing to wealthy donors or motivating such individuals to donate in the first place. Depending on how far one may extrapolate the results reported here, our research suggests that such a process might require an understanding of how to leverage high status signals (on the part of charities themselves) or how to portray those in need in ways that emphasize their humanity, warmth, competence, and similarity to potential givers. By contrast, codified inequality-reducing policies (such as progressive taxation) do not rely on the generosity of individuals to meet their aims. Unfortunately, even well-meaning generosity, if dispatched at the level of individuals, may be biased by processes of person-perception that direct resources on the basis of attributes other than who is most needy or how resources can best be distributed.

Conclusion

We found that individuals adopting symbols of higher social class were viewed more favorably by and elicited more compassionate responding (i.e., prosocial behavior) from strangers than those adopting lower social class symbols. These findings suggest the power of status symbols to shape our impressions of others–including the poor and needy–and they highlight how rapidly these perceptions have the potential to shape our social judgments and tendencies to meet suffering with compassionate responding. Understanding the role of status symbols in shaping initial judgments of others has direct implications for bridging divides between the rich and poor in society and, potentially, for shifting broader political attitudes about the causes and consequences of wealth and poverty.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://osf.io/bxw7g/?view_only=dd6aa7803dce4debb5219bc2b5dd2244 (Open Science Framework).

Ethics statement

The studies involving human participants were reviewed and approved by University of Illinois, Urbana-Champaign Institutional Review Board. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

BC and MK designed the experiments, collected the data, analyzed the data, and contributed to the manuscript. QD aided interpretation of results and contributed to the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.936170/full#supplementary-material

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Affective and cognitive brain-networks are differently integrated in women and men while experiencing compassion

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Different theoretical models have proposed cognitive and affective components in empathy and moral judgments encompassing compassion. Furthermore, gender differences in psychological and neural functions involving empathic and moral processing, as well as compassionate experiences, have been reported. However, the neurobiological function regarding affective and cognitive integration underlying compassion and gender-associated differences has not been investigated. In this study, we aimed to examine the interaction between cognitive and emotional components through functional connectivity analyzes and to explore gender differences for the recruitment and interaction of these components. Thirty-six healthy participants (21–56 years; 21 women) were exposed to social images in an fMRI session to judge whether the stimuli elicited compassion. The results showed a different connectivity pattern for women and men of the insular cortex, the dorsomedial prefrontal cortex (dmPFC), the orbitofrontal cortex (OFC), and the cingulate cortex. The integration of affective and cognitive components follows a complex functional connectivity pattern that is different for both genders. These differences may indicate that men largely make compassionate judgments based on contextual information, while women tend to notably take internal and introspective processes into account. Women and men can use different affective and cognitive routes that could converge in similar learning of moral values, empathic experiences and compassionate acts.

KEYWORDS

compassion, empathy, moral, gender differences, functional connectivity

Introduction

Compassion can be described as a feeling of affliction that is elicited by perceiving the pain or suffering of another and that motivates to alleviate the suffering party (Haidt, 2003). Since this moral emotion has been related to prosocial behaviors, such as altruism or caring, there has been a growing scientific interest in understanding its complexity from multiple perspectives. For example, its evolutionary origins, its neurobiological substrates and its relations with emotional and behavioral domains such as love, reconciliation, or cooperation (Goetz et al., 2010; Kim et al., 2020; Novak et al., 2022). Social and psychosocial perspectives have also contributed to understanding the phenomenology behind compassion and the sociocultural properties that influence variations in conceptual understanding and/or behavioral expressions (Keltner et al., 2010; Kariyawasam et al., 2021). As reasoned from the previous lines, compassion implies empathic abilities that allow inferring the suffering of others, as well as judgments, evaluation of social signals and decision making to perform helping behaviors. Thus, both affective and cognitive components shape and motivate compassionate experiences and actions.

Empathy and compassion must not be confused. Empathic inference about others states is not restricted to suffering but includes a variety of feelings, whether positive or negative. Also, compassion involves emotional and behavioral understandings, expressions and actions framed on necessary socio-cultural contexts (Preckel et al., 2018). So, empathy may be considered as a crucial affective component of compassion. This component may be phylogenetically recent and emerge early during human development (Perner, 1992; Diamond, 2002). Its neurobiological substrates involve a sensorimotor mirror system particularly based on the anterior insula (AI) and on other brain regions such as, the anterior cingulate cortex (ACC) and the inferior frontal gyrus (IFG) engaged during the first-hand experience of pain and disgust and when perceiving someone else experiencing similar physical or emotional states (Singer et al., 2006; Jabby and Keysers, 2008; Van Overwalle, 2009; Zaki et al., 2009; Lamm et al., 2011).

The cognitive components that shape compassion may have emerged later in evolution and allow humans to better understand and speculate about the intentions and internal states of others. Brain regions with social perception and mentalizing-related functions are proposed as part of such components: the superior temporal sulcus, the medial prefrontal cortex, and the temporoparietal junction (Lamm et al., 2007; Decety and Svetlova, 2012; Healey and Grossman, 2018). In particular, the dorsomedial prefrontal cortex (dmPFC) has been proposed as the critical region involving a network for mentalizing and high-level constructional processes for social stimuli, social learning, and decision-making that allow complex social behaviors (Baetens et al., 2017; Alcalá-López et al., 2018; Moll et al., 2018; de Kloet et al., 2021; Ni and Li, 2021).

The orbitofrontal cortex (OFC) and the anterior cingulate cortex (ACC) have been proposed to play a critical role in affective-cognitive integration (Decety and Svetlova, 2012). OFC damage leads to antisocial behaviors and lack of empathy (Bechara et al., 2000; Damasio, 2003; Decety et al., 2012). As for ACC, its function is related to decision making and convergent information integration (Allman and Atiyahakeem, 2001; Botvinck et al., 2004; Yu et al., 2011).

The affective and cognitive components involving compassion are not the only interesting issue. Gender differences remain a controversial field. For example, women tend to express empathic concern (Reyes-Aguilar and Barrios, 2016) and care-oriented decisions to a greater extent when they reason a sense of injustice, while men tend to express duty-oriented thoughts when reasoning morally (Björklund, 2003; Edele et al., 2013). Likewise, activation in the posterior cingulate cortex and the AI occurs in women while the inferior parietal cortex occurs in men in response to moral stimuli; these activations are related to the perceived severity of a moral violation (Harenski and Hamann, 2006; Harenski et al., 2008). Controversially, although women score higher than men on self-reported dispositional empathy when viewing scenes of induced physical pain, no gender differences are found in brain-related activation of empathy involving the amygdala, the prefrontal cortex, the IA and the ACC (Michalska et al., 2013). Regarding compassion, two studies report that women and men express similar compassionate experiences while viewing compassion-evoking images, but women show greater and more diverse activation than men in the ACC, the left superior frontal gyrus, the thalamus, the insular cortex, and the prefrontal cortex (Mercadillo et al., 2011, 2015a).

Research on the neural basis of compassion using neuroimaging has included a variety of designs. For example, listening to stories and imaginary about situations of suffering (Kédia et al., 2008; Immordino-Yang et al., 2009), or reading statements and observing visual stimuli (Moll et al., 2003; Kim et al., 2009). Such experimental diversity shows a consequent variety of neurobiological findings whose cognitive and affective functions we are still discussing. By a meta-analysis derived from 16 fMRI studies on compassion, Kim et al. (2020) showed common activation in the inferior frontal gyri, the substantia nigra/periaqueductal gray, the ACC, the AI, the putamen, and the thalamus when experiencing compassion elicited by different sensory modalities. Novak et al. (2022) presented a systematic review of 35 neuroimaging studies revealing that the IFG, the cerebellum, the middle temporal gyrus, the insula, and the caudate nucleus are the most recurrent brain regions associated with compassion. Although these reports indicate neuroscientific interest in compassion, analyzes focused on anatomical location and/or brain activation elicited when performing tasks, but functional connectivity and gender differences have not been assessed. It remains unclear whether affective and cognitive components integrating

compassion are anatomically and functionally dissociable or may be independent and recruit overlapping brain functions. Furthermore, it is imprecise whether compassion brain-related functions are similarly or distinctively recruited by women and men, even if similar compassionate experiences are expressed.

We present an exploratory study assessing gender differences when watching compassion-evoking pictures and indicating compassionate experiences motivating helping behaviors. Our approach is based on functional brain connectivity using Psychophysiological interaction (PPI) analysis (O'Reilly et al., 2012) focused on four brain regions: Right AI as a crucial affective component for compassion due to its recurrent activation when perceiving suffering inflicted on others (Singer et al., 2006; Lamm et al., 2011); right-dmPFC as a cognitive component due to its role in high-level processes and mentalization required for social learning and decision-making that favor compassionate expressions (Baetens et al., 2017; Ni and Li, 2021); left-ACC and OFC as brain integrators due to their proposed role in the convergence of both affective and cognitive information involving social situations (Allman and Atiyahakeem, 2001; Decety and Svetlova, 2012). These four brain regions were reported to be functionally active in a previous study using the same experimental task as the one used here (Mercadillo et al., 2011).

Method

Participants

Thirty-six participants (21 women, M age = 34 ± 9.9, range: 21–56 years; 15 men, M age = 31 ± 9.2 years, range: 20–52 years) were recruited through advertisements in internet groups and through personal invitations in Mexico City and Querétaro (Mexico). Since most studies on the functional brain basis of compassion are limited to college-educated youth, we aimed to recruit a more diverse sample for this exploration. An inclusion criterion was 12 years of education, which in Mexico is considered basic education (9 years) and high school (3 years) to promote adequate reading ability, as well as understanding of instructions and information about the experiment. Criteria also included strong right-handedness as measured by the Edinburgh Handedness Inventory, good general health as verified by a clinical interview, and the absence of current mental and neurological disorders as assessed by the Mexican electronic version of the Symptom Check List 90 (González-Santos et al., 2007) and a psychiatric interview. Security restrictions for magnetic resonance imaging studies were also considered. The protocol was designed in accordance with the guidelines of the American Psychological Association (2002) and the Declaration of Helsinki and was approved by the Bioethics Committee of the Institute of Neurobiology of the Universidad Nacional Autónoma de México. No individual was paid for their participation. No subject was taking any regular medication during any stage of the study.

Experimental task

The task was designed in E-Prime (Psychology Software Tools, Inc., Pittsburg, PA, United States) and projected through the visual system with googles placed on the head coil (Nordic Neurolab, Bergen, Norway). It consisted of one series of 100 visual stimuli from the International Affective Picture System (Lang et al., 2005) previously validated by our group for fMRI studies on compassion in Mexican samples (see Mercadillo et al., 2007, 2011, 2015a).

Two categories of stimuli in the series were contrasted applying an event-related design. Fourteen compassion-evoking pictures depicting suffering in different settings and situations (e.g., war scenes, sad facial expressions, famine situations, or people experiencing poverty or addiction) were alternated with 86 emotionally neutral social pictures (e.g., people walking or waiting for the bus). Each picture was presented for 2,500 ms followed by a fixation cross with 500 ms duration (**Figure 1**).

Participants were instructed to respond *via* a button box (ResponseGrip, Nordic Neurolab, Bergen, Norway) if each image elicited compassion (Response: Yes/No). Behavioral responses were recorded to verify attention during the task and to quantify stimuli reported as eliciting compassion. Compassion was defined as feelings of affliction caused by the perception of suffering in others that motivates helping the suffering party. To neutralize the effect of lateralized finger motor responses, half of the participants used their right index finger while the rest used their left.

Imaging acquisition and data analysis

Participants were scanned in a GE Discovery MR750 3T scanner (General Electric Medical Systems, Milwaukee, WI, United States) at the Resonance Magnetic Unit, Institute of Neurobiology, Universidad Nacional Autoìnoma de Meìxico. Anatomical images were collected with a high-resolution 3D SPGR (spoiled gradient sequence); 140 slices, relaxation time = 24 ms, echo time = 5 ms, flip angle = 30°, voxel size = 1 × 1 × 1 mm^3. Functional images were acquired using an EPI-GRE sequence (30 slices, 5 mm thick with no gap, relaxation time = 3000 ms, echo time = 30 ms, flip angle = 90°, FOV = 24 cm, voxel size = 4 × 4 × 4 mm^3).

All preprocessing and statistical analyses were conducted using FSL 4.1.[1] At the individual level, the first four data points of the run were discarded. Preprocessing of images

1 www.fmrib.ox.ac.uk/fsl

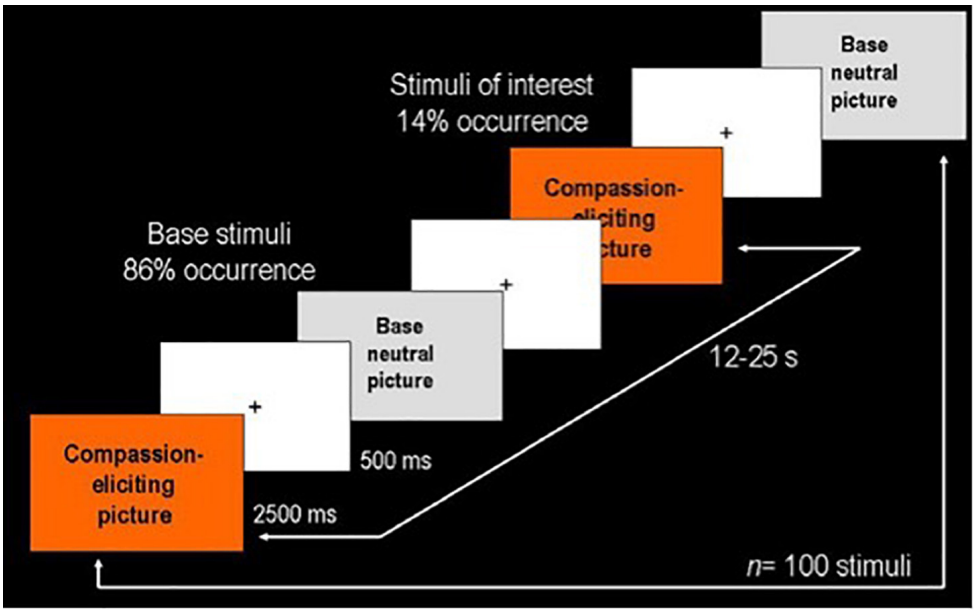

FIGURE 1
Event-related design used in the presentation of visual stimuli. The series consisted of 100 pictures: 14 compassion-eliciting pictures depicting suffering in different contexts (stimuli of interest) and 86 neutral pictures representing common social scenes (base stimuli). Each stimulus was presented for 2,500 ms followed by a fixation cross for 500 ms. Stimuli of interest were randomly presented at 12–25 s intervals.

included: time slice correction to synchronize for inter-slice time difference; MCFLIRT realignment for head movement (Jenkinson et al., 2002); spatial smoothing with a 6 mm FWHM Gaussian kernel (Friston, 2007); BET extraction (Smith, 2002); and normalization to the standard Montreal Neurological Institute (MNI) space.

Connectivity analyses were performed following a PPI method according to the procedures described in O'Reilly et al. (2012). Regions of interest (ROI) were defined on the basis of the activated regions mean map. An isometric mask (3 voxels^3) at one of two possible locations (as some locations were not suitable for each individual participants) was located in each ROI for each participant: right AI (x, y, z = 42, 16, 0; 42, 22, −2), left ACC (x, y, z = −2, 16, 32; −2, 14, 34), left OFC (x, y, z = −44, 22, −4; −38, 28, −4), and right dmPFC (x, y, z = 4, 18, 48; 0, 18, 50).

Some participants with specific poor ROI structural co-localization from the MNI standard, with more than one voxel shift in the seed localization, were not used for that structure PPI functional connectivity estimation. The final sample for the functional connectivity analyses was: (r)AI: women = 17, men = 13; (l) ACC: women = 18, men = 14; (l) OFC: women = 16, men = 10; and (r) dmPFC: women = 19, men = 16.

A general linear model was used to analyze the interaction of the time course in each ROI and the presentation time points of compassion-evoking stimuli (PPI analysis) in the whole brain. Since PPI analyses tend to lack statistical power, especially in event related paradigms (O'Reilly et al., 2012), we decided to consider those results with a $P < 0.005$ threshold level and clusters shaped by seven contiguous voxels as minimum.

Results

As indicated by the finger-motor responses, we did not observe gender differences regarding compassionate experiences elicited by watching the pictures (n = 14; men = 13 ± 1.37; women = 12.8 ± 1.08; $T = 0.48$, $p = 0.92$).

Psychophysiological interaction analyses for the ACC seed revealed a significant effect for the full sample integrating women and men in the frontal pole, the IFG, the precuneus, the putamen, and the lateral occipital cortex. The analysis for men showed a profuse connectivity with frontal and temporal regions. In addition, neural coupling with the post-central gyrus, the insular cortex, the central operculum, the putamen and the cerebellum were found. In women, the ACC seed showed to be functionally connected with the precuneus (**Table 1** and **Figure 2**).

When analyzing the functional connectivity for the OFC seed no significant effects were found for the full sample. For women, the OFC showed connectivity with the frontal pole. For men, this region showed functional connectivity with the middle temporal gyrus, the putamen, the parahippocampal and fusiform gyri, and the amygdala (**Table 1** and **Figure 2**).

Functional connectivity analyses for the AI in the full sample revealed a profuse connectivity with a network involving the

TABLE 1 Brain regions presenting significant functional connectivity with four different seed regions: anterior cingulate cortex (ACC), orbitofrontal cortex (OFC), dorsomedial prefrontal cortex (dmPFC), and anterior insula (AI).

Brain region	Laterality	MNI coordinates *x*	*y*	*z*	*Z*-value
Anterior cingulate cortex (seed)					
Full sample					
Frontal pole	L/R	−46	48	−2	3.4
		14	54	−8	3.03
		46	38	−8	2.8
Precuneus	R	16	−60	26	3.3
Inferior frontal gyrus	L/R	−52	36	8	3.3
		54	16	4	3.16
Putamen	L/R	−18	6	4	3.2
		26	14	4	3.1
Lateral occipital cortex	R	30	−48	−38	2.8
Orbital cortex	R	42	26	−16	2.7
Women					
Precuneus	R	16	−62	28	2.5
Men					
Temporal pole	R	46	22	−30	3.3
Putamen	R	26	14	4	3.3
Inferior frontal gyrus	R	52	14	22	3.3
Post-central gyrus	R	50	−24	44	3.2
Cerebellum	R	32	−44	−42	3.2
Supramarginal gyrus–TPJ	L	−42	−32	40	3.1
		64	−20	24	3.1
Precentral gyrus	R	56	10	18	3.1
		26	−6	46	2.7
Middle temporal gyrus	L	−48	−4	−30	3.09
Insular cortex	R	38	0	10	3.08
Middle frontal gyrus	R	32	12	40	3.03
Frontal pole	L/R	−22	56	4	2.9
		50	40	10	2.9
		−6	56	−4	2.8
Inferior temporal gyrus	L	−48	−52	−18	2.8
Central operculum	L	−50	−22	−18	2.8
Superior frontal gyrus	R	24	14	50	2.7
Paracingulate cortex		0	54	4	2.7
Orbitofrontal cortex (seed)					
Full sample					
Null					
Women					
Frontal pole	L	−46	46	−6	2.8
Men					
Middle temporal gyrus	R	52	−14	−16	3.009
Putamen	R	28	10	−8	2.84
Amygdala	L	−20	−6	−22	2.7
Parahippocampal gyrus	L	−24	−32	−20	2.6
Fusiform gyrus	L	−22	−6	−8	2.6
Anterior insula (seed)					
Full sample					
Middle temporal gyrus	L	−56	−6	−28	3.7
Lingual gyrus–TPJ	L	−24	−54	−8	3.1
Precuneus	L	−10	−66	16	3.08
Cerebellum	L/R	−24	−48	−52	3.0
		46	−56	−34	3.0
Orbitofrontal cortex	L	−52	32	−14	2.9
Parahippocampal gyrus	L	−26	−28	−20	2.9
Fusiform cortex	R	30	−38	−22	2.9
Occipital lateral cortex	R	40	−66	12	2.8
		26	−80	24	2.8
Inferior frontal gyrus	R	52	22	4	2.7
Women					
Frontal pole	R	14	44	40	2.8
Inferior frontal gyrus	L/R	−56	18	10	2.5
		60	14	2	2.5
Middle temporal gyrus	L	−48	−8	−26	2.5
Men					
Orbitofrontal cortex	L	−34	24	−14	2.9
Anterior insula	L	−38	6	−12	2.8
Inferior temporal gyrus	L	−58	−8	−32	2.8
Precuneus	L	−6	−80	44	2.8
Intracalcarine fissure	L	−12	−62	6	2.8
Cerebellum	R	44	−52	−46	2.8
Temporal pole	L	−52	6	−32	2.7
Post-central gyrus	R	38	−20	40	2.7
Fusiform cortex	L	−24	−52	−18	2.7
Lateral occipital cortex	R	28	−80	24	2.7
Superior parietal lobe	R	26	−50	52	2.7
Dorsomedial prefrontal cortex (seed)					
Full sample					
Null					
Women					
Parahippocampal gyrus	R/L	24	−20	−24	3.7
		−30	−28	−18	3.26
Inferior frontal gyrus	L	−52	10	14	3.46
Precentral gyrus	L	−62	2	12	3.46
Paracingulate gyrus	R	10	44	30	3.43
Cerebellum	R/L	26	−54	−54	3.4
		−2	−46	−8	3.06
Posterior cingulate cortex	L	−6	−20	44	3.18
Amygdala	R	30	−6	22	3.05
Hippocampus	R/L	24	−26	−10	3.04
		−32	−18	−20	2.9
Insula	R	30	12	8	3.03
Lingual gyrus	R	12	−42	−4	3.01
Middle temporal gyrus	R	58	−2	−24	2.9
Central operculum	L	−40	8	12	2.8
Putamen	L	−24	−4	16	2.7
Thalamus	R/L	6	−32	4	2.7
		−8	−32	10	2.6
Precuneus	R	30	−50	66	2.5
Men					
Cerebellum	L/R	−26	−66	−48	3.04
		14	−74	48	2.87

Results given for *Full sample* integrating women and men, for only *Women* and for only *Men*.

OFC, the IFG, the middle temporal gyrus, the fusiform gyri, the precuneus, the lateral occipital cortex and the cerebellum. For men, the AI showed to be connected with the OFC, the temporal pole, the post-central gyrus, the precuneus, the fusiform cortex, the lateral occipital cortex and the superior parietal lobe. Conversely, analyses for women revealed connectivity with the frontal pole, the IFG and the middle temporal gyrus (**Table 1** and **Figure 2**).

In regard to the functional connectivity for the dmPFC seed, no significant effects were observed for the full sample. For women, the dmPFC displayed a wide-spread connectivity with cortical and subcortical regions including the IFG, the middle temporal gyrus, the insular cortex, the central operculum, the parahippocampal gyrus, the posterior cingulate cortex, the precuneus, the cerebellum, the putamen, the hippocampus, and the amygdala. For men, the dmPFC presented a neural coupling with different cerebellar clusters (**Table 1** and **Figure 2**).

Discussion

In this exploratory study, we aimed to assess gender differences in the affective and cognitive components underlying compassion. We examined the functional connectivity presented in four brain regions related to those components (AI and dmPFC, respectively), as well as to affective-cognitive integration (ACC and OFC). We did not find a solid pattern of connectivity that supports the role of the ACC or the OFC as the main affective-cognitive integrators. However, despite the extensive overlap in brain activation reported for women and men while experiencing compassion (Mercadillo et al., 2011, 2015a), we clearly found dissociable connectivity patterns for both genders suggesting distinctive neurocognitive pathways that allow compassionate experiences and decisions.

We expected that the OFC and/or the ACC could play as integrators of affective and cognitive components. Our results may support this assumption only for the ACC in men for whom it was connected with the IA, the IFG (affective component-associated brain regions), the dmPFC (related to mentalizing), and with other regions related to social and moral cognition, such as the frontal and temporal poles. As previously suggested, that ACC connectivity may allow regulation of empathic expressions (Kunz et al., 2011; Olalde-Mathieu et al., 2022) and its connectivity with the temporal pole may implicate autobiographical processes and the attribution of social qualities in others (Mercadillo et al., 2017). For women, the ACC was only coupled to the precuneus, whose function involves self-awareness related to emotional valuations, episodic memory (Ochsner et al., 2004; Atilano-Barbosa et al., 2022), imagery about another's mental states (Schurz et al., 2014) and moral judgments (Bzdok et al., 2012). The precuneus is also suggested as a central node in fronto-parietal networks allowing connectivity between different brain regions (Bullmore and Sporns, 2009). Thus, the precuneus may function within a cascade-like mechanism that gathers information from other brain functions and leads to compassionate integration with salient introspective processes in women.

The OFC seed did not exhibit connectivity with neither brain regions involving affective nor cognitive components for the entire sample. However, for men, the coupling with the amygdala, the parahippocampal cortex, the putamen, and the middle temporal gyrus may suggest a role for the OFC as an integrator of emotional and mnemonic elements, as suggested when people feel anger or sadness while making moral judgments on collective painful situations (Fourie et al., 2017). In women, the OFC exhibited functional connectivity only with the frontal pole, which was also connected to the IA in women and to the ACC in the full sample. The frontal pole may play an important role in moral cognition, values, and long-term goals; furthermore, it exhibits structural and functional differences between long-term loving-kindness meditation practitioners (Greene and Haidt, 2002; Moll et al., 2005; Moll and Schulkin, 2009; Engen et al., 2018). The observed patterns of connectivity may suggest the integration of long-term values that encompass the affective component of compassion, as well as, moral appraisals while experiencing compassion involving beliefs and learned values.

Regarding the AI as an affective component, its connectivity with the IFG for the full sample and for women may imply a mirror system that allows mimicry of gestures and emotional contagion (Jabby and Keysers, 2008). The profuse connectivity between the AI and occipital regions, both for the full sample and for men, may suggest visual input influencing somatovisceral responses, presumably related to pain. Only men showed functional connectivity between the AI and the temporal pole, with functions proposed for the understanding of social semantics (Moll et al., 2005) and for the integration of higher order information that involves emotional-visceral responses (Olson et al., 2007). For the full sample, the IA presented connectivity with the middle temporal gyrus. Interestingly, the ACC and OFC were also connected to this region for men, while for women it was connected to the dmPFC. Damage in the middle temporal gyrus has been associated with decreased altruistic behaviors in an experiment on real charitable decisions (Moll et al., 2018). Further studies may investigate whether the strength of the connectivity patterns of the middle temporal gyrus can predict altruistic decision making.

In contrast with the profuse connectivity revealed for the ACC and the AI as seed regions for men, women showed a more spread connectivity from the dmPFC. The dmPFC connectivity with the IFG and the central operculum is remarkable since their role in mimicry and emotional contagion suggest a mirror system directly intervening in the inference of other's mental states. In addition, the dmPFC showed connections with the

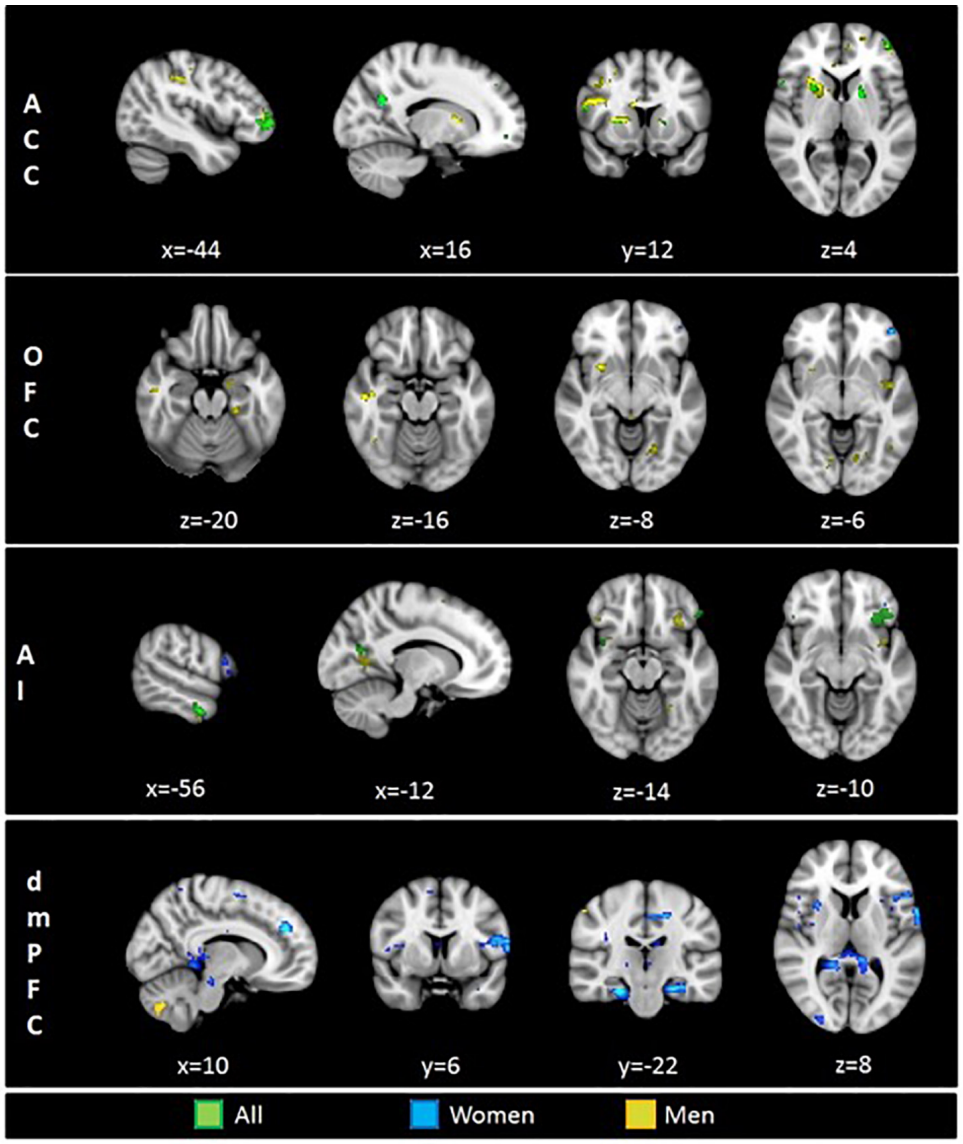

FIGURE 2
Brain regions functionally connected with four seed regions of interest (ROI): ACC, anterior cingulate cortex; OFC, orbitofrontal cortex; AI, anterior insula; dmPFC, dorsomedial prefrontal cortex. Displayed colors represent tree different groups: Green–Full sample, Blue–Women, Yellow–Men. Results at $p < 0.005$.

parahippocampal gyrus and posterior cingulate with functions related to scene recognition and emotional salience in episodic memory (Epstein and Kanwisher, 1998; Maddock et al., 2003). This connectivity pattern may exchange information among different cognitive sources required for mentalizing.

It is suggested that the dmPFC together with the posterior cingulate cortex modulated severity values in moral judgments; modulation by the posterior cingulate cortex has been reported to be significantly stronger in women than in men (Harenski and Hamann, 2006; Harenski et al., 2008). Robertson et al. (2007) report greater posterior cingulate activation when making care-based judgments compared to fairness-based judgments. So, women may perform compassionate judgments in a more caring-based way that requires inner elements, such as self-reflection or episodic memory. A notable finding is the dmPFC connectivity with the hippocampus and the amygdala for women. This connectivity may suggest a role for the dmPFC as a Theory of Mind or mentalization node assembling mnemonic and emotional information required for social decisions, such as expressions of distress and aversive situations in social contexts presented in the design of the task (Mercadillo et al., 2015a).

Both women and men showed connectivity between the dmPFC and the cerebellum, although more extensively for men. In recent years, neuroimaging findings have highlighted the

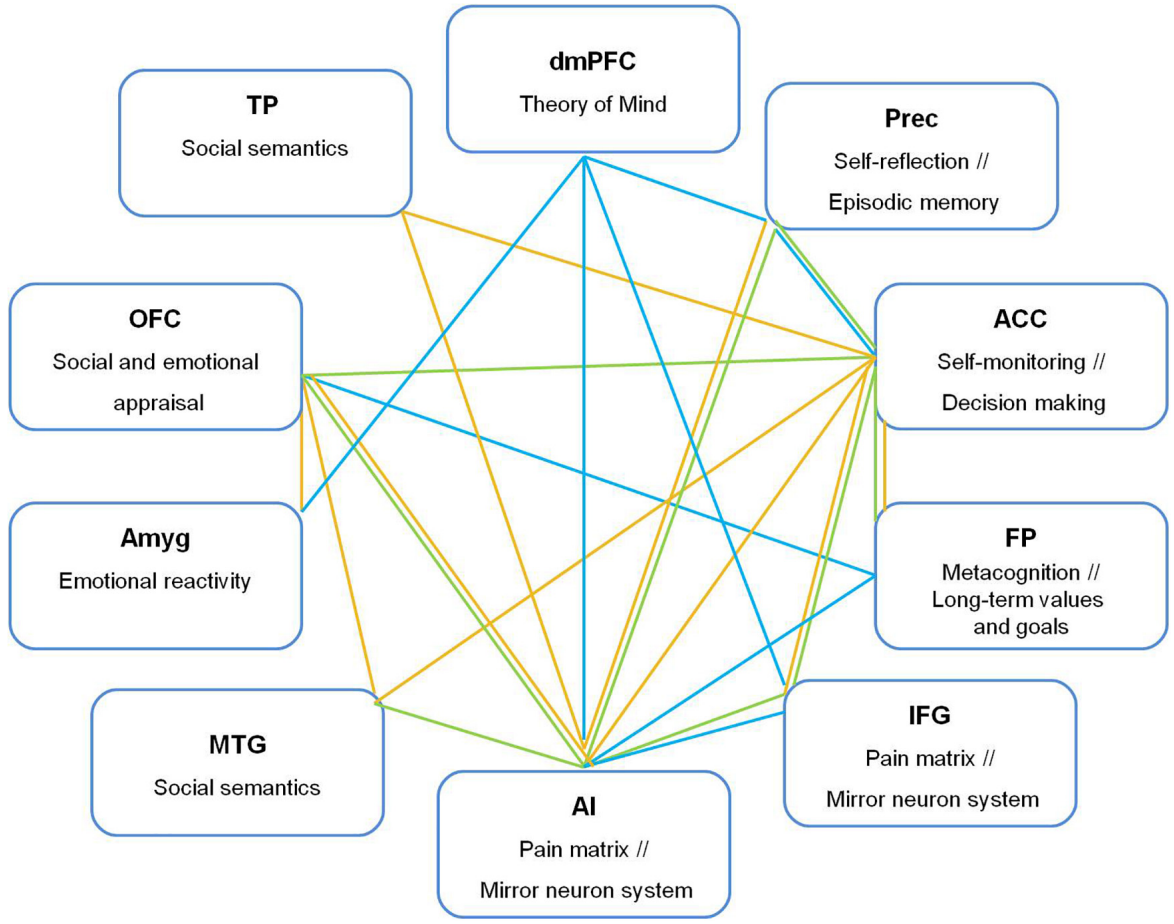

FIGURE 3
Functional connections from dorsomedial prefrontal cortex (dmPFC), anterior cingulate cortex (ACC), orbitofrontal cortex (OFC), and anterior insula (AI) with brain regions related to empathic and moral processes underlying compassion. Prec, precuneus; FP, frontal pole; IFG, inferior frontal gyrus; TPJ, temporoparietal junction, Amyg, amygdala; OFC, orbitofrontal cortex; TP, temporal pole; MTG, middle temporal gyrus. Green line: Both-gender group; yellow line: Men, blue line: Women.

role of the cerebellum in affective processes and experiences (Baumann and Mattingley, 2012). Furthermore, the reciprocal connections of the cerebellum with the prefrontal and cingulate cortices point to its relevance for moral cognition (Demirtas-Tatlidede and Schmahmann, 2013). Clinical approaches have reported that cerebellar damage causes alterations in mentalization, empathy, and social cognition (Gerschcovich et al., 2011; Mercadillo et al., 2015b). The relevance of the cerebellum for compassion may depend on sensory input, and how much it affects higher-order cognition remains unknown. We suggest that the cerebellum modulates unconscious bodily behaviors relevant to social or interpersonal dynamics and, in turn, is modulated by information or emotional experiences. Modulated behaviors may include gaze direction, posture, and language needed to infer states of distress in others and express compassion when caring or helping. Further connectivity analyzes with cerebellar seed regions would be helpful in exploring new neurobiological approaches to compassion.

The profuse functional connectivity of the ACC and the IA for the full sample may suggest common neural processes denoting affective components and the integration of affective-cognitive elements for compassion based on said brain regions. This cannot be said for the OFC and the dmPFC connectivity; null effects for the full sample suggest that the patterns identified separately for each gender are so different that they vanished when analyzed together.

The differences in functional connectivity found for women and men suggest a more complex system than the expected affective-cognitive integration based on one or two brain regions, such as the OFC or the ACC. The interpretation of these gender differences must consider several anatomical and behavioral elements. Women have been reported to exhibit greater anatomical connectivity, resulting in more diversified pathways that can make pattern identification more difficult (Gong et al., 2009). Regarding behavior, previous findings show that women's empathy and moral judgments involving

compassion predominantly recruit introspective and affective resources, whereas men may primarily use attentional processes and contextual information to define social cues involving compassion (Björklund, 2003; Singer et al., 2006; Harenski et al., 2008; Mercadillo et al., 2011; Moriguchi et al., 2014). It is possible, then, that a more profuse connectivity of the IA and the ACC for men underlies a modulating role of contextual factors in affective response and deliberation of possible helping behaviors. Importantly, these gender differences do not necessarily imply different consciously communicated compassionate experiences or prosocial motivated or performed behaviors when experiencing compassion. The differences may imply that women and men use different affective and cognitive routes that could converge in similar learning of moral values, empathic experiences and compassionate acts. How human evolution has determined such differences and how they depend on a particular gender-differentiated education or social context influencing functional connectivity requires further analytical research that can extend the neuroimaging findings. For now, we provide a summary of our findings in **Figure 3** to be useful in further studies on affective and cognitive hypotheses about compassion based on functional connectivity.

Our study has several limitations. We cautiously expect that the effects reported here are strong enough to be significant despite the small sample size. However, large samples are needed in functional connectivity studies to reduce the effect of individual variability that can lead to false positives. Therefore, a larger sample is necessary to confirm our results. Our sample included a wide age range and flexible selection criteria with the intention of exploring the neurobiology of compassion not limited to young and highly educated populations. However, certain conditions may have caused unknown effects. For example, controversial age-related differences in empathy have been reported (Lamm et al., 2018; Wieck et al., 2021; Ziaei et al., 2021). Additionally, a progressive decline in functional connectivity has been reported for default mode, ventral attention, and sensorimotor networks, while increased connectivity in the visual network for individuals older than 50 years (Zonneveld et al., 2019). Therefore, larger samples considering age groups can be used for comparisons in future studies. Likewise, further research could be done considering behavioral assessments, such as empathic dispositions, cooperative attitudes, moral reasoning, or educational level to relate them to functional connectivity patterns.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Bioethical Committee of the Institute of Neurobiology, Universidad Nacional Autoìnoma de México. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GR-N, RM, and FB developed the study concept and data analysis and interpretation. GR-N and EP performed testing and data collection. GR-N and RM drafted the manuscript under the supervision of FB. All authors contributed to the study design and approved the final version of the manuscript for submission.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Compassionate reappraisal and rumination impact forgiveness, emotion, sleep, and prosocial accountability

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Sufficient sleep quality and quantity are important for biopsychosocial well-being. Correlational research has linked trait forgiveness to better sleep. Prior experimental evidence also demonstrated contrasting effects of offense rumination versus compassionate reappraisal on forgiveness and psychophysiological responses, suggesting the value of testing effects on sleep. The present study assessed 180 participants (90M, 90F). First, we replicated an individual difference model of forgiveness, rumination, depressed and anxious affect, and sleep. Second, we conducted a quasi-experiment inducing offense rumination and compassionate reappraisal on two consecutive nights. Compassionate reappraisal (vs. rumination) replicated past research by prompting more empathic, forgiving, positive, and social responses, with less negative emotion including anger. New findings revealed that compassionate reappraisal (vs. rumination) was also associated with faster sleep onset, fewer sleep disturbances, and fewer sleep impairing offense intrusions. The morning after compassionate reappraisal, participants reported less rumination and intrusive impact of the offense, with more hedonic well-being and accountability to others. Compared to rumination, compassionate reappraisal was associated with more empathy and forgiveness, better sleep, well-being, and prosociality.

KEYWORDS

accountability, compassionate reappraisal, empathy, forgiveness, flourishing, sleep, rumination

Introduction

Empirical research has demonstrated associations between forgiveness and psychosocial variables (see Fehr et al., 2010 meta-analysis). Further, experiments testing forgiving processes and inducing more forgiving states also induced calmer and less negative emotion while subduing associated physiological reactivity (see Witvliet et al., 2020 for a review). Large-scale representative research *via* survey in the US has associated forgiveness with better sleep (Toussaint et al., 2019). Sleep comprises a quarter to a third of people's lives, is essential for optimal physical health (Grandner, 2017), mental health (Matsumoto et al., 2011; Buysse, 2014), emotional processing (Tempesta et al., 2018), self-regulation (Barber et al., 2013), and emotional regulation (Palmer and Alfano, 2017; Vandekerckhove and Wang, 2018). Overall, sleep influences comprehensive human flourishing that includes

positive social connection (Léger et al., 2001). In the current research, we first assessed the relationship of trait forgiveness and sleep *via* rumination and negative affect (Stoia-Caraballo et al., 2008); we also tested self-regulation (Carey et al., 2004) and flourishing (Keyes, 2002). We then assessed whether inducing two different cognitive responses to an unresolved real-life offense—rumination in contrast to a compassionate reappraisal of one's offender—would yield predicted reliable differences with comparatively higher state levels of empathy and forgiveness as well as positive and calmer emotion (Witvliet, 2020), prosocial accountability to others for one's actions (Witvliet et al., 2022), hedonic and eudaimonic flourishing (Keyes, 2002), and sleep (Knutson et al., 2017) after compassionate reappraisal. We offer this work as an initial empirical investigation of a compassion-oriented cognitive approach delivered online that may give people an alternative to reliving an offense and its negative impact which still allows for holding one's offender accountable (Witvliet, 2020).

Rumination

Rumination that repetitively reviews one's problems and emotions has been associated with depressive symptoms, anxious symptoms, and poor problem-solving (Nolen-Hoeksema et al., 2008; Aldao et al., 2010). Rumination has also played an important role in the empirical literature on sleep. Specifically, people high (vs. low) on trait rumination experienced more pre-sleep intrusive thoughts and poorer sleep quality (Guastella and Moulds, 2007). Additionally, elevated states of rumination (e.g., stress-induced rumination) have increased sleep onset latency (Zoccola et al., 2009). Rumination has had a significant association with reduced sleep quality even when controlling for depression and anxiety (Thomsen et al., 2003). To better understand the role of rumination in the relationship between trait forgiveness and sleep over the past month, Stoia-Caraballo et al. (2008) tested and found that anger rumination as well as depressed and anxious affect mediated the forgiveness-sleep association; we aimed to replicate their indirect effect model results. Further, we assessed correlations with self-regulation and with flourishing based on theorizing that rumination would have inverse associations, whereas forgiveness would have positive relationships with these variables (Witvliet, 2020).

Substantial experimental evidence has shown that rumination focused on a hurtful real-life offense and its negative impact (compared to cognitive coping responses consistent with holding the offender accountable) was associated with comparatively lower levels of self-reported empathy and forgiveness, as well as higher negative and aroused emotions and indicators of physiological stress (see Witvliet, 2020 for a summary; Witvliet et al., 2001, 2010, 2011, 2015). The current study aimed to assess self-reported sleep using a similar paradigm. Accordingly, we aimed to replicate experimental findings for rumination about a real-life offense versus a coping condition involving compassion to test differences between these two conditions on measures related to forgiveness, emotion, and social responses, while extending this to sleep. We offer this as a first experimental research step with a degree of ecological validity for understanding the human experience of ruminating about and coping with an interpersonal hurt before bed and associated results for forgiveness, psychosocial variables, and sleep.

Reappraisal

Reappraisal is a cognitive approach to interpreting an emotional experience in a way that constructively addresses it (Watkins, 2008) while modulating one's emotions through decreasing negative (Gross, 1998) and increasing positive emotions (Gross, 2007). Accordingly, reappraisal has been considered to be a regulation strategy that has been effective in emotional repair (Augustine and Hemenover, 2008); reappraisal has been associated with less depression and anxiety (Aldao et al., 2010), as well as more positive emotion, better relationships, satisfaction with life, and well-being (Gross and John, 2003).

Reappraisal has been examined in relation to rumination within the forgiveness literature (Witvliet, 2020). The most studied reappraisal approach is compassionate reappraisal of a real-life offender which responds to one's offender in a way that aligns with theorizing about a process of forgiving an offender, which can involve:

1. Recognizing and responding to the humanity of the person responsible for the hurtful interpersonal injustice—not totalizing the wrongdoer in terms of the offense,
2. Acknowledging the wrongdoing and its impact—without minimizing,
3. Seeing the injustice as evidence that the wrongdoer needs positive change—responsibly correcting and improving behavior with respect to the relationship, and
4. Genuinely desiring the good of the person responsible for the wrongdoing—even when the relationship cannot be restored (Witvliet, 2020, p. 168).

In research testing compassionate reappraisal inductions, the person who has been hurt by another person's offense has been prompted to focus on the humanity of the offender, to view the offense as an indication of that person's need for learning, growth, or positive transformation, and to find a way to genuinely wish the offender well for their good–even if the relationship cannot continue (e.g., because it is unsafe, unwise, or not possible due to distance, differences, or death). Collectively, five experiments (Witvliet et al., 2010, 2011, 2015, 2020; Baker et al., 2017) have shown that compared to a condition prompting rumination about the offense and its impact, the condition of compassionate reappraisal has prompted higher state levels of self-reported empathy and forgiveness on scales and ratings, along with higher ratings of positive valence and perceived control, as well as lower levels of arousal and anger. Compassionate reappraisal has also been found to prompt more language use consistent with

forgiveness and positive emotion, as well as sociality. Accordingly, we aimed to replicate and extend the experimental findings for compassion in comparison to rumination. Specifically, in alignment with Stoia-Caraballo et al.'s (2008) findings, we tested effects on sleep and anticipated better sleep after compassionate reappraisal vs. rumination. Additionally, self-compassion has been shown to improve sleep quality by reducing self-blame and the utilization of cognitive emotional regulation strategies (Semenchuk et al., 2021). Here, rather than examining self-compassion, we focused on other-oriented compassionate reappraisal of an offender.

We also examined the effects of compassionate reappraisal (vs. rumination) on prosociality and flourishing (hedonic and eudaimonic) the next morning. Recent research found that accountability and flourishing were both associated with forgiveness at the trait level (Witvliet et al., 2022). Compassionate reappraisal can align with holding offenders accountable for wrongdoing (Witvliet, 2020); yet, no prior research has tested whether compassionate reappraisal (vs. rumination) is associated with a greater willingness to be accountable to others. We reasoned that because experiment participants have been more forgiving, empathic, and social—as well as more positive—after compassionate reappraisal (vs. rumination; Witvliet et al., 2010, 2020; Baker et al., 2017), they would also be likely to be more prosocial in welcoming their accountability to treat others responsibly. Further, substantial evidence has shown that after compassionate reappraisal (vs. rumination), participants experienced a shift from negative and aroused emotion to more positive and calm emotion with more social language (Witvliet et al., 2010, 2015, 2020). This set of positive hedonic emotions and sociality led us to assess whether greater state flourishing would also occur on a measure of feeling and functioning well (Keyes, 2002).

Current study

The purpose of this study was to advance the science and practice of positive psychology with respect to forgiveness and sleep. We first evaluated forgiveness and sleep related variables at the individual difference (trait) level to replicate past findings (Stoia-Caraballo et al., 2008) and incorporate self-regulation and flourishing measures (Witvliet, 2020). Then we extended the quasi-experimental literature that has tested in the moment (state) forgiveness levels to assess whether adopting a compassionate reappraisal approach—which has been associated with forgiveness and psychophysiological side effects (compared to rumination; Witvliet et al., 2010, 2011, 2015; Baker et al., 2017)—would also benefit sleep. We assessed measurements across two consecutive night-morning pairs that spanned a total of three consecutive weekdays. First, we assessed individual difference level variables. Second, we used a quasi-experimental design to test the effects of induced rumination and compassionate reappraisal about a real-life unresolved interpersonal offense on forgiveness and that night's sleep. Drawing on the literature, participants began with rumination on night one, and then engaged compassionate reappraisal on night two. We followed this sequence because (1) interventions such as REACH (see Worthington, 2020) begin with recalling and reliving a real-life interpersonal offense before engaging empathy toward the offender, (2) compassionate reappraisal is known to evoke empathic change on the first trial and to transform subsequent rumination with greater empathy toward one's offender (Witvliet et al., 2015), and (3) ethically, we had to conclude the study with compassionate reappraisal rather than rumination because rumination has known adverse effects of on negative affect and stress physiology, whereas compassionate reappraisal has known psychophysiological benefits (Witvliet, 2020).

We designed this research to be conducted using remote online technology (in keeping with the methodology of this special section for compassion research using online methods) to deliver conditions instructions adapted from the paradigm used by Witvliet et al. (2020). This approach made the intervention study accessible to participants in their natural sleep environment using well studied measures. This research did not use physiological assessments of sleep variables (e.g., actiwatches, ambulatory monitors) due to cost and challenges in the pandemic; thus, we invite other researchers to incorporate quality objective sleep-related measures in follow-up research.

We tested an equal number of self-identified male and female participants given gender variations in sleep quality and quantity (Jonasdottir et al., 2021). We also focused on college students because they experience a confluence of developmental and life factors that contribute to impaired sleep quality and quantity, through difficulty falling asleep, social pressures, and elevated risk of anxiety and depression (Garcia, 2021).

Hypotheses

At the individual difference (trait) level, we preregistered the following primary hypotheses.[1] Better baseline sleep quality and sleep quantity would have a significant inverse relationship with trait rumination and negative affect in accordance with research by Mellman (2006), but a direct relationship with trait self-regulation, forgiveness, and flourishing in the past month. The latter hypotheses extend from research on sleep and its beneficial associations with self-regulation (Barber et al., 2013), emotion regulation (Palmer and Alfano, 2017; Vandekerckhove and Wang, 2018), emotional processing (Tempesta et al., 2018), forgiveness (Toussaint et al., 2019), and quality of life (Léger et al., 2001).

We also hypothesized that forgiveness would have a significant inverse relationship with trait rumination and negative affect, but a direct relationship with trait self-regulation and flourishing. This is consistent with theorizing by Witvliet (2020) based on experimental data showing that rumination (vs. compassionate reappraisal) was associated with lower self-reported forgiveness,

1 https://osf.io/5b7h8

greater negative affect, and cardiac dysregulation, whereas coping conditions that induced forgiveness also reduced negative affect and have maintained cardiac regulation similar to baseline levels (Witvliet et al., 2011, 2015); further, recent research has found a correlation between forgiveness and flourishing (Witvliet et al., 2022). Stoia-Caraballo et al. (2008) found that forgiveness indirectly predicted sleep quality through rumination and negative affect (and through negative affect alone); thus, we predicted that we would replicate the model results.

At the state level, we made predictions based on programmatic research on compassionate reappraisal and rumination, including measures used by Baker et al. (2017) and Witvliet et al. (2010, 2011, 2015, 2020). Accordingly, we predicted that compassionate reappraisal (vs. rumination) toward a real-life offender would prompt higher empathy and forgiveness scores (Witvliet et al., 2010, 2015, 2020; Baker et al., 2017). Consistent with these studies, we also hypothesized that compared to compassionate reappraisal, the offense rumination condition would prompt more negative and aroused emotion—including anger as well as less perceived control (Witvliet et al., 2010, 2011), and lower scores for that night's sleep quality and quantity (Guastella and Moulds, 2007). Compared to compassionate reappraisal, we also hypothesized that rumination would prompt higher scores on the intrusive impact of events and rumination scales because repetitive thoughts may continue including during sleep (Horowitz et al., 1979; McCullough et al., 1998), as well as lower self-regulation, accountability to others, and flourishing scores the subsequent morning. The self-regulation hypothesis is based on research by Witvliet et al. (2010, 2011) noting that rumination (vs. compassionate reappraisal) was associated with significantly lower heart rate variability (vs. no difference) compared to baseline levels. The state accountability and flourishing hypotheses were based on theorizing (Witvliet, 2020) and data (Witvliet et al., 2022) linking the relational virtues of forgiveness and accountability with each other and with flourishing as feeling good and functioning well in relationships with a sense of purpose (Keyes, 2002).

Materials and methods

Participants

One-hundred and eighty undergraduate students from a midwestern United States undergraduate liberal arts college participated in the current study as one way to receive extra credit or meet course expectations for research experience. As documented in the OSF pre-registration, we aimed to obtain a gender-balanced sample as close to 200 as possible based on a G*Power analysis considering the possibility of small effect sizes for sleep and the possibility that participant drop-out could occur for this 4-part repeated measures study. The gender distribution of these 180 participants was 90 self-identified females and 90 self-identified males. Upon obtaining a sufficient sample of self-identified females, we recruited participation of self-identified males to aim to have a gender balanced sample. Of these 180 participants, 153 participants (85.0%) self-identified as *White, Anglo, Caucasian, or European American*; five (2.8%) as *Hispanic, Latino, or Spanish origin*; eight (4.4%) as Black or African American, 13 (7.2%) as *Asian or Asian American*; and one (0.1%) identified *Some other race or ethnicity or origin*. The 180 participants completed the trait measures on night one, and 170 participants individually identified and wrote about a real-life offender for the experimental conditions on night one and night two, and also completed all components of the experiment on night one, morning one, night two, and morning two.

To handle missing data, we adopted the following strategies. If a scale item was unanswered, we used mean imputation based on that participant's other responses on that scale (only 4 items were missing across all participants, thus we imputed 0.008% of scale items). If a single-item rating was missing, it was excluded from analysis (only 9 items were missing across all participants, thus we excluded 0.171% of single-item ratings). One participant completed all components of the experiment, except the anxiety scale component of the depression anxiety stress scale (DASS anxiety) on night one; for this participant, we excluded the DASS anxiety score, but we included all other data in analyses.

Overall design

We used a correlational survey design to assess individual differences, followed by an experiment with an incomplete repeated-measures within-subjects design to test the effects of rumination vs. compassionate reappraisal toward a specific offender on two consecutive evening-morning periods. Each participant selected a particular previous, non-traumatic and unresolved interpersonal offense where they felt hurt or wronged, focusing on this single offense for both experiment conditions. Readers are directed to the protocol materials to see the imagery and writing prompts for each condition (see pre-registration[1] and its associated project link [2] for all protocol and measures materials as well as de-identified data).

On the first night, participants completed the rumination induction beginning with a two-minute imagery period in which they actively focused on the negative thoughts, feelings, and physical responses they experienced as they thought about the ways they experienced harm by the offender. After this, they responded to written response prompts about their emotions, blame of the offender, harm experienced, and continued impact of the offense (Witvliet et al., 2020).

On the second night, participants completed the compassionate reappraisal condition beginning with a two-minute imagery period, focusing on the offender's humanity and need for positive transformation, trying to genuinely wish them well with

2 https://osf.io/wr2f7/

compassion. Participants then responded to writing prompts about the offender's humanity, the wrongdoing as evidence of the offender's need for positive change and growth, a small way to wish the person well, and how one's compassion can be genuine even if the relationship discontinues.

All participants were in the rumination condition on night one and compassionate reappraisal condition on night two; this sequence aligned with the intervention literature (Worthington, 2020), as well as evidence that rumination ought to be assessed first because compassionate reappraisal elevates empathy for subsequent rumination (Witvliet et al., 2015), and ethical considerations to avoid the potential harm of ending a study with rumination which has been associated with negative affect and physiological stress (Witvliet, 2020).

Procedure

Participants were recruited for this Human Subjects Review Board-approved research through online software (Sona Systems).[3] They then completed all phases of this study online, with informed consent, data collection, and debriefing conducted using Qualtrics software (Provo, UT). Participants completed the study either Monday night through Wednesday morning, Tuesday night through Thursday morning, or Wednesday night through Friday morning. Data were not collected on weekends due to the potential confound of different sleep—wake schedules on weekends within this US sample of college students (Machado et al., 1998).

The study began at 8:00 pm on night one on Monday, Tuesday, or Wednesday night to ensure sufficient time to complete the surveys before participants went to bed. Both nights, participants received an email with the Qualtrics link at 7:45 pm to complete the study between 8:00 pm and 11:59 pm. We note that the preregistered plan indicated that we would allow completion between 8:00 pm and 9:00 pm, however, the longer timeframe was more feasible for participants' evening schedules.

Once participants clicked on the night one link, they completed informed consent, as well as demographics and individual difference measures of sleep quality and quantity, flourishing, forgiveness, negative affect, rumination, and self-regulation. Next, participants identified a specific person they held responsible for an unresolved interpersonal offense against them. They then underwent the rumination manipulation. This section was timed in Qualtrics, so participants could not proceed until they completed the rumination condition for the full 2 min. Following rumination imagery, participants were prompted to write about their thoughts, feelings, and reactions to the event through a variety of free response questions, and then they were required to sign a safeguard statement which provided mental health resources to ensure protection. Finally, after the rumination imagery and writing on night one, participants completed scales and ratings of their state levels of emotions, empathy, and forgiveness.

The next day, the Qualtrics questionnaire link for morning one was emailed to participants at 6:00 am, which they were instructed to complete upon awakening before noon. Participants then completed surveys that evaluated their sleep disturbances the prior night, levels of the perceived impact of the offense event, and levels of rumination about it since the imagery and writing they did the night before. Levels of state self-regulation, willingness to be accountable to others, and flourishing were also assessed.

On night two, after instructions were emailed at 7:45 pm, participants again had between 8:00 pm and 11:59 pm to complete this portion of the study. During this period of time, the compassionate reappraisal manipulation was completed. As before, they were required to consider the same offense as night one (i.e., rumination condition), but this time to utilize the provided compassionate reappraisal techniques for 2 min before proceeding. Participants were prompted to engage in compassionate imagery and to write down their thoughts, feelings, and reactions through free-response questions. They were prompted to agree to the same safeguard statement as provided in night one. Additionally, participants' state levels of emotions, empathy, and forgiveness were assessed with scales and ratings.

The following (second) morning, participants received a 6:00 am email link prompting them to report by noon their prior night's sleep disturbances, their perceived impact of the offense event and rumination about it since their imagery and writing the night before, as well as state self-regulation, accountability to others, and flourishing. Following completion of the study, participants were debriefed about the study and offered follow-up mental health resources available by phone and telehealth.

Measures

All reported measures for this registered study are publicly available (see study registration[4] and associated project link[5] to select Protocol files). Below we report the measures we analyzed and provide the citations for them. Cronbach's alphas are reported for the current sample. For state measures, the alpha for the rumination condition is reported before the alpha for the compassionate reappraisal condition.

Trait measures (measured on night one before rumination)

Sleep quality and quantity (PSQI)

Baseline measures of sleep quality and quantity were evaluated utilizing the Pittsburgh Sleep Quality Index (PSQI), a

3 https://www.sona-systems.com

4 https://osf.io/5b7h8

5 https://osf.io/wr2f7

questionnaire detailing the participant's self-reported sleep patterns within the past month; the scale has items for a bed partner or roommate's responses, but these do not affect the global score and were not used. The PSQI includes open-ended sleep hygiene questions, such as "*When have you usually gone to bed?*" as well as ordinal questions where participants rate the extent of disturbance by variables that influence sleep quality (e.g., *In the past month, how often have you had trouble sleeping because you feel too cold*) on a scale of 0 (*not during the past month)* to 3 (*three or more times per week*). The PSQI global score is a total of seven components: *subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction*. The possible range of global scores for the PSQI is zero to 21, with a higher score indicating poorer sleep quality. The PSQI is considered the gold standard for measuring self-reported sleep quality and quantity (Buysse et al., 1989). In this sample, the internal consistency of the global PSQI score across all seven components (α =0.67) was similar to recent research by Zhang et al. (2020).

Short Form Self-Regulation Questionnaire (SSRQ)

We assessed trait self-regulation using the 31-item questionnaire developed by Carey et al. (2004), evaluating the extent to which individuals felt competent in their ability to regulate their behaviors while pursuing goals (α=0.84). Participants were asked to rate their level of agreement with several statements pertaining to self-regulatory behaviors, such as "*I do not seem to learn from my mistakes*" (reversed) and "*I have a lot of willpower*" on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Scores can range from 31 to 155, with a higher score indicating higher levels of self-regulation.

Ruminative Response Scale (RRS)

We used the 22-item RRS by Nolen-Hoeksema et al. (1999), which details the frequency of ruminative thoughts including when feeling sad, down, or depressed (α=0.95). Statements include rating the frequency of thoughts such as "*Think about how alone you feel*" and "*Think about all your shortcomings, failings, faults, mistakes*" on a scale of 1 (*almost never*) to 4 (*almost always*). Scores can range from 22 to 88, with a higher score indicating higher levels of self-regulation.

Depression Anxiety Stress Scale (DASS)

Negative affect was evaluated using 14 depression items and 14 anxiety items on the DASS (Lovibond and Lovibond, 1995), a scale that assessed the presence of depressive and anxious symptoms over the past week (α=0.96). Participants rated statements indicative of symptoms of depression, such as (in the past week) "*I felt that I had nothing to look forward to*," and statements indicative of symptoms of anxiety, such as "*I felt scared without any good reason*" on a scale of 0 (*did not apply at all*) to 3 (*applied very much or most of the time*). Scores can range from 0 to 42, with a higher score indicating greater levels of depressive and anxious symptoms within the past week.

Trait Forgiveness Scale (TFS)

Dispositional forgiveness toward other people was assessed using the 10-item Trait Forgiveness Scale by Berry et al. (2005; α = 0.79). Participants were asked to rate the extent of agreement to statements such as "*I can forgive a friend for almost anything*" and "*I have always forgiven those who have hurt me*" on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Scores can range from 10 to 50, with a higher score indicating higher level of dispositional trait forgiveness.

Flourishing Scale (FS)

Levels of flourishing over the past month were evaluated using Keyes' (2002) 14-item scale which combines hedonic items about feeling good and eudaimonic indicators of functioning well (α=0.94). Questions include rating the extent to which one has felt experiences consistent with hedonic flourishing such as "*happy*" and "*interested in life,*" and eudaimonic flourishing such as "*I have something important to contribute to society*" and "*My life has a sense of direction or meaning to it*" on a scale from 1 (*never*) to 6 (*every day*). Scores can range from 14 to 84, with a higher score indicating a greater experience of flourishing within the past month.

State measures (measured on night one and night two during and after experimental conditions)

Night state measures

We report the analyzed measures in the order in which participants received them. Because the protocol provides all measures, we provide wording and sample items only where we believe it will offer needed clarity for readers.

Linguistic Inquiry and Word Count (LIWC)

After the imagery and writing prompts for each condition (rumination, compassionate reappraisal), participants were instructed to *Write a paragraph (60+ words). If the person who hurt or offended you walked into the room right now, what would you feel like saying or doing in response to him/her?* The word count suggestion was offered to guide participants on length for responses; however, a minimum word count was not required, and no participants wrote nonsensical responses or unrelated filler content. We used LIWC software (Pennebaker et al., 2007) to compute the proportion of words in participant responses that corresponded with software's internal dictionary lists of positive emotions, negative emotions and social words, plus a forgiveness dictionary developed by Witvliet et al. (2010). This allowed us to test for differences in word use to describe responses to one's offender immediately after inductions of rumination and compassionate reappraisal.

Spielberger's State Anger Scale (SAS)

State levels of anger in participants were evaluated using Spielberger's 10-item State Anger Scale (Spielberger, 1988;

αs = 0.94, 0.95), which includes several statements related to anger such as "*I am mad*" and "*I feel like banging on the table*," rated from 1 (*strongly disagree*) to 4 (*strongly agree*). Scores on the scale can range from 10 to 40, with a higher score indicating greater state levels of anger.

Ratings

Participants provided single item ratings based on Witvliet et al.'s (2001) approach, which has been adopted in subsequent studies comparing offense rumination and compassionate reappraisal conditions (Witvliet et al., 2010, 2011, 2015, 2020; Baker et al., 2017). They rated the valence of their emotion right after each condition, from (1) *Very negative* to (7) *Very positive*. They also rated how aroused/intense, in control, angry, and sad they felt, as well as how much empathy and forgiveness they felt for the person who hurt them, from (1) *Not at all* to (7) *Completely* (e.g., Witvliet et al., 2020).

Batson's Empathy Adjectives Scale

We used Batson et al.'s (1986) 8-item empathy adjectives scale to assess state empathic emotions for the person who hurt them (αs = 0.91, 0.93). This scale has been established as a valid and reliable way to assess empathy levels, and has been utilized in other studies pertaining to empathy and forgiveness (e.g., Kidwell, 2009; Niezink et al., 2012; Witvliet et al., 2020). Participants indicated the extent they experienced affective states for their offender, such as "*sympathetic*," "*moved*," and "*compassionate*" on a scale of 0 (*not at all*) to 5 (*extremely*). Total scores can range from 0 to 40, with higher scores indicating greater levels of state empathy toward one's offender.

Transgressions-Related Interpersonal Motivations Inventory (TRIM-18R)

State levels of forgiveness were assessed through the 18-item scale by McCullough et al. (2006). This questionnaire examines benevolent, avoidance, and revenge motivations by rating the extent to which one agrees with statements such as "*I'll make him/her pay*" and "*I do not trust him/her*" on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Total scores (for which avoidance and revenge items were reverse-scored) can range from 18 to 90; higher scores indicate greater overall state forgiveness toward one's real-life interpersonal offender (αs = 0.89, 0.92).

Morning state measures

In order to assess the sleep quality and quantity of the prior night, as well as other psychological indicators, participants completed the following measures each morning upon awakening.

Sleep Health

We used a modified version of the Sleep and Health Self Report Scale from the National Sleep Foundation. The Sleep Health Self Report Scale includes three domains of sleep health: sleep quantity (using questions such as, *I went to bed last night at:* ____, *I woke up this morning at:*_____), sleep quality (using questions such as, *When I woke up for the day, I felt …* 1 (*very fatigued*) to 5 (*very refreshed*), and sleep disturbances (using questions such as, *Last night, my sleep was disturbed by: Noise, Lights, Pets, Allergies, Temperature, Discomfort, Stress, Anxiety, Anger, Sadness, Other, or None*). We only used two of these three domains (sleep quantity and sleep quality), because the sleep disturbances could be measured more accurately with the Sleep Disturbance Questionnaire (SDQ). The Sleep and Health Self Report Scale has been shown to be a valid measure and has been used by other researchers to assess sleep health (Knutson et al., 2017). Several studies have examined self-reported sleep quantity and sleep quality using items similar to the items in the current study assessing sleep on the night before (Leigh et al., 1988; Meltzer et al., 2012) and using a repeated-measures design (Ward et al., 2008).

Sleep Disturbance Questionnaire (SDQ)

We used Espie et al.'s (1989) 12-item questionnaire which assesses cognitive, emotional, physical, and behavioral disruptions to one's sleep the night before (αs = 0.91, 0.91). Participants were prompted to rate the extent to which they experienced varying disturbances, such as "*I could not get into a comfortable position in bed*" and "*I got too worked up at not sleeping*" on a scale of 1 (*never true*) to 5 (*very often true*). Scores can range from 12 to 60, with a higher score indicating a greater amount of sleep disturbances from the prior night. This scale has been used to evaluate the impact of cognitive factors on patients with sleep disturbances and disorders such as insomnia (Espie et al., 2000).

Impact of Events Scale (IES)

We used the 7-item intrusion subscale of the IES (Horowitz et al., 1979) to assess how much participants were distressed by intrusive thoughts, images, and dreams since the offense-focused imagery and writing they did the prior evening (αs = 0.90, 0.89). Items included rating statements such as "*Other things kept making me think of it*," "*I had dreams about it*" and "*I had trouble falling asleep or staying asleep because of pictures or thoughts about it that came into mind*" on a scale of 0 (*not at all*) to 4 (*extremely*). Scores can range from 0 to 28, with a higher score indicating a greater perceived impact of the event.

Rumination About an Interpersonal Offense (RIO)

We used Wade et al.'s (2008) 6-item scale to assess rumination about their offender and offense since the induction of imagery and writing the prior night (αs = 0.91, 0.92). Items include rating statements such as "*the wrong I suffered is never far from my mind*" and "*I cannot stop thinking about how I was wronged by this person*" on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*).

On a scale of 6 to 30, a higher total score indicates greater levels of rumination about the offense.

Self-Regulation Scale (SRQ)

We administered an unpublished 25-item questionnaire by Twenge and Ciarocco (2004) assessing the extent to which individuals felt able to manage their present emotions, thoughts, and actions (αs = 0.95, 0.96). Items include rating statements such as "*I feel drained*" and "*I would want to quit any difficult task I was given*" on a scale of 1 (*strongly disagree*) to 4 (*strongly agree*). A higher total score indicates greater levels of self-regulation, with a total possible range of scores of 25 to 100.

Accountability scale (state version)

We adapted an 11-item measure of the disposition to welcome one's accountability to others (Witvliet et al., 2022) so we could assess participants' current state levels of the prosocial virtue. Participants were instructed to assess their current responsibilities in relation to others (e.g., *Right now…I am willing to be held responsible for my contributions on tasks*, *I care about the people who are affected by my work*, *I welcome corrective feedback from people who evaluate me)* using a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert-type scale (αs = 0.88, 0.90). Scores can range from 11 to 55, with higher scores indicating greater state levels of welcoming relational accountability.

Flourishing

State levels of flourishing as feeling good (hedonic well-being) and functioning well (eudaimonic well-being) were evaluated using a state adaptation of Keyes' (2002) flourishing measure reported above, which has been used in psychiatric inpatients (Currier et al., 2019). Participants rated *Right now, I am… happy*, *interested in life*, and *satisfied* (hedonic items) as well as 11 eudaimonic items (e.g., *I feel that I have something important to contribute to society,* and *that I belong to a community*) on a 0 (*not at all*) to 4 (*completely*) response scale (αs = 0.92, 0.93). Scores can range from 0 to 56, with a higher score indicating greater overall state levels of flourishing.

Data analysis

Data were analyzed using SPSS 27. In addition to bivariate Pearson correlations, we tested an indirect effect model using the PROCESS 3.5 Macro (Hayes, 2017) for SPSS 27, with two mediators in Model 6, using 5000 bootstraps and 95% confidence intervals. Specifically, we assessed the indirect effect of forgiveness on sleep quality through rumination and negative affect, using the PROCESS add-on for SPSS. For the quasi-experiment, we performed repeated measures analyzes of variance (ANOVAs) to compare the rumination condition to the compassionate reappraisal condition for all dependent variables. Finally, to assess the internal consistency of the scales utilized, we used scale reliability analysis in SPSS.

Results

De-identified data for this registered study are publicly available (see study registration[6] and associated project link[7] to select Data files).

Individual differences

Table 1 shows the correlations results. Consistent with predictions, lower PSQI global scores (indicating better sleep quality) were associated with lower levels of rumination, as well as the DASS negative affect measures of anxiety and depression, and higher self-regulation and flourishing. Forgiveness also had a significant inverse correlation with trait rumination, anxiety, and depression, but a direct positive correlation with trait self-regulation and flourishing. PSQI scores did not show the predicted significant correlation with trait forgiveness; rather, the association of forgiveness and sleep was indirect. Specifically, this study replicated Stoia-Caraballo et al.'s (2008) indirect effect of trait forgiveness on sleep quality as described and depicted in Figure 1. That is, trait forgiveness predicted better sleep on the PSQI through lower rumination and negative affect (and through lower negative affect only).

Induced rumination versus compassionate reappraisal

All reported results and interpretations are focused on the dependent variables for these two conditions in comparison to each other. We do not make claims about how these variables would compare to nights in which participants were not thinking about their unresolved offense and real-life offender or any other context for sleep.

Written responses about the offender

Table 2 reports the repeated-measures ANOVA results for linguistic analyzes of participants' written descriptions of how they would respond to encountering their offender right after each condition. As predicted, LIWC data showed that after compassionate reappraisal (vs. rumination), participants used a significantly higher proportion of words associated with forgiveness, positive emotions, and sociality, whereas rumination prompted use of significantly more negative emotion words.

Self-reported forgiveness and emotions

Additionally, Table 2 documents the scales and ratings results, which were consistent with hypothesized patterns. Following the rumination (vs. compassionate reappraisal) condition, participants

6 https://osf.io/5b7h8

7 https://osf.io/wr2f7

TABLE 1 Means, standard deviations, and correlations for sleep quality and quantity, and trait measures.

Variable	*M*	*SD*	1	2	3	4	5	6
1. PSQI	6.61	3.11						
2. SSRQ	113.51	16.94	−0.256**					
3. RRS	47.28	15.70	0.411***	−0.449***				
4. Anxiety	9.01	8.18	0.399***	−0.304***	0.662***			
5. Depression	11.04	10.43	0.453***	−0.530***	0.782***	0.669***		
6. Forgiveness	36.00	6.80	−0.137	0.290***	−0.257**	−0.259***	−0.302***	
7. Flourishing	57.18	14.55	−0.349***	0.589***	−0.584***	−0.482***	−0.746***	0.316***

M and SD represent mean and standard deviation, respectively. PSQI, Pittsburgh Sleep Quality Index (lower scores indicate better sleep); SSRQ, Short Form Self-Regulation Questionnaire; RRS, Ruminative Response Scale. Anxiety and Depression are from the Depression and Anxiety Stress Scale (DASS). Possible scale score ranges are reported in the Measures section of the Method. **Indicates $p \leq 0.01$. ***Indicates $p < 0.001$.

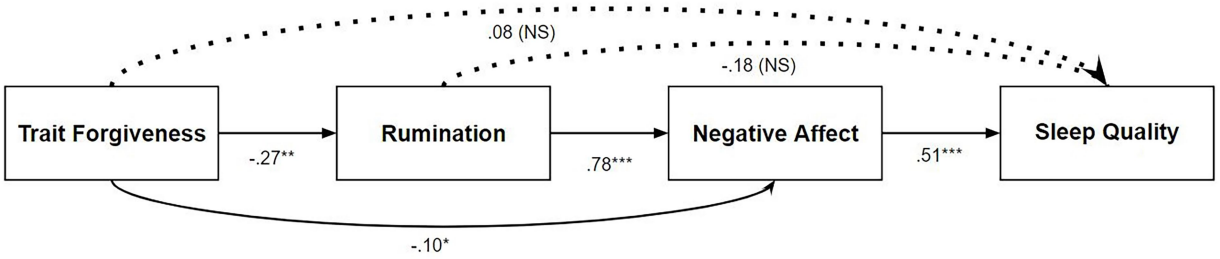

FIGURE 1
We tested an indirect effect of trait levels of forgiveness on sleep quality through trait rumination and negative affect in PROCESS 3.5.3 using Model 6. The measures used in the model, from left to right were the Trait Forgiveness Scale (TFS), the Ruminative Response Scale (RRS), the combined Depression Anxiety Stress Scale (DASS) assessing negative affect, and the Pittsburgh Sleep Quality Index (PSQI). We report standardized coefficient *betas* for direct paths tests, followed by the completely standardized effects for the two reliable indirect effects. Trait forgiveness was associated with trait rumination (b=−0.27, SE=0.17, 95% CI=−0.94 to −0.28), rumination was related to negative affect (b=0.78, SE=0.05, 95% CI=0.75–0.95), and negative affect was related to sleep quality (b=0.51, SE=0.004, 95% CI=0.01–0.03). The path from trait forgiveness directly to negative affect was also significant (b=−0.10, SE=0.11, 95% CI=−0.48 to −0.03). The path from trait rumination to sleep quality was not significant (b=−0.18, SE=0.004, 95% CI=−0.02 to 0.002). Further, the direct path from trait forgiveness to sleep quality was not significant (b=0.08, SE=0.01, 95% CI=−0.01 to 0.02). Overall, as predicted, the model showed that trait forgiveness was associated with sleep quality *via* two significant indirect effects: through both trait rumination and negative affect (b=−0.11, SE=0.04, 95% CI=−0.18 to −0.04), and through negative affect alone (b=−0.05, SE=0.02, 95% CI=−0.09 to −0.01).

TABLE 2 Night measurement means, standard deviations, *F* values, 0.95 confidence intervals for condition mean differences, significance, and partial eta-squared effect sizes.

Variable	Rumination *M* (*SD*)	Compassionate reappraisal *M* (*SD*)	*F*	Mean difference 0.95 *CI*	*p*	η^2
Linguistic inquiry and word count (LIWC)						
Forgiveness	0.22 (0.51)	0.44 (0.83)	8.62	−0.36, −0.07	0.004	0.049
Positive emotion	3.31 (2.18)	4.61 (3.33)	21.30	−1.85, −0.74	<0.001	0.112
Negative emotion	2.99 (2.15)	2.26 (1.97)	11.30	0.30, 1.16	0.001	0.063
Social	14.37 (4.31)	15.46 (4.94)	5.85	−1.99, −0.20	0.017	0.033
State self-report scales and ratings						
Anger scale	18.39 (7.26)	13.55 (5.22)	102.12	3.89, 5.78	<0.001	0.377
Negative-to-positive rating	3.56 (1.43)	4.74 (1.30)	112.74	−1.40, −0.96	<0.001	0.400
Arousal rating	3.29 (1.67)	2.19 (1.31)	77.03	0.85, 1.35	<0.001	0.313
Perceived control rating	4.87 (1.74)	5.26 (1.67)	8.55	−0.65, −0.13	0.004	0.048
Sadness rating	3.92 (2.00)	2.95 (1.66)	51.44	0.70, 1.23	<0.001	0.233
Empathy scale	10.96 (8.66)	16.35 (10.03)	122.98	−6.35, −4.43	<0.001	0.421
Forgiveness scale	59.83 (13.05)	63.77 (13.03)	46.25	−5.09, −2.80	<0.001	0.215

Single item ratings for anger, empathy, and forgiveness showed the same reliable differences between rumination and compassionate reappraisal as each of their respective scales (all $Fs \geq 52.62$, all $ps < .001$, and all $\eta^2s \geq 0.24$). Possible score ranges are reported in the Measures section of the Method.

experienced more state anger, arousal, and sadness. By contrast, compassionate reappraisal activated more empathy, forgiveness, perceived control, and more positively valent emotion.

Sleep effects that night

Several findings were consistent with the hypothesis that evening rumination (vs. compassionate reappraisal) would be followed by lower sleep quality and quantity for that night's sleep. As Figure 2 demonstrates, sleep onset latency was delayed following the rumination (vs. compassionate reappraisal) condition; that is, participants fell asleep faster following the compassionate reappraisal condition. Additionally, Figure 3 shows that participants reported reliably more sleep disturbances on the SDQ following the rumination condition (vs. compassionate reappraisal). Table 3 further documents that after ruminating about their offense experience, participants reported more *trouble falling or staying asleep because of pictures or thoughts about it that came into mind* (IES item 2). Although no analyses directly countered predictions, the following sleep variables did not show reliable differences between conditions: feelings of refreshment, subjective sleep quality, bedtime, wake time, or total sleep time.

Psychological impact reported the next morning

Table 3 documents the subsequent morning impacts of rumination vs. compassionate reappraisal, largely consistent with hypotheses. Specifically, the morning after the offense rumination (vs. compassionate reappraisal) imagery and writing condition, participants reported greater intrusive impact of the offense event (IES) and levels of rumination, with lower levels of welcoming accountability to others. However, conditions did not differ for levels of self-regulation or total flourishing scores. To further

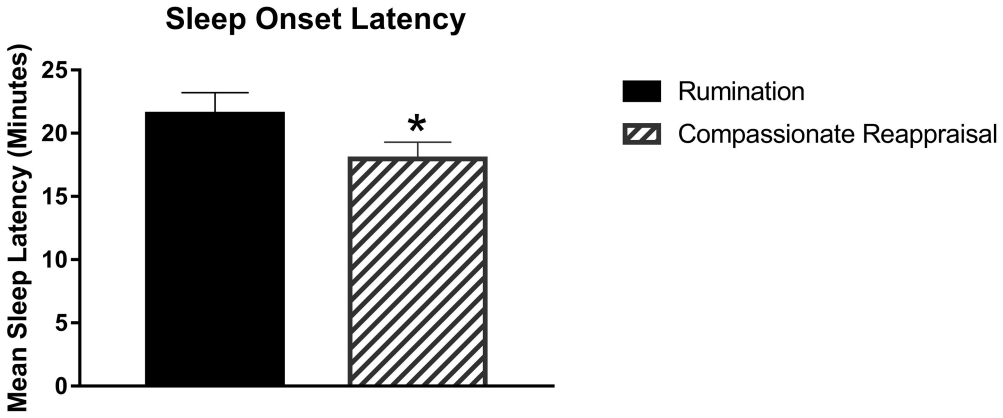

FIGURE 2
Sleep onset latency was significantly shorter indicating participants fell asleep faster following the compassionate reappraisal manipulation (M=17.96, SEM=1.35) compared to after the rumination manipulation (M=21.51, SEM=1.70), F (1, 169)=4.15, p=0.043. Error bars indicate Standard Error of the Mean (SEM). *Indicates p<0.05.

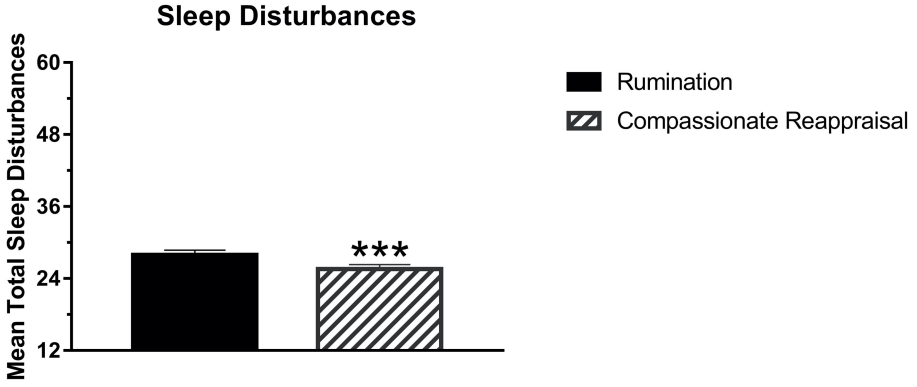

FIGURE 3
Total sleep disturbances as measured by the Sleep Disturbances Questionnaire (SDQ) were significantly lower following compassionate reappraisal (M=25.57, SEM=0.77) compared to rumination (M=27.95, SEM=0.81), F (1, 169)=11.70, p <0.001. Error bars indicate Standard Error of the Mean (SEM). The y-axis gives the minimum to maximum score on the SDQ. ***Indicates p<0.001.

TABLE 3 Morning measure means, standard deviations, *F* values, 0.95 confidence intervals for condition mean differences, significance, and partial eta-squared effect sizes.

Variable		Rumination *M* (*SD*)	Compassionate reappraisal *M* (*SD*)	*F*	Mean difference 0.95 *CI*	*p*	η^2
Sleep variables	Bedtime	12.78 (1.25)	12.57 (1.72)	2.37	−0.06, 0.48	0.126	0.014
	Wake time	8.53 (1.24)	8.49 (1.21)	0.09	−0.19, 0.26	0.760	0.001
	Subjective sleep quality	3.48 (0.91)	3.48 (0.90)	0.01	−0.16, 0.17	0.945	<0.001
	Feelings of refreshment	2.66 (0.93)	2.78 (0.95)	1.81	−0.29, 0.06	0.180	0.011
	Total sleep time	7.46 (1.24)	7.55 (1.35)	0.52	−0.34, 0.16	0.473	0.003
	Trouble falling or staying asleep	0.37 (0.70)	0.22 (0.56)	7.12	0.04, 0.26	0.008	0.040
	Sleep onset latency	21.51 (22.13)	17.96 (17.61)	4.15	0.11, 6.99	0.043	0.024
	Sleep disturbances	27.95 (10.53)	25.57 (9.98)	11.70	1.01, 3.76	0.001	0.065
State self-report	Impact of event (IES)	4.51 (5.06)	2.70 (3.86)	40.13	1.24, 2.37	<0.001	0.192
scales	Rumination	12.43 (5.84)	10.58 (5.29)	38.38	1.26, 2.44	<0.001	0.185
	Accountability	38.65 (6.48)	42.75 (7.09)	102.02	−4.89, −3.29	<0.001	0.376
	Self-regulation	63.25 (13.18)	64.42 (13.54)	2.23	−2.72, 0.38	0.137	0.013
	Flourishing	33.94 (11.24)	34.23 (10.92)	0.50	−0.51, 1.09	0.479	0.003
	Eudaimonic	26.81 (8.79)	26.78 (8.49)	0.01	−0.60, 0.65	0.926	<0.001
	Hedonic	7.14 (3.05)	7.45 (2.93)	4.58	−0.61, −0.03	0.034	0.026

Sleep variables are based on the Sleep and Health Self Report Scale, with the exception of trouble falling or staying asleep (item 2 of the IES intrusion subscale). Possible score ranges are reported in the Measures section of the Method.

investigate levels of flourishing between conditions, we conducted *post hoc* analyzes of flourishing subscales scores. This showed higher hedonic flourishing (feeling happy, interested in life, and satisfied)—but not eudaimonic flourishing—the morning after compassionate reappraisal.

Discussion

The current study centered on trait and state assessments of variables relevant to the literatures on forgiveness and sleep, factors associated with biopsychosocial flourishing (Léger et al., 2001; Witvliet, 2020). In doing so, we used both an individual difference correlational design and a quasi-experimental design (comparing compassionate reappraisal versus rumination about an unresolved real-life offense) to replicate findings while also extending the literature.

Individual differences related to forgiveness and sleep

Recent research showed that at the trait level, people who were more forgiving also slept better (Toussaint et al., 2019). Other research found that the forgiveness and sleep relationship was mediated by lower levels of rumination and negative affect (Stoia-Caraballo et al., 2008). The current study replicated this indirect effect. Specifically, the trait of being forgiving toward others indirectly predicted sleep quality in the past month through lower trait rumination and negative (depressed and anxious) affect, and through lower negative affect alone. This work further demonstrated that sleep difficulties over the past month were correlated with rumination, anxiety and depression, as well lower self-regulation and flourishing. By contrast, forgiveness was positively associated with self-regulation and flourishing, and negatively associated with depression and anxiety. Thus, the current work expands the literature on individual differences. In light of these individual differences, we also sought to test whether adopting one cognitive approach or another (ruminating or cognitively reappraising with compassion) would make a difference for states of forgiveness and sleep along with other psychosocial factors.

Compassionate reappraisal, rumination, and sleep

We used a quasi-experimental design to replicate forgiveness-related findings while extending the literature to test sleep and other psychosocial variables. Specifically, this study replicated the empathy, forgiveness, social, and emotional effects of rumination about a real-life and unresolved offense in comparison to compassionate reappraisal (see Witvliet, 2020) while contributing new findings about biopsychosocial self-reported variables including sleep.

One reliable sleep effect was that sleep onset latency was delayed after ruminating rather than compassionately reappraising one's real-life offender. This finding builds on previous research which showed that a less personal form of rumination (e.g., about a midterm exam) delayed sleep onset latency (Guastella and Moulds, 2007). In addition to delayed sleep onset, the rumination condition (vs. compassionate reappraisal) was associated with more sleep disturbances overall. Further, an item from the IES showed that after the rumination (vs. compassionate reappraisal) imagery and writing, participants perceived more trouble falling or staying asleep due to intrusive

thoughts or images associated with the distressing event. Other indicators of sleep, however, did not show reliable differences (self-reported sleep timing, quality, or feelings of refreshment). Overall, sleep differences centered in falling asleep and sleep disturbances, with intrusive thoughts and images delaying and disturbing sleep. Thus, for people with offense rumination and these types of sleep difficulties, compassionate reappraisal imagery and writing prompts could offer a beneficial approach. This study also demonstrated that these cognitive approaches could be prompted, and self-reported responses could be assessed, through a virtual format. Results suggest that people who want to find a way to hold offenders accountable while also being more forgiving and accountable themselves may find that compassionate reappraisal provides a path forward.

Compassionate reappraisal, rumination, and state forgiveness, emotions, and prosocial accountability

Further evidence across the linguistic measures, scales, and ratings showed that compassionate reappraisal (vs. rumination) significantly elevated forgiveness and empathy, positive emotion, and social responses. By contrast, ruminating about one's offense activated more negative emotion, aroused/intense emotion, anger, sadness, and lower levels of perceived control. These findings are consistent with several studies finding that compassionate reappraisal (vs. rumination) improved forgiveness and emotional states (Witvliet et al., 2001, 2010, 2011, 2020; Baker et al., 2017).

The present study also showed that induced rumination on night one was associated with higher reports the next morning of intrusive thoughts of the offense and ruminations about it since the imagery and writing induction. These findings—in combination with the emotion effects—are broadly consistent with prior research which demonstrated that rumination is linked to state increases in anxiety (Olatunji et al., 2013) and depression (Aldao et al., 2010). However, rumination and compassionate reappraisal did not yield differences in self-reported self-regulation. Past research had shown that compared to a relaxing baseline period, rumination imagery impaired self-regulation as measured by heart rate variability, whereas compassionate reappraisal was equivalent to relaxation levels (Witvliet et al., 2010, 2011). Further, compassionate reappraisal promoted hedonic—but not eudaimonic—flourishing. That is, participants felt happier, more interested in life, and more satisfied the morning after, whereas their sense of societal connection, meaning, and purpose did not change.

Importantly, participants showed greater welcoming of accountability to fulfill their responsibilities to others—a prosocial response to give others what they are due (Peteet et al., 2022)—the morning after compassionate reappraisal compared to rumination. Interpersonal offenses have been interpreted as a failure of relational accountability (Witvliet, 2020), and this study offers the first evidence that a compassionate reappraisal (vs. ruminative) response to one's real-life offender may elevate one's own willingness to be accountable to others. It is possible that such willingness to be accountable to other people could diminish the likelihood of offending others—a possibility worth further study. Compassionate reappraisal is a response consistent with holding interpersonal offenders accountable for their offenses while desiring needed positive transformation—an approach that promotes forgiveness and positive side effects of improved emotions, sleep, and prosociality. Thus, this study amplifies evidence pointing to compassionate reappraisal as a response to offense rumination that is consistent with both justice and mercy, while promoting a suite of psychological, physiological, sleep, and social shifts important for mental and physical health and quality of life (Zlotnick et al., 2000; Léger et al., 2001; Witvliet, 2020).

Study strengths and limitations

A strength of this study was its attention to both individual difference (trait) and state levels in assessing forgiveness, sleep, and related psychosocial variables. At the same time, longer interventions and longitudinal designs are needed to test whether people can implement compassionate reappraisal in ways that grow forgiving dispositions and enduring sleep and psychosocial benefits.

One strength of the online paradigm was that the imagery and writing components of the conditions could be standardized in format and timing. Further, collecting data in participants' home environments elevated ecological validity by assessing night and morning effects in the residence setting in which the rumination, compassionate reappraisal, and sleep occurred. The remote methodology also made it possible to conduct a sleep study in the context of COVID-19. Yet, we acknowledge that in the pandemic, general anxiety levels have been elevated (Lee, 2020). We cannot know if this influenced our study findings, and we hope others build on the current study to replicate and extend it.

From an experimental perspective, the study was designed to compare two cognitive approaches to an unresolved real-life offense, and we offered interpretations of the results in light of the two conditions of rumination and compassionate reappraisal. Accordingly, we urge readers to be cautious in interpretations because the design does not compare these conditions to a control that was not focused on one's unresolved offense. We did not include a baseline (e.g., no-imagery relaxation) night due to concern about the length of the study in light of the goal of avoiding weekend nights and mornings in this US college sample, as well as possible drop-off in completion rates, or implications of practice or fatigue effects. The reasons for sequencing rumination before compassionate reappraisal were that forgiveness interventions begin with reliving one's offense before taking steps to build empathy for that offender (Worthington, 2020), prior research has shown that participants ruminate with more empathy for their offenders after

compassionately reappraising them (Witvliet et al., 2015), and we believed it would be unethical to conclude the experiment with rumination in light of substantial evidence showing its adverse emotional, relational, and physiological effects (see summary in Witvliet, 2020). Therefore, to retain standardization, reduce the potential for confounds, and maintain ethical research practice, we utilized this specific sequence.

Finally, a strength of the trait study is that we used gold standard measures for forgiveness (TFS) and sleep (PSQI). A strength of the state study is that we used many of the same measures as in prior studies to allow for replication, and the same effects on anger, empathy, and forgiveness were found for both the scales and single-item state ratings. However, a limitation of the sleep measures is that they relied on self-report rather than physiological assessment. Having sleep lab measures for the intervention would be valuable for internal validity and objective verification, although this was not feasible for this study because of cost, access, and COVID-19 protocols. While sleep apps and watches and ambulatory monitoring devices present a measurement alternative, this approach was also not feasible for us in the context of the pandemic and timing to conduct this study of 180 participants within an academic year time frame. Relatedly, our sample was comprised of residential college students in the US, so we cannot generalize to other populations without substantial Western, educated, industrialized, rich and democratic (WEIRD) caveats (Henrich et al., 2010).

Future research

In contrast to rumination, compassionate reappraisal prompted increased empathy, forgiveness, positive emotion, prosociality, and better sleep in the short term. In light of this, it would be important to assess the effects of a more sustained and developed intervention on dispositional forgiveness, empathy, rumination, and sleep. Accordingly, if individuals consistently practice compassionate reappraisal rather than ruminating about real-life offenders, the repetition of the responses could promote habit formation and development of trait behaviors (Lally et al., 2010) with the potential to decrease overall rumination and negative emotions, and in turn, improve overall sleep. If so, this is one pathway for improved health (Levenson et al., 2016). At minimum, we recommend compassionate reappraisal as an antidote to rumination and commend its inclusion in integrative approaches to sleep and biopsychosocial health.

The current study builds on a programmatic body of forgiveness research. For example, four psychophysiological studies showed transforming benefits of compassionate reappraisal imagery in contrast to rumination. Two of these studies showed that compassion also outperformed suppression of negative emotions about the offense (Witvliet et al., 2011, 2015), leading us to hypothesize that trying not to experience or express negative emotions about one's offense by another person would not aid forgiveness, empathy, positive emotion, prosociality, or sleep. Two of these studies incorporated a benefit-focused reappraisal that promoted forgiveness as well as gratitude and positive emotion with effects on event related potentials in the brain (Baker et al., 2017) and cardiovascular regulation evident in improved heart rate variability (Witvliet et al., 2010). Further, a recent study used imagery plus writing paradigm similar to the current study, finding use of two consecutive compassion and benefit-focused reappraisals strengthened and sustained forgiveness and diminished negative emotion effects of rumination (Witvliet et al., 2020). Given the importance of rumination and negative affect in trait models, adding a third night-morning pair with the imagery and writing induction paradigm tested here—and counter-balancing the sequence of compassion and benefits—could yield more potent forgiveness with side effects for emotion, prosociality (e.g., accountability to others), and better sleep. We hope the current research and suggested future directions catalyze research on sleep in relation to compassion, forgiveness, and positive psychology.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/5b7h8 (Open Science Framework pre-registered hypotheses; associated project link https://osf.io/wr2f7/ contains protocol files and data sets).

Ethics statement

The studies involving human participants were reviewed and approved by Hope College Human Subjects Review Board. The participants provided their written informed consent to participate in this study.

Author contributions

AG and CW co-developed the research idea, protocol, HSRB, OSF preregistration, analysis plan, analyses, and manuscript. AG worked closely with all students involved in data collection. SB collected data, assisted with analyses, and contributed to all phases of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Epidemiology of compassion: A literature review

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Psychology and neuroscience have contributed significantly to advances in understanding compassion. In contrast, little attention has been given to the epidemiology of compassion. The human experience of compassion is heterogeneous with respect to time, place, and person. Therefore, compassion has an epidemiology, although little is known about the factors that account for spatial or temporal clustering of compassion or how these factors might be harnessed to promote and realize a more compassionate world. We reviewed the scientific literature to describe what is known about "risk factors" for compassion towards others. Studies were included if they used quantitative methods, treated compassion as an outcome, and used measures of compassion that included elements of empathy and action to alleviate suffering. Eighty-two studies met the inclusion criteria; 89 potential risk factors were tested 418 times for association with compassion. Significant associations with compassion were found for individual demographic factors (e.g., gender, religious faith); personal characteristics (e.g., emotional intelligence, perspective-taking, secure attachment); personal experience (e.g., previous adversity); behaviors (e.g., church attendance); circumstantial factors during the compassion encounter (e.g., perceptions of suffering severity, relational proximity of the compassion-giver and -receiver, emotional state of the compassion-giver); and organizational features. Few studies explored the capacity to receive, rather than give, compassion. Definitions and measures of compassion varied widely across disciplines; 87% of studies used self-report measures and 39% used a cross-sectional design. Ten randomized clinical trials documented the effectiveness of compassion training. From an epidemiologic perspective, most studies treated compassion as an individual host factor rather than as transmissible or influenced by time or the environment. The causal pathways leading from suffering to a compassionate response appear to be non-linear and complex. A variety of factors (acting as effect modifiers) appear to be permissive of—or essential for—the arising of compassion in certain settings or specific populations. Future epidemiologic research on compassion should take into account contextual and environmental factors and should elucidate compassion-related dynamics within organizations and human systems. Such research should be informed by a range of epidemiologic tools and methods, as well as insights from other scientific disciplines and spiritual and religious traditions.

KEYWORDS

compassion, empathy, epidemiology, risk factor, psychology, public health, training, sociology

Background

Compassion is a response to suffering that involves cognitive awareness, empathy, and action to alleviate suffering. Psychology and neuroscience have contributed significantly to advancing the understanding of compassion in recent years. In contrast, relatively little attention has been given to the epidemiology of compassion. Epidemiology, the quantitative science that informs public health, is used to describe how and why phenomena are clustered in terms of time, place, and person; to identify causal relationships; to develop metrics and apply them for monitoring and evaluating interventions; and to provide evidence for policy and advocacy. Typically, epidemiology has focused on disease, injury, and other threats to human health. By identifying "risk factors," i.e., variables associated with increased likelihood of a disease (or other outcome of interest), epidemiologists can help to determine what causes that disease and promote behaviors and policies to prevent it.

VanderWeele and colleagues recently highlighted the need for a "positive epidemiology" that aligns with the field of positive psychology, "a positive epidemiology that takes as its object not only disease but also health in its fullest sense" (VanderWeele et al., 2020). Despite pioneering work by Levin and others on the epidemiology of love (Levin, 2000, 2022), the field of positive epidemiology remains under-developed.

The character strength of compassion, valued by all major world religions and spiritual traditions, is essential to human society (Armstrong, 2009). In general, humans experience compassion as "clustered"—we do not experience compassion at the same level of intensity and quality at all times, in all places, and from all people. Therefore, compassion has an epidemiology, although little is known from a quantitative perspective about how compassion is distributed or about the most effective ways to foster compassion in different stages of life, specific populations, or environments.

Understanding the epidemiology of compassion could have practical significance. The lack of compassion in current social discourse, fueled by political polarization and the trauma of the COVID-19 pandemic, is of increasing concern. The past two decades have witnessed an explosion of interest in loving-kindness and compassion meditation, as well as other forms of contemplative practice to foster mindfulness and resilience. A growing body of scientific evidence demonstrates the effectiveness of such practices at the individual level (Riess et al., 2012; Jazaieri et al., 2013; Brito-Pons et al., 2018; Gonzalez-Hernandez et al., 2018), but little is known about how to effectively "scale up" compassion to the organizational or population levels.

Trzeciak and Mazzarelli (2019) recently documented the benefits of compassion for patient outcomes, physician well-being, and hospital systems, and compassion is increasingly recognized as essential for quality healthcare (Ghebreyesus, 2018). Several countries, including Scotland, Ethiopia, and Malaysia have highlighted compassionate care in their national health plans (The Scottish Government, 2010; Federal Democratic Republic of Ethiopia Ministry of Health, 2015; Ministry of Health Malaysia, 2021). However, current knowledge is insufficient to make detailed, evidence-based recommendations for developing compassionate health systems, and validated metrics to monitor progress on compassionate care within these systems are lacking. Providing such evidence is the purview of epidemiology.

The many different views of compassion represent a challenge for epidemiology, which requires clear, quantifiable case definitions. Gilbert, in particular, has explored controversies about the nature and origins of compassion (Gilbert, 2017, 2020). Some investigators define compassion in terms of its constituent components (Goetz et al., 2010; Strauss et al., 2016; Worline and Dutton, 2017; Gu et al., 2020). Others regard compassion primarily as a feeling or emotion, a motivation, or a disposition (Goetz and Simon-Thomas, 2017). Still others focus on the role of intention and self-related goals in moving from deliberation to compassionate action (Poulin, 2017; Gilbert, 2020).

As global health practitioners, our working understanding of compassion reflects the practical, action-oriented nature of the field. We view compassion as having the three essential elements (not necessarily sequential) of awareness (cognitive appraisal), empathic resonance, and action to relieve and prevent suffering (Focus Area for Compassion and Ethics, 2022). We agree with Gilbert and others that compassion extends beyond an immediate response to suffering to include prevention, avoidance of harm, and promotion of human flourishing (Gilbert and Choden, 2013; Gilbert, 2020). For the purposes of this review, our case definition of compassion required evidence of empathy and either action or the intention to act to alleviate suffering or distress.

Materials and methods

We conducted a detailed review of the literature to identify risk factors for compassion (i.e., factors that have been quantitatively associated with compassion). We were broadly interested in other-directed compassion (i.e., compassion directed toward other humans, rather than oneself) and compassion as an *outcome* (not as a predictor of other potential benefits, such as improved health). We searched the available literature through April 2021 in the following subject areas: healthcare, psychology, sociology, anthropology, religion and faith, early childhood development, education, business, organizational development, mindfulness training, contemplative studies, communications, arts, and government.

Studies were *included* in the analysis if they reported quantitative findings and used a measure of compassion that included empathy and either action or the intention to act to alleviate suffering or distress. Studies were *excluded* from the analysis if the authors used only qualitative methods, reported only qualitative results, or if the measure of "compassion" was limited to empathy (emotional resonance) without action or intention to act. Studies that focused on prosocial behavior or altruism, including those involving "money games," were not

included unless they were explicitly situated within a context of suffering or distress, and the authors' intent to study compassion was evident. Similarly, studies that focused on self-compassion as an outcome were not included, as our interest was in giving or receiving other-directed compassion. Articles that addressed "compassion satisfaction" and so-called "compassion fatigue" as outcomes were also excluded.

A search strategy and terms were developed for each subject area (Figure 1), guided in part by the Oxford Handbook of Compassion Science (Seppälä et al., 2017) and proceedings of a January 2020 symposium on the epidemiology of compassion and love (Focus Area for Compassion and Ethics, 2020). Specific areas were assigned to students pursuing their masters' degree in public health at Rollins School of Public Health and staff members of the Focus Area for Compassion and Ethics (FACE). Relevant databases (Figure 1) were searched for articles on compassion. The abstract of each article was reviewed, and if deemed potentially relevant, the full article was reviewed for inclusion in the analysis. The team met weekly during the 2020–2021 academic year to discuss preliminary findings, refine criteria for inclusion, cross-check references, and resolve issues.

Relevant articles were reviewed by three team members, who extracted information into a spreadsheet. For each potential risk factor, the direction of association with compassion (positive, negative, or no significant effect) was noted, as well as whether the risk factor was regarded as an independent variable or an effect modifier. For each study, other characteristics were also recorded, including age and gender of subjects; definitions of compassion and of risk factors, as well as the measures used to assess them; whether compassion was considered a state, trait, or skill; level of assessment (individual, organizational, or community); study design; and analytic method. Information was recorded on whether compassion was assessed from the perspective of the compassion-giver ("first-person" measure), the receiver of compassion ("second-person" measure), or an independent observer ("third-person" measure; Mascaro et al., 2020).

Risk factors for each article were assigned to one of four categories:

Associated. Having a statistically significant independent association with compassion in the population or a sub-population studied.

Not associated. Having no statistically significant independent association with compassion.

Effect modifier. Significantly modifying the direct relationship between other risk factors and compassion, for example, gender in a study of empathy training in which compassion scores improved among women, but not men (Riess et al., 2012).

Second-order modifier. Significantly modifying relationships among other risk factors that were themselves associated with compassion. For example, previous experience of adversity modifies the relative strength of a compassionate response to suffering of individuals vs. larger groups (Lim and DeSteno, 2020).

After potential risk factors were identified, we used an iterative process to group them into six interrelated themes or domains. This grouping helped to shape further exploration and facilitated comparison with the three main parameters of descriptive epidemiology: person, time, and place.

Results

Study characteristics

More than ten thousand articles were captured by search terms and reviewed for relevance. Sixty-four articles met the criteria for inclusion in the analysis. Of these, 44 (68.8%) articles came from the fields of psychology, sociology, anthropology, or childhood development; 14 (21.9%) articles addressed compassion in healthcare settings; 13 (20.3%) evaluated training or immersion programs to improve compassion, mindfulness, or empathy; and 10 (15.6%) involved organizational dimensions of compassion. These categories are not mutually exclusive (e.g., some articles assessed compassion training in healthcare settings).

These 64 articles reported results of 82 separate studies. Of these studies, 32 (39.0%) were cross-sectional in design (mostly surveys) and 25 (30.5%) were randomized experiments or clinical trials (RCTs); 14 (17.1%) studies evaluated interventions without randomization or control groups; 7 (8.5%) followed cohorts longitudinally but did not test interventions; 2 (2.4%) employed experience sampling methods; and 2 (2.4%) were meta-analyses (Table 1). None of the individual 41 studies in the meta-analysis by Butts et al. (2019) were included in our review. Only one of the 64 studies in the other meta-analysis, by Howick et al. (2017), which used the Consultation and Relational Empathy (CARE) measure to assess empathy of medical practitioners, was included in our review as a separate article. This study (Lelorain et al., 2015) included compassion-related measures and examined risk factors other than those reported by Howick et al. (2017).

Researchers used a variety of measures to assess compassion (Table 2). By far the most common approach was self-report of the person being evaluated for their tendency or capacity to give compassion to others—the "compassion-giver" (i.e., first-person measure); 71 (86.6%) studies included at least one such self-report measure. The validated first-person self-report scales most commonly used were Compassionate Love Scale for Humanity (Sprecher and Fehr, 2005) in eight studies and the Santa Clara Brief Compassion Scale (Huang et al., 2008) in seven studies. Investigators in 23 studies asked subjects to rate their feelings of compassion, usually in combination with other measures, while 15 studies assessed self-reported willingness to help, usually in combination with other measures. In nine (11.0%) studies, compassion was assessed by the potential receiver ("target") of compassion (i.e., second-person measure). The most commonly used second-person measure was the CARE scale (Mercer et al., 2004; 4 studies; Table 2). Twenty (24.4%) studies used an objective measure of behavior to assess compassion (third-person measure), including offering to donate money (9 studies) or rendering assistance (5 studies) to a person in distress, usually in experimental settings. These categories are not mutually exclusive.

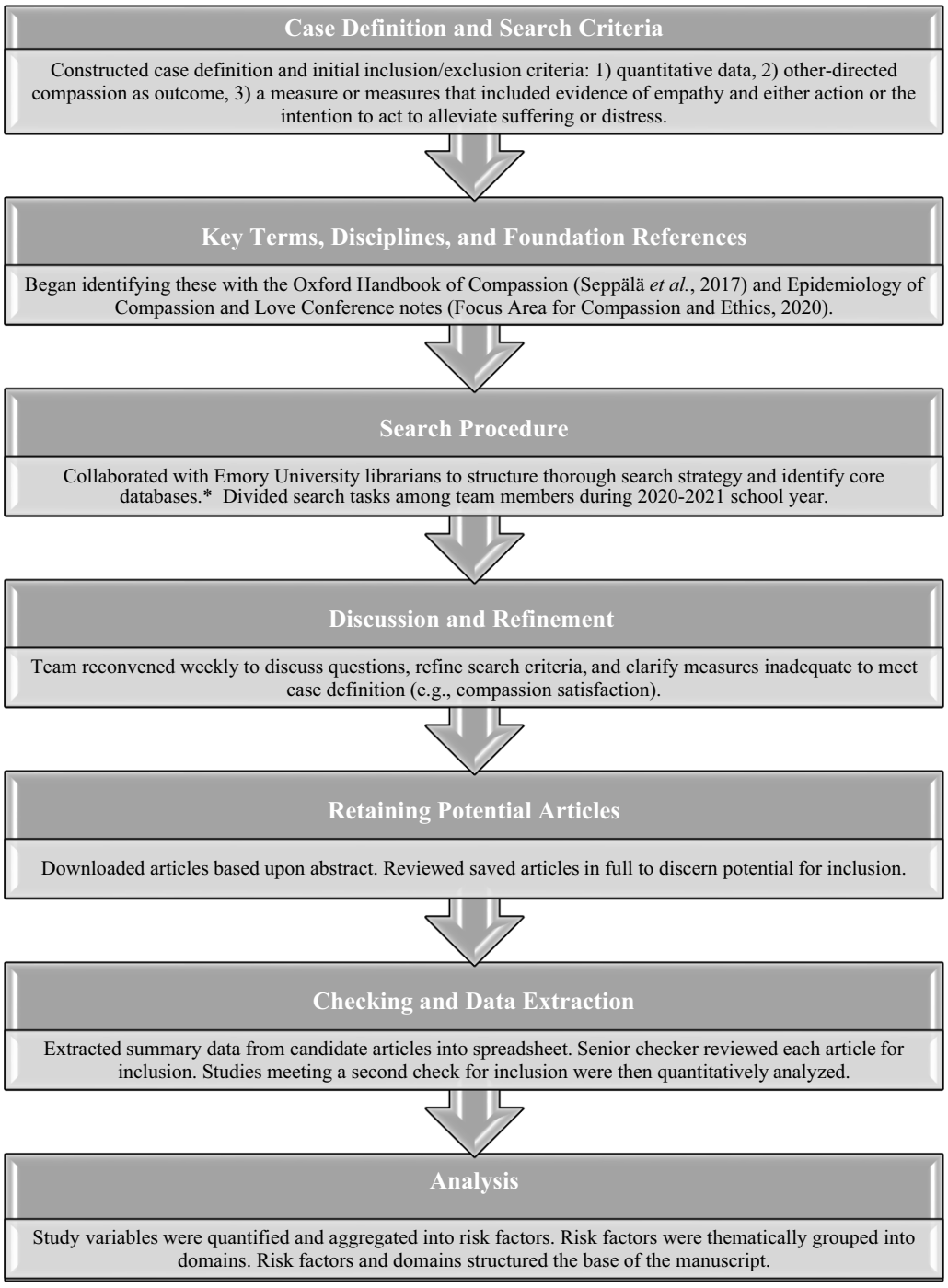

FIGURE 1
Schematic illustration of work flow. *Databases searched included PubMed, EBSCO (PsychInfo, SocINDEC, Academic Search Complete, Encyclopedia of Religion and Philosophy), JSTOR, Scopus, Web of Science, Sociological Abstracts, Social Sciences Full Text, CAB Direct, and Google Scholar.

Potential "actors" or sources of compassion (compassion-givers) were individual people in 81 (98.8%) studies, an organization in three (3.7%) studies, and both individuals and an organization in two (2.4%) studies (Table 1). The self-report measures completed by individual compassion-givers tend to refer to receivers (targets) of compassion in a hypothetical or general sense, although some experimental studies assessed compassion towards real persons (e.g., patients, actors, or confederates whose role was part of the study design). Potential recipients of compassion were hypothetical individuals or groups in 50 (61.0%) and 41 (50.0%) studies, respectively, actual individuals or groups in 30 (36.6%) and 16 (19.5%) studies, and the environment in one

TABLE 1 Characteristics of 82 studies included in the analysis of risk factors for compassion.

Characteristic	Value	No. (%) of studies
Study design	Survey (cross-sectional)	32 (39.0)
	Randomized clinical trials or experiments	25 (30.5)
	Interventions without randomization or control groups	14 (17.1)
	Longitudinal cohorts, without intervention	7 (8.5)
	Experience sampling	2 (2.4)
	Meta-analysis	2 (2.4)
Assessment perspective (who assessed compassion?) *	1st person—self-report of the potential giver or agent of compassion	71 (86.6)
	2nd person—assessment by the potential receiver or target of compassion	9 (11.0)
	3rd person—objective or behavioral measure of compassion	20 (24.4)
Source of compassion (compassion-giver)	Individual only	79 (96.3)
	Organization only	1 (1.2)
	Individual and organization	2 (2.4)
Target of compassion (compassion-receiver) **	Hypothetical individual	50 (61.0)
	Actual individual	30 (36.6)
	Hypothetical group	41 (50.0)
	Actual group	16 (19.5)
	Environment (the earth)	1 (1.2)
Compassion considered as	Trait	65 (79.3)
	State	24 (29.3)
	Skill	17 (20.7)

*18 studies used >1 perspective.
**Some measures include both individuals and groups.

(1.2%) study. Eight (9.8%) studies assessed compassion using both hypothetical and actual persons.

Sixty-five (79.3%) studies treated compassion as a trait (i.e., a stable personality characteristic). Twenty-four (29.3%) regarded compassion as a state (i.e., a short-term pattern of thought or behavior). Seventeen (20.7%) studies treated compassion as a skill (Table 1). Some studies considered compassion in more than one of these categories.

Demographic information on study subjects was incomplete. More than 82,000 subjects were studied. Among the 71 studies that reported participant gender, the proportion of females ranged from 30 to 100% (mean 61.5%). All but two studies, both meta-analyses, reported participant age range. Sixty-five (81.3%) studies included young adults (ages 18–29 years), most often university students. Five (6.3%) studies included children less than 18 years old, 46 (57.5%) included persons 30–60 years of age, and 33 (41.3%) included older adults. Mean age of subjects in each study ranged from 13 to 77 years. Race and ethnicity were often not recorded. Of the 82 studies, 15 (18.3%) were conducted entirely in Western Europe and 46 (56.1%) in North America. Four (4.9%) studies were conducted entirely in India (Choudhary and Madnawat, 2017a,b; Singh et al., 2018; Prabha and Mittal, 2019), two (2.4%) each in Israel (Eldor, 2018; Prabha and Mittal, 2019) and Chile (Brito-Pons et al., 2018), and one (1.2%) each in Malaysia (Owuamalam and Matos, 2019) and South Korea (Moon et al., 2014). Eleven (13.4%) additional studies used data from multiple countries, including countries in Western Europe and North America, Israel, Turkey, nine countries in South America (Chang et al., 2021), and Ethiopia, China, and Japan (Howick et al., 2017).

Risk factors

A total of 89 potential risk factors for compassion were identified and categorized into six themes or domains to facilitate further analysis.

- Domain 1—Demographic features (mostly of the compassion-giver)
- Domain 2—Personal characteristics, including disposition and skills of the compassion-giver
- Domain 3—Personal history and experience of the compassion-giver
- Domain 4—Habitual behaviors of the compassion-giver
- Domain 5—Circumstantial or contextual factors of the "compassion encounter," when compassion is given or withheld
- Domain 6—Organizational or structural characteristics

The 89 potential risk factors were tested a total of 418 times for association with other-directed compassion; 56 (68.3%) potential risk factors were assessed in more than one study. The vast majority of risk factors referred to demographic features and personal characteristics of individual persons, i.e., host factors, as well as to circumstantial factors at the moment of the compassion encounter (Figure 2).

Potential risk factors assessed for association with compassion (either as independent risk factors or effect modifiers) are summarized in Table 3. Among potential risk factors that were evaluated in three or more tests of

TABLE 2 Measures used to assess compassion in 82 studies examining compassion as an outcome.

Perspective	Scale or measure	No. studies
1st person (self-report)	Feelings of compassion for person(s) suffering, i.e., victim(s) or patient(s)	23*
	Santa Clara Brief Compassion Scale (Huang et al., 2008)	7
	Compassion Scale, Pommier (Pommier et al., 2020)	6
	Dispositional Positive Emotions Scale (DPES; Shiota et al., 2006)	6*
	Compassionate Love scale—strangers and humanity (Sprecher and Fehr, 2005)	8
	Compassionate Love scale—close others (Sprecher and Fehr, 2005)	4
	Compassionate Love scale—specific others (Sprecher and Fehr, 2005)	2
	Self-reported willingness to help	15*
	Temperament and Character Inventory (TCI)—compassion subscale (Clonninger et al., 1993)	3
	Fears of Compassion Scales (Gilbert et al., 2011)	3
	Interpersonal Reactivity Index (IRI; Davis, 1983)	3*
	Abbreviated Compassionate Love scale (Krause and Hayward, 2015; Krause et al., 2018)	2*
	Self-Other Four Immeasurables scale (SOFI; Kraus and Sears, 2009)	1
	Questions from Monitoring the Future Survey (National Institute on Drug Abuse, 2022)	1
	Compassion of Others' Lives (COOL; Chang et al., 2014)	1
	Prosocial Tendencies Measure-Revised (Carlo and Randall, 2002)	1*
	Amount of money the theoretical "victim" should receive from social welfare (Delton et al., 2018)	2*
	Compassion Engagement and Action scales—for others (Gilbert et al., 2017)	1
	Self-report caring behaviors (Jazaieri et al., 2016)	1
	Questionnaire for Cognitive and Affective Empathy (Reniers et al., 2011; Runyan et al., 2019)	1*
	Compiled measure of empathy, compassion and recent helping behavior (Runyan et al., 2019)	1
	Environmental Motives Scale (Bengtsson et al., 2016)	1
2nd person (target of compassion)	Consultation and Relational Empathy Scale (CARE; Mercer et al., 2004)	4
	Schwartz Center Compassionate Care scale (Rodriquez and Lown, 2019)	2
	Patient ratings of physician's compassion (similar to CARE)	1
	Compassionate affection scale—Shaver et al. (Shaver et al., 1987; Eldor, 2018)	1
	Compassion Engagement and Action scales—from others (Gilbert et al., 2017)	1
	Frequency or quality of compassion received (Moon et al., 2014; Sabey and Rauer, 2018)	2
3rd person (behavioral measures)	(Amount of) money willing to donate	9*
	Offering assistance to someone in need or distress	5*
	Time spent helping confederate (Lim et al., 2015; Lim and DeSteno, 2016)	2*
	Carkhuff Empathy Scale (Carkhuff, 1969; Bas-Sarmiento et al., 2019)	1
	Reynolds Empathy Scale (Reynolds, 2000)	1
	Peer nomination: "shows strong compassion for others" (Bengtsson et al., 2016)	1
	Content analysis of Tweets (Boulianne et al., 2018)	1
	Emotion Recognition Index (Scherer and Scherer, 2011)	1*
	Healthcare provider's rating of their team and their organization (Lown et al., 2020)	1
	Compassion Scale, Pommier (4 items modified for observer rating; McDonald et al., 2018)	1
	Psychologists' rating of participants' recorded responses to stories of personal distress (Palgi et al., 2015)	1

*At least one study paired this measure with another measure to create a full measure of compassion.

association and found to be associated with compassion in ≥50% of those tests, *demographic factors* included female gender (51% of tests of association being positively associated with compassion), religious faith (77%), socioeconomic status of the compassion-receiver (50%), and country of origin. Factors positively related to *personal characteristics* included social and emotional intelligence (100%), prosocial attitudes and values (100%), personal well-being or eudaimonia (100%), personality traits of openness (80%) and humility (67%), self-compassion (80%), the capacity for perspective-taking (80%), secure emotional attachment (75%), and empathic concern (71%). Attachment avoidance was negatively associated with compassion (91% of tests of association).

Factors related to *personal history* included participation in compassion, empathy, or mindfulness training (80%) and previous exposure to stressful life events (69%). Among *habitual behaviors*, 57% of tests of church attendance were significantly associated with compassion. Participation in community service or volunteering also was associated with compassion (67%).

Domain		Epidemiologic Parameters		
		Person ('host factors')	Time	Place (environment)
1	Demographic features	Gender, race/ethnicity, faith, marital status, education level, income (SES) of compassion-giver, income (SES) of target, home ownership, employment status, political views, type of clinical provider (in healthcare)	Age, change with time	Country of origin, household size
2	Personal characteristics, including disposition and skills of the compassion-giver	Perspective-taking, empathic concern, secure attachment, attachment avoidance, attachment anxiety, social/emotional intelligence, prosocial attitudes, wellbeing, depressive symptoms, physical health, self-efficacy, personality traits, social power, burnout, wandering mind, resilience, mindfulness, common humanity, environmental compassion, passionate love, self-compassion, fears of compassion, positive affect, commitment to career course or studying the sciences (university students), valuing being well-off financially		
3	Personal history and experience of the compassion-giver	Exposure to stressful life events, training exposure, parental acceptance and warmth	Length of time practicing medicine (for healthcare workers)	Attending child daycare, participation in cultural immersion trip during college
4	Habitual behaviors of the compassion-giver	Church attendance, social media use, community service or volunteering, partying		
5	Circumstantial or contextual factors of the "compassion encounter", when compassion is given or withheld	Perceptions of distress, impact of action, personal cost, certainty of harm, and patient's needs being met (in healthcare settings); perceived similarity with, liking, and worthiness of target; expectation to donate; personal distress, secure attachment, anticipated positive affect; recalling vulnerability; oxytocin	Being rushed or too busy; length of clinical consultation (in healthcare)	Severity and chronicity of suffering, number of victims, relational closeness, social status of compassion target, diffusion of responsibility, being at home.
6	Organizational or structural characteristics	Perceived organizational threat		Social and organizational support, ethical or compassionate leadership, organizational compassion, organizational unit, accessibility, coordination, and continuity of healthcare

FIGURE 2
Primary alignment of potential risk factor domains with the epidemiologic parameters of person, time, and place. Even though individual potential risk factors are listed only once, some risk factors may be active in multiple domains and affect multiple parameters, e.g., environmental disasters are stressful personal life events. Risk factors refer to the compassion-giver unless otherwise noted.

Circumstantial factors significantly associated with compassion in ≥50% of studies that examined them included in-group similarity (100%), perceived distress in the target, i.e., the person suffering (100%), a sense of secure attachment in the compassion-giver (89%), perceived severity of suffering (83%), and relational closeness between the compassion-giver and the target (83%).

Organizational or structural factors associated with compassion in ≥50% of studies that examined them included social or organizational support, ethical or compassionate leadership, and organizational compassion. Each of these variables was examined in three separate studies, all of which showed a positive association with individual-level compassion within the organization.

Risk factors are described below in more detail and shown in Table 3. Except where noted, risk factors refer to the compassion-giver rather than the recipient of compassion.

Domain 1—Demographic features

Age (17 studies, 17 tests of association)

The relationship between compassion and age was mixed, with 11 of 17 tests showing no association. In many studies, particularly those involving college students, age range was limited. However, two longitudinal cohort studies reported that compassion increased between 30 and 50 years of age (Hintsanen et al., 2019; Saarinen et al., 2020). In contrast, Sabey and Rauer (2018) found that self-reported compassionate love for others declined over a 17-month period among older heterosexual married couples (mean age 71 years). Bengtsson et al. observed a decrease in compassion for others in adolescents between 12 and 14 years of age. This decline was linked to negative self-perceptions in 13- and 14-year-old girls (Bengtsson et al., 2016).

Gender (41 studies, 47 tests of association)

Of 47 tests of association that evaluated gender as a risk factor for compassion, 24 (51%) found that females were more likely to be compassionate than males. One such study reported that female, but not male, physicians demonstrated increases in compassion following empathy training (Riess et al., 2012). Twenty-one tests reported no significant differences in compassion by gender. In the one study that reported greater compassion among males, spouses were asked to rate the level of compassion of their spouse; in this case, wives were more likely to rate their husbands as compassionate than *vice-versa* (McDonald et al., 2018).

Race and ethnicity (8 studies, 9 tests of association)

In general, race and ethnicity of the compassion-giver were not associated with compassion (5 of 7 associations, 71.4%). However, two studies reported that persons of color were less likely to be offered compassion than Caucasians (as potential receivers of compassion). The race and ethnicity of the study subjects (the 'compassion-givers') did not appear to influence this tendency (Stellar et al., 2012; Hirsh et al., 2019).

TABLE 3 Potential risk factors evaluated, by domain, and direction of statistically significant association with compassion as an outcome.*

	Variable	No. Studies	No. Assoc.	Positive association			No effect			Negative association			Modifier of modifier	
				Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Some Effect	No Effect
				Overall	Some strata		Overall	Some strata		Overall	Some strata			
Domain 1														
Demographic features	Age (increasing)	17	17	4			9		2	2				
	Gender (female = 1)	41	47	23	1		19		2	1			1	
	Race/ethnicity	7	7	2			5							
	Race/ethnicity (compassion target)	2	2	2										
	Religiosity/spirituality/faith	10	13	10			3							
	Country of origin/study (any difference)	9	10	9		1								
	Marital status (married = 1)	5	6				5			1				
	Education level	6	6	2			2		1	1				
	Income (SES) of compassion-giver	8	9	1			3		1	3		1		
	Income (SES) of compassion-target	4	4	2			1			1				
	Home ownership	2	2	1			1							
	Household size	1	1				1							
	Employment status	1	1				1							
	Politically liberal	2	2	1									1	
	Clinical provider type (any difference)	3	3	1			2							
Domain 2														
Personal characteristics (including disposition and skills)	Perspective taking	7	10	6		2	1						1	
	Empathic concern	12	24	13		4		5	1					1
	Secure attachment (dispositional)	2	4	3			1							
	Attachment avoidance	9	11				1			9	1			
	Attachment anxiety	8	11				9	1			1			
	Self-compassion	5	5	4			1							
	Social and emotional intelligence	3	3	3										
	Prosocial attitudes or values	3	3	3										
	Well-being/eudaimonia	2	4	3		1								
	Depressive symptoms	4	5				3			1		1		
	Physical health	4	5	1			1			1	1	1		
	Efficacy (self-efficacy)	4	6	2					1				3	
	Personality – humility	2	3	1	1			1						
	Personality – openness	4	5	4			1							
	Personality – conscientiousness	3	5	1	1		2	1						

(Continued)

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TABLE 3 (Continued)

	Variable	No. Studies	No. Assoc.	Positive association			No effect			Negative association			Modifier of modifier	
				Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Some Effect	No Effect
				Overall	Some strata		Overall	Some strata		Overall	Some strata			
	Personality – extraversion	3	4	1			3							
	Personality – neuroticism	4	5				5							
	Personality – agreeableness	3	5	1	1		2	1						
	Personality – emotionality	1	1	1										
	Social power (of compassion-giver)	1	2							1		1		
	Burnout	2	2				1			1				
	Mind wandering to negative	1	1							1				
	Resilience	1	1	1										
	Mindfulness	1	1						1					
	Common humanity	1	1	1										
	Environmental compassion	1	1	1										
	Passionate love	1	1	1										
	Fears of compassion	1	1							1				
	Positive affect (in compassion-giver)	1	1				1							
	Committed to a career course	2	2	2										
	Studying the natural/social sciences	2	2	1			1							
	Valuing being financially well-off	1	1							1				
Domain 3														
Personal history or experience	Exposure to stressful life events	9	13	7	2								4	
	Training exposure	14	15	12			3							
	Parental acceptance	1	1	1			1							
	Parental warmth	1	1	1										
	Attending child daycare	1	2	1			1							
	Cultural immersion trip during college	1	1	1										
	Length of time practicing medicine	1	1	1										
Domain 4														
Habitual behaviors	Church attendance	5	7	4			3							
	Social media use	1	1	1										
	Doing community service/volunteering	2	3	1	1						1			
	Partying behavior	2	2							2				

(Continued)

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TABLE 3 (Continued)

		Variable	No. Studies	No. Assoc.	Positive association			No effect			Negative association			Modifier of modifier	
					Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Some Effect	No Effect
					Overall	Some strata		Overall	Some strata		Overall	Some strata			
Domain 5															
Circumstantial or contextual factors related to the compassion encounter	Perception of suffering & outcome	Severity of suffering	4	6	4		1							1	
		Chronicity of suffering	1	2				1		1					
		Number of "victims"	6	11		4			2		1	2		2	
		Perceived distress in target	2	3	1	1	1								
		Perceived positive impact of compassionate action	1	1	1										
		Perceived personal cost of compassionate action	1	2							1			1	
		Perceived certainty of harm	1	1										1	
		Patient's care needs are met	2	2	2										
	Relational aspects	Perceived similarity/in-group	6	8	8										
		Liking/valuing other	2	2	1			1							
		Relationship closeness/proximity	6	6	5			1							
		Expectation to donate	1	2					1			1			
		High social status (target)	2	2		1		1							
		Perceived worthiness	1	1			1								
		Diffusion of responsibility	1	1						1					
	Inner state	Personal or empathic distress	15	18	5	1		4		3		2	2	1	
		Secure attachment (situational)	7	9	6		2	1							
		Anticipated positive affect	3	5	2									3	
		Recalling vulnerability	2	3				2				1			
	Time	Being rushed/too busy	1	1							1				
		Length of clinical consultation	2	2	2										
	Other	Oxytocin	1	1		1									
		Being at home	1	1	1										

(Continued)

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TABLE 3 (Continued)

Variable		No. Studies	No. Assoc.	Positive association			No effect			Negative association			Modifier of modifier	
				Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Independent risk factor		Effect modifier	Some Effect	No Effect
				Overall	Some strata		Overall	Some strata		Overall	Some strata			
Domain 6														
Organizational and structural characteristics	Social and organizational support	3	3	3										
	Ethical or compassionate leadership or management	3	3	3										
	Organizational compassion	3	3	3										
	Perceived organizational threat	2	2				1			1				
	Organizational unit	1	1	1										
	Healthcare accessibility (organizational)	1	1	1										
	Continuity of care	1	1	1										
	Coordination of care	1	1	1										

*Variables refer to the compassion-giver unless otherwise noted.

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Religiosity, spirituality, and faith (10 studies, 13 tests of association)

In 10 (76.9%) of 13 tests, religiosity and spirituality, defined differently among the studies, were positively associated with compassion. In a survey of psychiatrists, Rindt-Hoffman et al. found a significant positive relationship between spirituality and compassionate love for a specific close other, but not for strangers or humanity in general (Rindt-Hoffman et al., 2019), while Sprecher and Fehr reported that religiosity and spirituality were associated with compassionate love for others, particularly for strangers and humanity (Sprecher and Fehr, 2005).

Socioeconomic status of compassion recipient (4 studies, 4 tests of association)

Of four studies examining the socioeconomic status of the compassion-recipient and whether compassion was offered, one found no association when controlling for perceptions of distress in the recipient (Stellar et al., 2012) and one, in an experimental setting, showed greater compassion for persons with lower income (Delton et al., 2018). However, in healthcare settings, greater physician bias and less compassionate care were reported for patients of lower socioeconomic status (Hirsh et al., 2019), while higher-income patients were more likely to perceive their medical care as compassionate (O'Malley and Forrest, 2002).

Country of origin (9 studies, 10 tests of association)

Ten tests examined the relationship between compassion and study participants' country of origin. Patterns for specific countries were inconsistent and inconclusive. Chang et al. reported empathy being higher in subjects from South America than Turkey, although scores for alleviating suffering were highest in Turkey and lowest in South America (Chang et al., 2021). Gilbert et al. (2017) found that compassion for others was higher in Portugal than in the United States or the United Kingdom. Mikulincer et al. (2005) reported greater compassion among study participants in the United States than in Israel. In a study by Howick et al. (2017), patients rated empathy among clinicians using the CARE measure. Patients in Australia, the United States, and the United Kingdom rated their caregivers as highest in empathy; the lowest scores were reported in Hong Kong. Sinclair et al. (2020) reported greater compassion among Spanish participants than their Canadian counterparts.

Other demographic factors

Other demographic factors were examined in smaller numbers of studies or had no strong association with compassion, including marital status, education level, home ownership, household size, political affiliation, employment status, and type of healthcare provider (Table 3).

Domain 2—Personal characteristics, disposition, and skills

Several studies found significant associations between compassion and personal characteristics or skills of the compassion-giver (Table 3). Perspective-taking and empathic concern, often considered necessary for compassion, were examined in relatively large numbers of studies (7 and 12, respectively). Ten studies also examined the relationship between compassion and dispositional secure or insecure attachment.

Perspective-taking (7 studies, 10 tests of association)

Perspective-taking is the cognitive skill of understanding the situations of others (Davis, 1983). Seven studies examined 10 potential associations between compassion and perspective-taking; perspective-taking was a positive independent risk factor for compassion in six associations and an effect modifier in two. In a survey of 202 young adults in New Mexico, Davis et al. (2019) found that perspective-taking positively predicted empathic concern, which in turn, was associated with self-reported prosocial behaviors; perspective-taking was also associated with previous exposure to major stressful life events. In a survey of 201 patients with metastatic cancer in France, patient assessment of physician perspective-taking was positively associated with compassion (Lelorain et al., 2015). An experimental study of undergraduate students by Lim et al. (2015) found that both perspective-taking and empathic concern led to dispositional compassion, which, in turn, predicted compassionate action when confronted with an unwell and overworked confederate. Vollhardt and Staub (2011), also studying undergraduate students, found that perspective-taking mediated the relationship between compassion-givers' previous experience of suffering and their prosocial attitudes and helping behavior. Cassidy et al. reported positive associations between perspective-taking and compassion, regardless of the degree of similarity between the compassion-giver and the target (Cassidy et al., 2018).

Empathic concern (12 studies, 24 tests of association)

Batson defines empathic concern as an "other-oriented emotion elicited by and congruent with the perceived welfare of a person in need" (Batson, 2017). Of 24 tests of association between empathic concern and compassion, 13 (54%) showed a direct effect on compassion and four more (17%) reported empathic concern as a positive modifier. Boulianne et al. (2018), studying the public response to the massive 2016 wildfire in Fort McMurray, Alberta, Canada, reported that concern and professed care for the victims were associated with higher odds of actually helping them. Lim and Desteno (2016) observed that empathic concern, but not perspective-taking, reliably predicted enhanced dispositional compassion. In the study by Davis and colleagues mentioned above, empathic concern provided the link between previous stressful life events and compassionate prosocial behavior (Davis et al., 2019). Cassidy et al. (2018) also reported positive associations between empathic concern and compassion.

Empathic concern appears to moderate the relationship between compassion and some of its risk factors, including adverse life events (Davis et al., 2019), severity of adversity or perceived

suffering (Lim and DeSteno, 2020), and target group membership (Tarrant et al., 2009). In this latter study, Tarrant and colleagues found that empathic concern can override the effect of outgroup membership of the compassion target, which is typically associated with decreased compassion. In contrast, Zoghbi-Manrique-de-Lara and Viera-Armas (2019) reported that "common humanity," but not empathic concern, mediated the link between ethical organizational leadership and compassionate actions among peers within the organization. Similarly, Cialdini et al. (1997) reported that the association between empathic concern and helping behavior became non-significant when "oneness"—a measure of perceived self-other overlap—was considered.

Secure attachment (dispositional; 2 studies, 4 tests of association)

Two studies reported positive associations between compassion and general measures of attachment security. Shiota et al. examined this association in the context of adult romantic relationships (Shiota et al., 2006). Rindt-Hoffman et al. (2019) reported that secure attachment was associated with compassionate love for close others and a specific close other, but not for strangers or humanity in general, suggesting that the effect of attachment may depend on the target of compassion.

Attachment avoidance (dispositional; 9 studies, 11 tests of association)

Nine studies measured attachment avoidance using a subscale of the Experience in Close Relationships questionnaire. Of 11 tests of association, 10 (91%) reported significant *negative* associations with compassion. Sabey and Rauer found that among older heterosexual married couples, wives' attachment avoidance was predictive of less self-reported compassionate love for husbands a year later (Sabey and Rauer, 2018). Consistent negative associations have also been reported in experimental settings (Mikulincer et al., 2005; Cassidy et al., 2018).

Attachment anxiety (dispositional; 8 studies, 11 tests of association)

In contrast, only one (9%) of 11 tests showed a negative association between dispositional attachment anxiety and compassion. This was reported by Cassidy et al. (2018) in an experimental setting.

Self-compassion (5 studies, 5 tests of association)

Of the five tests that examined the relationship between self-compassion and other-directed compassion, four (80%) found a significant positive association. Bengtsson et al. (2016) highlighted the importance of "the perspective-taking component of self-compassion," while Henshall et al. correlated self-compassion with both compassion for others and compassion at the organizational level (Henshall et al., 2018). Jazaieri and colleagues found that compassion training strengthened the association between caring for self and caring for others (Jazaieri et al., 2016).

Social and emotional intelligence (3 studies, 3 tests of association)

Social and emotional intelligence, a construct related to empathic concern, was significantly associated with compassion in all three studies in which it was examined. In a quasi-randomized controlled trial of training to cultivate emotional skills, Paakannen et al. reported a significant association between emotional skills and compassion; the positive effect of training on compassion was mediated by improved emotional skills (Paakkanen et al., 2021). Prabha and Mittal, reporting on a survey of 200 adults in Jaipur, India, found that social intelligence was positively correlated with both altruism and compassion, and negatively correlated with aggression (Prabha and Mittal, 2019). A survey of adults in Canada and Spain strongly linked trait emotional intelligence and emotionality to compassion (Sinclair et al., 2020).

Prosocial attitudes and values (3 studies, 3 tests of association)

Three studies that examined positive attitudes towards compassion (Kirby et al., 2021), egalitarian values (Owuamalam and Matos, 2019), or self-transcendent values (McDonald et al., 2018) found positive associations with compassion. As defined by McDonald et al. (2018), self-transcendent values are closely related to eudaimonia (happiness arising from fulfilling one's virtuous potential) and well-being.

Well-being/eudaimonia (2 studies, 4 tests of association)

Both studies that examined well-being or eudaimonia reported positive associations with compassion. Using moment-to-moment experience sampling methods, Runyan et al. (2019) found a strong association between eudaimonia and compassion. Eudaimonia was more closely associated with compassion than with empathy. Further, among subjects reporting lower eudaimonia—but not those with higher eudaimonia—as measured by experience sampling, feeling overwhelmed predicted lower moment-to-moment compassion (Runyan et al., 2019). Gilbert et al. (2017), surveying university students in the United Kingdom, Portugal, and the United States, found a weak but significant correlation between well-being and compassion for others.

Depressive symptoms (4 studies, 5 tests of association)

Five tests evaluated the association between compassion and depressive symptoms in the compassion-giver, with mixed results. Three studies found no significant correlations between compassion and depression or anxiety (Moore et al., 2015; Gilbert et al., 2017; Lopez et al., 2018). In a survey of more than 1,000 adults ages 55–99 years, neither past or current depression nor anxiety were significantly associated with self-reported compassion for others (Moore et al., 2015). In contrast, using data from the Young Finns Study—a multi-decade longitudinal population-based study of six birth cohorts ranging from 3 to

18 years old at the time of enrollment—Hintsanen and colleagues reported a strong negative correlation between depressive symptoms and self-reported compassion for others; depressive symptoms also attenuated the association between having received parental emotional warmth as a child and self-reported compassion for others in adults (Hintsanen et al., 2019).

Physical health (4 studies, 5 tests of association)

Mixed results were observed concerning physical health. Using the Young Finns longitudinal cohort study, Saarinen et al. (2020) found that frequent somatic complaints predicted a slower trajectory of increasing compassion later in adulthood. In a prospective study of older married heterosexual couples, poorer health of the husband predicted increased compassionate love from the wife some 17 months later (Sabey and Rauer, 2018). In a survey of mostly African-American women who were receiving healthcare, 56% who described their health as excellent ranked their physician as compassionate, compared to 39% who described their health as poor to fair (O'Malley and Forrest, 2002). Lopez et al. found no association between the presence of physical disease and self-reported compassion (Lopez et al., 2018).

Self-efficacy (4 studies, 6 tests of association)

Two (33%) of six tests of association between self-efficacy and compassion found a positive result. A study by Lim and DeSteno (2020) reported that beliefs about one's ability to help predicted felt compassion. Other studies found the role of self-efficacy in prompting compassionate action to be affected by the number of "victims" and previous history of adversity (Cameron and Payne, 2011; Lim and DeSteno, 2020).

Personality traits (7 studies, 28 tests of association)

Relatively few studies examined prosocial personality traits such as openness, humility, and emotionality, but all of these traits were significantly and positively associated with compassion (Shiota et al., 2006; Krause and Hayward, 2015; Choudhary and Madnawat, 2017a; Krause et al., 2018; Singh et al., 2018). The personality trait of neuroticism was not associated with compassion, while conscientiousness and agreeableness were both associated with compassion in 40% of tests (Shiota et al., 2006; Choudhary and Madnawat, 2017a; Sinclair et al., 2020). Agreeableness was associated with compassion in Canadians, but not Spaniards (Sinclair et al., 2020).

Social power of compassion-giver (1 study, 2 tests of association)

Social power—the influence a person exerts over other people as a result of social status or position—was inversely associated with compassion for others in a study by van Kleef and colleagues (van Kleef et al., 2008). Further, individuals of lower social power, but not their higher-power peers, showed a commensurate increase in compassion as severity of suffering and victim distress increased.

Burnout (2 studies, 2 tests of association)

A survey of physicians and nurses by Lown and colleagues reported negative correlations between their scores on the Schwartz Center Compassionate Care Scale and how frequently they indicated that burnout inhibited their ability to provide compassionate care (Lown et al., 2019). In contrast, among survey participants recruited through Amazon Mechanical Turk (MTurk), a crowdsourcing marketplace, burnout did not predict scores on measures of compassion or empathy (Kirby et al., 2021). The two studies used different scales to measure burnout, making it difficult to directly compare.

Mind wandering to negative (1 study, 1 test of association)

Using experience sampling methods, Jazaieri and colleagues demonstrated that caring behavior was less likely when study participants' minds wandered to negative or neutral topics (Jazaieri et al., 2016).

Other risk factors

Relatively few studies examined other characteristics including resilience, mindfulness, a sense of common humanity, environmental compassion, passionate love, fears of compassion, positive affect, commitment to a career course in university students, studying the sciences, and valuing being well-off financially. Significant positive associations were observed with compassion for some of these characteristics (Table 3).

Domain 3—Personal history and experience of the compassion-giver

Exposure to stressful life events (9 studies, 13 tests of association)

Nine of the 13 associations that examined the role of previous adversity or stressful life events found a positive relationship with compassion (Vollhardt and Staub, 2011; Moore et al., 2015; Lim and DeSteno, 2016, 2020; Davis et al., 2019). Lim and Desteno reported that compassion was positively associated with severity of past adversity, a relationship that was mediated through increased empathy (Lim and DeSteno, 2016). Vollhardt and Staub found that previous experience of traumatic life events, such as natural disasters or interpersonal and group-based harm, was associated with a significantly greater likelihood of exhibiting prosocial attitudes and helping behaviors for social outgroups experiencing similar adversity (Vollhardt and Staub, 2011).

In a second series of studies, Lim and DeSteno explored the role of previous adversity in moderating the effect of the number of victims on compassionate response. Among persons who had experienced little adversity, compassion tended to decrease with the number of victims, an effect known as the identifiable victim effect (Lim and DeSteno, 2020). In contrast, among those who had experienced previous adversity, compassion increased with the number of victims. However, persons who had experienced previous adversity also expressed greater compassion for single

TABLE 4 Characteristics of studies that assessed a training intervention to promote compassion.

Type	Author and Year	What tested	Population	Perspective	Results
RCT	Bas-Sarmiento et al. (2019)	Empathy intervention vs. waitlist control	Nursing students, Spain	2nd, 3rd	Higher post-test scores on compassion with empathy intervention
	Brito-Pons et al. (2018)	CCT© vs. waitlist control	Adults, Chile	1st	Improved compassion skills with CCT©
	Brito-Pons et al. (2018)	CCT© vs. MBSR	Adults, Chile	1st	Greater compassion with CCT©
	Gonzalez-Hernandez et al. (2018)	CBCT® vs. usual treatment	Breast cancer survivors, Spain	1st	Greater total compassion score with CBCT®
	Hirsh et al. (2019)	Virtual perspective-taking intervention vs. control	Resident physicians, United States	1st; video simulation	Lower odds of bias (assessed by simulation); increased compassion (self-report)
	Jazaieri et al. (2013)	CCT© vs. waitlist control	Adults, United States	1st	Greater compassion in all domains with CCT©
	Lim et al. (2015)	Mobile app and mindfulness training vs. cognitive training	University students, United States	3rd	Mindfulness group more likely to give up seat to person who needed it
	Paakkanen et al. (2021)	Emotional skills cultivation training vs. no-intervention control	Workplace managers and employees, Finland	1st, 2nd	Improved emotional skills, compassion
	Riess et al. (2012)	Empathy training modules vs. standard post-graduate education	Resident physicians, United States	2nd	Patients rated intervention group higher on CARE measure
	Weibel (2007)	Lovingkindness vs. no-intervention control	College students, United States	1st	Greater increase in compassionate love, but not at 2-month follow-up
Pre-Post test	Dawson et al. (2021)	Schwartz Rounds	Healthcare workers, U.K.	1st	No significant effect on compassion score
	Jazaieri et al. (2016)	CCT©	Adults, United States	1st (experience sampling)	No significantly improved self-reported caring behaviors
	Vuorinen et al. (2021)	Character strength training	Early childhood development teachers, Finland	1st	Improved "sense of compassion" and other measures
Cross-section	Callister and Plante (2017)	Reported attendance at a racial- or cultural-awareness workshop	University students, United States	1st	Higher self-reported Santa Clara Brief Compassion score on survey

CBCT, cognitively-based compassion training. CCT, compassion cultivation training. MBSR, mindfulness-based stress reduction. RCT, randomized clinical trial.

victims than did their low-adversity counterparts. The authors attributed this effect to a greater sense of efficacy (i.e., their perceived ability to alleviate suffering, both for single-victim and group-victim scenarios) in persons who had survived adversity (Lim and DeSteno, 2016).

Compassion, empathy, or mindfulness training (14 studies, 15 tests of association)

Twelve (80.0%) of 15 tests that examined the effects compassion, empathy, or mindfulness training showed a significant and positive association with measures of compassion (Table 4). All of them treated compassion as a trait or a skill of individual people. Of the 14 studies, 10 (71.4%) were RCTs (Weibel, 2007; Riess et al., 2012; Jazaieri et al., 2013; Lim et al., 2015; Brito-Pons et al., 2018; Gonzalez-Hernandez et al., 2018; Bas-Sarmiento et al., 2019; Hirsh et al., 2019; Paakkanen et al., 2021); three (21.4%) were longitudinal studies with pre- and post-intervention measures (Jazaieri et al., 2016; Dawson et al., 2021; Vuorinen et al., 2021); and one was cross-sectional in design (Callister and Plante, 2017). Of the 10 RCTs, three tested Compassion Cultivation Training (CCT©; Jazaieri et al., 2013; Brito-Pons et al., 2018); one tested Cognitively Based Compassion Training (CBCT®; Gonzalez-Hernandez et al., 2018); two tested empathy training (Riess et al., 2012; Bas-Sarmiento et al., 2019); and the four remaining tested mindfulness, perspective-taking, emotional skills, or lovingkindness interventions (Weibel, 2007; Lim et al., 2015; Hirsh et al., 2019; Paakkanen et al., 2021). Interventions tested in the three non-randomized studies using a pre-/post-test design included CCT©, Schwartz Rounds, and an intervention focused on compassion and "character strengths" for teachers (Jazaieri et al., 2016; Dawson et al., 2021; Vuorinen et al., 2021). One cross-sectional study tested the association between self-reported compassion in university students and previous participation in a workshop to raise cultural and racial awareness (Callister and Plante, 2017).

Nine of the 14 studies assessed compassion solely from the first-person perspective of the compassion-giver, using self-report measures (Weibel, 2007; Jazaieri et al., 2013, 2016; Callister and Plante, 2017; Brito-Pons et al., 2018; Gonzalez-Hernandez et al., 2018; Dawson et al., 2021; Vuorinen et al., 2021). Five of the RCTs included assessments from other perspectives (Riess et al., 2012; Lim et al., 2015; Bas-Sarmiento

et al., 2019; Hirsh et al., 2019; Paakkanen et al., 2021). Hirsh et al. (2019), in an RCT of a perspective-taking intervention, assessed the effect of training on bias among resident physicians using patient simulation videos (third-person). Riess et al. (2012) used the CARE scale for patients to assess compassion in physicians who had been randomized to receive empathy training modules or other post-graduate training (second-person). Bas-Sarmiento and colleagues (2019) evaluated the effects of an empathy training intervention in nursing students by observing their interactions with actors posing as patients (third-person) and by having those actors rate the interactions using the CARE scale (second-person). Lim and colleagues tested app-based mindfulness training using a third-person behavioral measure (Lim et al., 2015). While subjects waited in an area outside the experimental laboratory, a confederate entered using crutches, wearing a walking boot, and obviously in discomfort. A compassionate response was defined as the subject standing and offering his or her seat to the confederate. Finally, in the workplace setting, Paakanen et al. evaluated the impact of training organizational managers to cultivate emotional skills, based on employees' assessments of compassion in their managers (second-person; Paakkanen et al., 2021).

Two studies, both pre-/post-test in design, did not show a significant positive association between empathy or mindfulness training and compassion (Table 4). Dawson et al. found no significant increase in self-reported compassion among UK healthcare workers who regularly attended Schwartz Rounds over an eight-month period (Dawson et al., 2021). Jazaieri et al., using experience sampling, found a positive, but non-significant trend in the proportion of times persons receiving CCT© reported caring behaviors (Jazaieri et al., 2016). Finally, Weibel showed a significant difference in self-reported compassionate love between intervention and control groups immediately following four weekly 90-min sessions of loving-kindness meditation training, but this difference attenuated and was non-significant at the two-month follow-up assessment (Weibel, 2007).

In addition to improved compassion, many of the studies on training also reported improvements in empathy, well-being, relational skills, and other desirable outcomes.

Parental warmth and acceptance (1 study, 2 tests of association)

Few studies in our sample explored the importance of secure attachment during childhood in relation to one's compassion later in life. One study, by Hintsanen et al., found that parental warmth in childhood was positively associated with compassion in adulthood (Hintsanen et al., 2019).

Other historical factors

Other potential historical or experiential risk factors for compassion included childcare environment, participating in a cultural immersion trip during college, and length of time practicing medicine. These factors were examined in only a few studies (Table 3).

Domain 4—Habitual behaviors of the compassion-giver

Church attendance (5 studies, 7 tests of association)

Of seven tests of association between church attendance and compassion, four were significantly and positively associated (Sprecher and Fehr, 2005). However, Krause and Hayward (2015) reported that religious commitment, but not church attendance, was associated with compassion.

Other behavioral factors

Relatively few studies assessed other behavioral traits or habits of the compassion-giver. In the wake of the Fort McMurray wildfire in Alberta, Canada, Boulianne and colleagues found that those who used social media were significantly more likely to know someone who was affected, and those who followed the wildfire on social media were nearly twice as likely to help as those who did not follow the fire on social media (Boulianne et al., 2018). Callister and Plante, studying compassion in university students, reported that volunteering and doing community service were highly correlated with self-reported compassion (Callister and Plante, 2017). Lovette-Colyer reported similar findings among students who volunteered for community service, although he found an inverse correlation with compassion for students who were *required* to participate in service learning (Lovette-Colyer, 2013). Both groups of investigators in these latter two studies reported inverse correlations between self-reported compassion for others and partying behavior or participation in college sororities or fraternities (Lovette-Colyer, 2013; Callister and Plante, 2017).

Domain 5—Circumstantial or contextual factors related to the compassion encounter

Twenty-three risk factors were examined that relate to the immediate circumstances in which suffering presents the opportunity for compassion. These have been grouped into the following categories: (1) perceptions of suffering and of potential outcomes of compassionate action; (2) relational aspects between the person suffering and the compassion-giver; (3) the inner emotional state of the compassion-giver; (4) time-related considerations; and (5) other risk factors.

Perceptions of suffering and outcomes of action

Severity of suffering (4 studies, 6 tests of association). Delton and colleagues reported two studies in which "absolute need," as measured by financial poverty of the victim, was positively associated with compassion (Delton et al., 2018). Cialdini et al. (1997) confirmed this association in an experimental setting and found that in higher-need (i.e., more severe) situations, relational closeness between

compassion-giver and the target led to greater empathic concern and willingness to help.

Chronicity of suffering (1 study, 2 tests of association). Butts et al., defining chronicity as the "likelihood that the suffering will continue or recur," found no significant association between chronicity of suffering and helping responses (Butts et al., 2019).

Number of victims (6 studies, 11 tests of association). In a meta-analysis of 41 studies, Butts et al. reported that larger victim group size negatively affects both helping intent and helping behavior, a phenomenon known as "numeracy bias" (Lim and DeSteno, 2020) "compassion collapse" (Cameron, 2017), or "identifiable victim effect" (Butts et al., 2019). This effect appears to be influenced by several factors. For example, Lim and DeSteno (2020) reported that persons who had experienced adversity reported significantly *greater* compassion as the number of victims increased, an effect that was modulated by greater self-efficacy in those who had experienced adversity. Cameron and Payne (2011) found that numeracy bias is also influenced by whether the compassion-giver expected to be asked to help; this expectation was not a significant factor for the single-victim condition but it made helping less likely if subjects expected to be asked to help for an eight-victim condition. Finally, Butts et al. (2019) reported that the negative relationship between victim group size and helping intent was stronger when threat severity and certainty of harm were higher.

Perceived distress in the person suffering (the target of compassion; 2 studies, 3 tests of association). The compassion-giver's perception of distress in the person suffering is related to the notion of severity of suffering. Two studies found a positive association between perceived distress and compassion, but in both studies, this effect was attenuated by increased social class or power of the compassion-giver. In an experimental setting, Stellar and colleagues found that subjects of lower social class perceived greater distress in colleagues being subjected to a difficult job interview, which predicted a compassionate response (Stellar et al., 2012). Van Kleef et al. (2008) paired undergraduate students, one of whom would describe an experience that had caused them suffering. Listeners with a higher sense of personal power experienced less distress and less compassion in listening to the accounts of their colleagues than did those with a lower sense of power.

Perceived positive impact (1 study, 1 test of association). Butts et al. (2019) found that the compassion-giver's perceived impact of intervening to reduce suffering—a construct that may be related to self-efficacy—was positively associated with both empathic concern and with helping behavior.

Perceived personal cost (1 study, 2 tests of association). In contrast, Owuamalam and Matos (2019) reported that study subjects were more likely to provide assistance when the political cost was low. Their willingness to help when the political cost was high was influenced by the status of the victim; study participants were more likely to assist high-status victims than low-status victims.

Perceived certainty of harm (1 study, 1 test of association). Butts et al. (2019) showed that certainty of harm modified the relationship between victim group size and both helping intent and behavior. The negative relationship between victim group size and helping intent was stronger when certainty of harm was higher.

Relational factors

Perceived similarity/in-group (6 studies, 8 tests of association). All six studies that examined similarity between the compassion-giver and the person suffering observed positive associations with compassion. University students listening to another student describe a distressing experience reported stronger empathy and intention to help if both students belonged to the same university (Tarrant et al., 2009). Valdesolo and DeSteno (2011) showed that experimentally-induced synchronous movement led to perceptions of similarity between pairs of individuals, which were further associated with compassion and altruistic behavior. Vollhardt and Staub found that prosocial attitudes toward tsunami victims were highest among those who had, themselves, suffered from natural disasters (Vollhardt and Staub, 2011). Cialdini et al. (1997) reported that the experience of "oneness" with the target significantly increased both empathic concern and helping.

Liking/appreciating/valuing the other (2 studies, 2 tests of association). This construct is closely linked to perceived similarity and relationship closeness. However, in the study by Valdesolo and DeSteno, although synchronous movement increased both the subject's perceived similarity with and liking for the victim, increased liking was not associated with compassion or helping (Valdesolo and DeSteno, 2011). In an organizational study by Moon et al., employees' appreciation for their organization's corporate social responsibility positively influenced their affective commitment to the organization, which, in turn, was associated with expressions of compassion at work (Moon et al., 2014).

Relationship closeness/psychological proximity (6 studies, 6 tests of association). Six studies examined the psychological closeness of the compassion-giver and receiver, five finding a positive association with compassion (Cialdini et al., 1997; Mikulincer et al., 2005; Boulianne et al., 2018), and the other finding no significant correlation (Cameron and Payne, 2011).

Expectation to donate (1 study, 2 tests of association). Under experimental conditions, Cameron and Payne found that participants' expectation that they would be asked to provide help to either single or multiple victims favored compassion toward a single victim. By removing this expectation, compassion was significantly more likely to be expressed for multiple victims (Cameron and Payne, 2011).

High social status of the victim (2 studies, 2 tests of association). Stellar et al. (2012) found no relationship between social class of an experimental subject undergoing a stressful interview and compassion reported by their peer study partner. In contrast, Owuamalam and Matos (2019) found that when the political cost of compassion was low, egalitarians displayed greater compassion towards higher-status victims and anti-egalitarians had similar levels of compassion for both high- and low-status victims. These findings suggest that when the cost of compassion is perceived to

be low, egalitarians can favor the privileged and anti-egalitarians can act equitably.

Perceived worthiness (1 study, 1 test of association). Owuamalam and Matos also found that the worthiness that anti-egalitarians assigned to high-status individuals explained their tendency to preferentially offer them help (Owuamalam and Matos, 2019). However, this was influenced by the perceived political cost of helping.

Diffusion of responsibility (1 study, 1 test of association). Diffusion of responsibility refers to the perception that responsibility for responding to suffering is shared among many individuals or groups. A study by Cameron and Payne reported that diffusion of responsibility did not play an important role in compassionate responses to incidents with multiple victims (Cameron and Payne, 2011).

Inner state of the compassion-giver

Personal or empathic distress (15 studies, 18 tests of association). In all five studies by Mikulincer et al. (2005), the compassion score among participants was significantly but not strongly associated with their personal distress. Interestingly, personal distress was consistently associated with attachment anxiety, which was not associated with compassion or helping. In contrast, two studies found no association between personal distress and either prosocial attitudes or helping behavior (Vollhardt and Staub, 2011; Kirby et al., 2021). In experimental settings, Cassidy et al. (2018) found no significant association between distress and compassion, while Cialdini et al. (1997) reported that personal distress and sadness attenuated the relationship between empathic concern and helping. Van Kleef and colleagues reported that among compassion-givers with a low sense of social power, personal distress was positively related to compassion, whereas among compassion-givers with high social power, personal distress was negatively related to a compassionate response (van Kleef et al., 2008).

Secure attachment (situational; 7 studies, 9 tests of association). Mikulincer et al. (2005) used implicit and explicit priming techniques to experimentally induce or boost a sense of secure attachment. In all five studies, these techniques were shown to foster both compassion and altruistic behavior. Similar results were found by Cassidy et al. (2018).

Anticipated positive affect (3 studies, 5 tests of association). Anticipated positive affect reflects anticipated feelings about how the compassion-giver will feel by rendering assistance. Butts et al. (2019) found significant effects of anticipated positive affect on helping behavior and empathic concern. In a study examining a closely related construct of anticipated "egoistic payoff" of helping behavior, Mikulincer et al. reported a positive association between compassion and the anticipation of "empathic joy" (Mikulincer et al., 2005).

Recalling vulnerability (2 studies, 3 tests of association). In two experimental studies, Cassidy et al. (2018) randomized subjects to remember either a time someone close to them hurt their feelings (hurt feelings memory), which they hypothesized would provoke attachment anxiety, or a neutral memory. The hurt feelings memory did not have a significant main effect on compassion.

Sense of time

Being rushed or too busy (1 study, 1 test of association). In a randomized experiment of seminarians at Princeton Theological Seminary, Darley and Batson found that a sense of being rushed strongly predicted they would not stop to offer assistance to a man (a confederate) lying in an alley in distress (Darley and Batson, 1973). Interestingly, having received an assignment to prepare a talk on the Good Samaritan that same day, a classic Christian parable of compassion for a stranger, was not associated with stopping to offer assistance.

Length of clinical consultation (2 studies, 2 tests of association). In healthcare settings, longer consultations with patients were associated with higher patient-reported CARE scores (Lelorain et al., 2015; Howick et al., 2017).

Other risk factors

Oxytocin (1 study, 1 test of association). Palgi and colleagues found that dosing subjects with oxytocin increased compassion when the target of compassion was a woman but not a man, irrespective of the gender of the compassion-giver (Palgi et al., 2015).

Being at home (1 study, 1 test of association). Using experience sampling, Runyan and colleagues found greater levels of compassion when the study subjects were at home, as opposed to outside, in class, or at work or school (Runyan et al., 2019).

Domain 6—Organizational and structural factors

Social and organizational support (3 studies, 3 tests of association)

In a cross-sectional study of university students, Beutel and Marini found that compassion was positively associated with social support, conceptualized as having "someone I can turn to if I need help" or "someone I can talk to, if I need to" (Beutel and Marini, 1995). Lown et al. reported that, among nurses and physicians, compassion-related behaviors were inversely correlated with a lack of perceived organizational support (Lown et al., 2019). In another study by Lown et al., perceptions of organizational support were positively associated with nurses' assessment of their own compassionate care (Lown et al., 2020).

Ethical and compassionate leadership (3 studies, 3 tests of association)

A longitudinal study in the public service workplace by Eldor reported that employees' perception of having received compassion from supervisors at baseline predicted improved employee engagement, lower burnout, and organizational citizenship behavior during the follow-up assessment, as well as employee service-oriented performance and compassionate behavior toward clients (Eldor, 2018). Other investigators reported a positive association between ethical leadership and peer-focused organizational citizenship behavior, which was mediated through a sense of common humanity

(Zoghbi-Manrique-de-Lara and Viera-Armas, 2019). Among a diverse group of businesses in South Korea, perceptions of corporate social responsibility were positively related to compassion at work (Moon et al., 2014).

Organizational compassion (3 studies, 3 tests of association)

Henshall et al. (2018) found perceived organizational compassion to be significantly associated with employees' compassion for others. In the healthcare setting, Lown et al. found positive correlations between nurses' perceived organizational compassion scores and self-reported scores for their own compassionate caregiving (Lown et al., 2020). Moon and colleagues reported that employee compassion was positively related to the employees' perception of their organization's social engagement as being just and compassionate (Moon et al., 2014).

Perceived organizational threat (2 studies, 2 tests of association)

Perceived organizational threat—i.e., workplace-related stresses, challenges, and threats—showed a weak negative correlation with employees' compassion for others in a study by Henshall et al. (2018). This association was no longer significant in a follow-up study when controlling for self-compassion, perceived organizational compassion, and gender.

Belonging to a supportive organizational unit (1 study, 1 test of association)

In the healthcare setting, Lown et al. found that having a caring nursing team (distinguished from the organization as a whole) was strongly and positively associated with nurses' perceptions of organizational compassion and with their self-reported individual compassion scores (Lown et al., 2020).

Organizational aspects of healthcare (1 study, 3 tests of association)

In a survey of mostly African-American women, O'Malley and Forrest (2002) found that their perception of compassion in primary care physicians was associated with higher organizational health care accessibility, continuity of care, and coordination of specialty care, but not with geographic or financial accessibility. The authors reported that women who highly rated their doctor's ability to address their health care needs also rated them as highest in compassion.

Discussion

Understanding the epidemiology of compassion—how and why it is clustered—could help inform and guide efforts to promote compassion at individual and societal levels. The current review attempts to summarize the quantitative scientific literature on factors associated with compassion.

Challenges and limitations

Several challenges were encountered. First, the scientific literature on compassion is scattered across many disciplines, each with its own methods and conventions. The concepts, definitions, and measures of compassion differ across disciplines and even among investigators within the same discipline (Strauss et al., 2016; Mascaro et al., 2020). Relatively few studies evaluate compassion as an outcome using quantitative data. In addition, there is little standardization across studies regarding the concepts and definitions of potential risk factors for compassion, or the statistical methods used to test for association with compassion. Such heterogeneity precluded the possibility of a meta-analysis and made it difficult to summarize measures of effect for specific risk factors.

Second, as Joan Halifax notes, compassion is not a single, easily defined entity, but rather is comprised of non-compassion elements (Halifax, 2012). We were guided by a simplified model of compassion that includes three fundamental elements: cognitive appraisal (awareness of suffering); empathy (emotional resonance with the person suffering); and action (or at least the intent of acting) to alleviate suffering or its causes. Considerable scientific research now exists on attributes or skills that are thought to foster (and, in some cases, be manifestations of) compassion, such as perspective-taking, empathic concern, altruism, and prosociality—each with their own emerging literature of associated correlates and risk factors. We focused our review on a construct of compassion that involves both empathy and intention to act. In doing so, we undoubtedly excluded articles that address less direct (although important) precursors of compassion (e.g., factors that promote perspective-taking or empathy).

Third, the relatively poor quality of the data and the high proportion (39%) of studies that used a cross-sectional design make it difficult to infer causality. Self-report measures—which may or may not relate to actual behavior—were used in 87% of studies. Further, with the exception of experimental studies in psychology laboratories (e.g., Cialdini et al., 1997; Mikulincer et al., 2005; Tarrant et al., 2009; Lim and DeSteno, 2016, 2020; Cassidy et al., 2018), few studies adequately controlled for potential confounders or analyzed data for factors that might modify relationships between reported risk factors and compassion (i.e., effect modifiers). Thus, a more nuanced set of studies is needed that includes adequate analysis of multiple covariates and controls for the influence of known risk factors.

Fourth, the geographic representativeness of the studies in this review is limited. More than half of the studies were conducted in North America, and university students comprised the majority of participants. Relatively few studies included subjects from Africa or South America.

Patterns

With these limitations in mind, several overall patterns emerged. Current quantitative research on compassion

overwhelmingly focuses on individual persons and their capacity to give compassion to others (Figure 2). Few studies in our review explored capacities or barriers to *receiving* compassion. Pioneering work by Gilbert and others on "fears of compassion" begins to address these barriers (Gilbert et al., 2011; Asano et al., 2017; Kirby et al., 2019); this research has important implications for human flourishing (Gilbert, 2020). For example, a recent study by Ramalho et al. highlighted the significant role of receiving compassion in improving quality of life among persons with chronic disease (Ramalho et al., 2021). New measures, such as the Compassion Engagement and Action Scale, include sub-scales on receiving compassion (Henje et al., 2020).

Recent work by a growing number of investigators has focused on the role and importance of compassion within organizations (Worline and Dutton, 2017). Most of these studies have been qualitative, rather than quantitative, in nature, and address themes such as compassion fatigue, compassion satisfaction, or burnout. Relatively few focus on other-directed compassion as an outcome. Nonetheless, several articles in this review underscore the importance of organizational culture, leadership, social support, and commitment to ethical principles for nurturing compassion among employees. In healthcare settings, organizational commitment to person-centered care, including coordination, continuity, and accessibility were positively associated with perceptions of compassion among patients (O'Malley and Forrest, 2002).

Implications for an epidemiology of compassion

Compassion is enacted in particular times and places, by particular people, and is influenced by social, cultural, and organizational norms as well as by the physical environment. To explore the implications of the risk factors identified in this review for an epidemiology of compassion, we consider them in the context of three traditional parameters of descriptive epidemiology: person, time, and place. In this framework, compassion can be considered a characteristic or capacity of an individual person (i.e., a host factor). It can also be affected by time (e.g., with age) or one's perception of time (e.g., feeling rushed), and it varies by place (i.e., particular physical or social environments; Figure 2). These three parameters overlap and interact.

Person (host factors)

As noted, most of the studies that met our inclusion criteria treated compassion as a host factor (i.e., a characteristic of an individual human being that predisposes them to respond to suffering with compassion; Figure 2). These host factors include demographic features; personal characteristics, dispositions, and skills; personal history and experience; and habitual behaviors. With the above limitations of available research in mind, several key signals emerged in the data, some of which point to modifiable risk factors. What follows is a discussion of the implications of these signals, by domain.

Domain 1—Demographic factors

Gender. The finding that female gender was significantly associated with compassion in the majority of studies that evaluated this variable aligns with the perception that women are more compassionate than men. This finding, which investigators did not explore further, is likely influenced, at least in part, by gendered social norms.

Age. Although the relationship between compassion and age was mixed, we observed a general trend among these studies, in which compassion increased with age during mid-adulthood. The meaning and reason for these observations have not been adequately explored.

Religiosity and spirituality. Religiosity and spirituality were associated with compassion in 10 (76.9%) of 13 tests. Religious scholar Karen Armstrong describes compassion as a common thread across all major religions and spiritual traditions (Armstrong, 2009). Unfortunately, religion also has the power to divide, and in some cases, justify cruelty and the withholding of compassion for out-groups (e.g., members of minority sects or persons with other religious backgrounds). In an increasingly pluralistic and interconnected world, the role of religion in fostering compassion—particularly for the stranger and the "distant other"—requires greater attention.

Domain 2—Personal characteristics, disposition, and skills

Many of the personal characteristics that were most strongly associated with compassion are considered precursors to, or elements of, compassion. Social and emotional intelligence and perspective-taking facilitate the recognition of suffering in others. Empathic concern activates the emotional resonance that prompts the desire to alleviate suffering. The most common approaches to standardized compassion training incorporate elements of perspective-taking, empathic concern, intention, and self-compassion. The positive findings from the studies evaluating such training—including all 10 RCTs—point to the importance of these elements for cultivating compassion. In some models of compassion, intention is considered essential (Worline and Dutton, 2017). Intention is shaped by prosocial attitudes and values, which were associated with compassion in all three studies that examined them (McDonald et al., 2018; Owuamalam and Matos, 2019; Kirby et al., 2021).

Attachment. Attachment theory has proven to be a powerful framework for understanding the nexus of safety, caregiving, and compassion (Mikulincer et al., 2001, 2005; Gilbert, 2020). Secure attachment as a trait emerged as a strong and consistent risk factor for compassion in the studies we reviewed. Although established in childhood and modified by life experience, secure attachment has life-long effects, influencing empathic concern in preschool-age children (Murphy and Laible, 2013), the development of moral emotions (Costa Martins et al., 2021), the

ability to provide empathic support to peers during the teenage years (Stern and Cassidy, 2018), and the quality of adult relationships (McGinley and Evans, 2020). Research by Mikulincer et al. (2005) and Cassidy et al. (2018) demonstrated how attachment can be primed experimentally by imagining the presence of a secure, nurturing other. This approach warrants further attention for efforts to develop compassion in situations where individuals feel insecure or under threat, but desire to respond with compassion.

The Experience in Close Relationships questionnaire, used in most of the studies that assessed attachment, includes subscales for attachment anxiety and attachment avoidance. Consistent with the broader literature (Mikulincer et al., 2001, 2005), the studies we reviewed reported that attachment avoidance was strongly associated with lower compassion scores, whereas attachment anxiety was associated with self-focused distress, but not with other-oriented compassion. Addressing attachment avoidance is a central component of compassion-focused psychotherapy (Gilbert, 2020).

Self-compassion. Self-compassion was associated with other-directed compassion in four of the five studies that examined this relationship. The nature of this relationship is complex and controversial (Strauss et al., 2016). The cross-sectional design of these studies makes it difficult to draw causal inferences.

Power. The negative relationship between social power and compassion aligns well with observations in many organizational and political settings, and points to an urgent need to cultivate compassion among leaders and those with influence.

Domain 3—Personal history and experience

Two factors related to the history or experience of the compassion-giver emerged as particularly important: compassion training and previous experience of suffering or adversity.

Training. Intentional training to improve one's capacity for compassion was well-represented among the intervention studies that met our criteria for inclusion. It was also the most rigorously evaluated; 10 of 14 such studies were RCTs. Recent advances in neuroscience have documented brain plasticity and the human capacity to change one's response to suffering (Davidson and McEwen, 2012; Weng et al., 2013). Emerging evidence indicates that different forms of contemplative training have different effects and that practices can be tailored to strengthen specific compassion-related skills (Singer and Engert, 2019). These findings suggest that expansion of opportunities for intentional training will be important for compassion to flourish at the societal level.

Previous adversity. Previous experience of suffering was consistently associated with compassion, a finding that supports the theoretical framework known as "altruism born of suffering" (Vollhardt and Staub, 2011). This finding is also consistent with the enactive view of compassion proposed by Halifax, which posits that memory is important for the emergence of compassion (Halifax, 2012). Empathic concern, which can be enhanced through the experience of adversity, may be an important mediator between previous adversity and compassion (Davis et al., 2019).

The relationship between suffering and compassion is paradoxical. As a virtuous response, compassion seeks to alleviate suffering, yet, as these studies show, the experience of suffering, itself, can predispose humans to respond compassionately to the suffering of others. The experience of suffering can also lead to its perpetuation (Basto-Pereira et al., 2022). Understanding how and under what conditions suffering leads to post-traumatic growth and meaning-making that foster compassion for others is an important area for further work.

Time

Relatively few studies addressed the epidemiologic dimension of time. Two longitudinal studies suggested that compassion increases from young-adulthood into middle-age (Hintsanen et al., 2019; Saarinen et al., 2020), but two others reported decreases in compassion within a two-year period among older married couples (Sabey and Rauer, 2018) and adolescents (Bengtsson et al., 2016). These decreases were attributed not to time itself, but to other factors, i.e., attachment avoidance and negative self-perception, respectively.

Using experience sampling methods, investigators have begun to explore moment-to-moment variability in compassion as an ephemeral state, rather than a relatively stable trait (Jazaieri et al., 2016; Runyan et al., 2019). Additional work is needed to understand the patterns, causes, and consequences of these fluctuations.

The *perception* of time seems to strongly influence whether one responds to suffering with compassionate action; feeling rushed or "time-compressed" is associated with decreased likelihood of helping behavior (Darley and Batson, 1973). Lack of time is consistently cited by healthcare providers and global health professionals as a major barrier to compassionate care and compassionate leadership, respectively (Babaei and Taleghani, 2019; Harrel et al., 2021). Patients' perception of their healthcare providers' compassion is associated with the length of clinical consultation (O'Malley and Forrest, 2002). An encouraging study by Fogarty et al. suggests that compassion can be communicated in healthcare settings even when time is severely constrained (Fogarty et al., 1999).

Place (physical and social environment)

Available data also suggest that compassion is influenced by physical, social, and organizational environments. All 10 tests for association that examined the relationship between compassion and country of residence—a crude spatial indicator—found national differences, although the direction of these differences was inconsistent with respect to specific countries.

As with the dimension of time, experience sampling methods reveal intriguing differences in the moment-to-moment experience of compassion associated with specific places. For

example, Runyan et al. (2019) found greater levels of compassion when study subjects were at home, as opposed to outside, in class, or at work or school. One might speculate that the spaces in which one feels more secure, safe, and supported are more conducive to compassion.

Compassion in humans evolved among small groups in specific places. The role of place and geographic proximity in nurturing compassion has changed radically with rapid advances in communications technology and global travel. Extending compassion to the abstract population level, as is required in the field of global health, for example, requires new ways of imagining ourselves in relation to distant others who may be suffering.

Several of the organizational studies in this review highlight the importance of social norms and organizational culture in creating the conditions in which compassion can emerge. These studies underscore the importance of local, socially-relevant environmental factors in nurturing or inhibiting compassion and point to the potential of further research using the tools and methods of environmental epidemiology.

Other considerations

Moment of the compassion encounter

Risk factors related to person, time, and place all appear to influence the moment in which suffering is apprehended and compassion emerges. Some of these risk factors are related to dispositional host factors, such as capacity for perspective-taking, social and emotional intelligence, and empathic concern. Others are related to the particularities of the suffering itself, such as its severity and the number of victims. Additional risk factors are rooted in the relationship between the person in the position of offering compassion and the person suffering, such as perceived in-group similarity and psychological proximity. In addition, factors related to the inner emotional state of the compassion-giver—such as emotional distress, a sense of secure attachment, and feeling rushed—play important roles in determining the probability of a compassionate response. Several studies illustrated the interconnected and interdependent nature of these and other factors at the moment of encounter.

Investigators have explored the underlying dynamics at the moment of encounter through different lenses. Loewenstein and Small focused on the interaction between sympathy, "which is caring but immature and irrational" and deliberation, "which is rational but uncaring" (Loewenstein and Small, 2007), while Poulin (2017) has explored the importance of intention and self-related goals in moving from deliberation to compassionate action. The appraisal model of compassion proposed by Goetz and colleagues illuminates both conscious and subconscious factors that determine whether witnessing negative outcomes leads to compassion (Goetz et al., 2010). Further research is needed to understand the degree to which factors associated with the withholding of compassion at the moment of encounter can be overcome.

Compassion as a transmissible agent

In addition to considering the dimensions of time, person, and place, infectious disease epidemiology focuses on transmission dynamics of the infectious agent. None of the studies overtly approached compassion as a transmissible agent, applying the tools and approaches of infectious disease epidemiology. However, studies of organizational compassion provide clues as to the potential of this approach. For example, in a longitudinal study in Israel, Eldor examined "public service sector employees who receive compassionate feelings such as affection, generosity, caring, and tenderness from their supervisors" (Eldor, 2018). Receiving compassion from supervisors at the beginning of the study significantly increased subsequent employee compassion for others, as measured by organizational citizenship behavior and employees' compassionate behavior toward clients (as assessed by clients). Similarly, it is possible to view secure attachment in adulthood having been "transmitted" by parents during early childhood. Kirby et al. have explored how compassion "flows," underscoring the positive role of attachment as well as factors that inhibit this flow, such as fears of compassion (Kirby et al., 2019). The maturation of thought and scholarship on fears of compassion provides a foundation for understanding factors that promote and inhibit transmission of compassion (Gilbert, 2020).

Implications for research

Despite several limitations, the current examination of existing knowledge and knowledge gaps can help inform a research agenda to better understand the epidemiology of compassion. The diverse risk factors identified in this review point to the complexity with which "non-compassion elements" come together to allow compassion to emerge. The causal pathways leading from suffering to a compassionate response appear to be non-linear and complex. Further, many factors (acting as effect modifiers) appear to be permissive of—or essential for—the arising of compassion in certain settings or in certain populations, but not others.

It is therefore not surprising that some, but not all, studies of a particular risk factor (e.g., gender) showed significant associations with compassion. It is not clear whether such discrepancies are related to differences in study design, definitions, or methods, or rather to variation in the patterns of interplay among "non-compassion elements" in specific contexts. As much as possible, future research on compassion should take into account the contextual factors and the various ways in which "non-compassion elements," such as perspective-taking, awareness, empathic concern, and memory, are active in particular settings. In addition, the role of risk factors identified in this review (whether as primary causes, confounders, or effect modifiers) should be considered in future epidemiologic studies of compassion.

Regardless of the inherent complexity of compassion, RCTs of various versions of compassion training demonstrate that, if committed and interested, individuals can improve their capacity for

compassion. Training works, although it is clear that different types of training can produce different outcomes (Singer and Engert, 2019). In addition to programs currently offered to adults, such as CBCT® and CCT©, the principles that underlie these programs—strengthening perspective-taking, encouraging empathy, fostering self-compassion—are increasingly being incorporated into early childhood education as well as primary and secondary schools (Roeser and Pinela, 2014; Jones et al., 2021; SEE Learning, 2022). Additional research is needed to determine the most effective and consequential interventions across the lifespan and in different settings and to better understand the relational factors that contribute to successful training (Condon and Makransky, 2020).

Our review highlights the fact that compassion researchers have regarded the giving of compassion primarily as an individual predisposition, host factor, trait, or skill. Much less is known about factors associated with the capacity to *receive* compassion. Future research should more fully address not only the giving and receiving of compassion, but its experience or phenomenology, which at its deepest level extends beyond the duality of giving or receiving. Recent work by Sinclair et al. (2016) reveals the richly nuanced experience of compassion among palliative care patients. Patients experienced compassion if they perceived virtues such as love, genuineness, honesty, and kindness in the healthcare provider; if the provider created a relational space of engaged caregiving and sought to understand the patient and their needs; and if the provider attended to multiple patient needs—physical, spiritual, emotional, and family-related—both to alleviate the patient's suffering and promote their well-being (Sinclair et al., 2016). It is at this level of human connection that compassion fosters human flourishing (Larkin, 2016). Newly-developed experience sampling methods and the tools of social neuroscience could provide crucial insights into the momentary experience of compassion and the most important factors and pathways that contribute to it.

Certain signals arising from the data warrant particular attention in further research. Among these are the role of previous adversity in predisposing one to compassion; the transmission and sustenance of a "compassion climate" within organizations (Nolan et al., 2022); and the attenuation of empathy and compassion with social power. Further, more research is needed to clarify the relationship between compassion and burnout, depression, and anxiety, currently represented by few studies and with mixed results. This is especially important for the development of desperately-needed compassion interventions for the public health and healthcare workforce. To this end, research to elucidate compassion dynamics within organizations and systems is also critical.

Additional research is needed on collective compassion and on organizations as the holders and transmitters of compassion. It appears from current research that ethical and compassionate leadership, organizational values, responsible social engagement, and prosocial operating norms have the potential to increase expressions of compassion among employees, both within and beyond the workplace. Understanding the mechanisms involved is important for the scaling-up of compassion from the individual to the collective level. Although RCTs clearly demonstrate the effectiveness of training for individuals who desire to become more compassionate, little is known about how to motivate individuals who have not self-selected to cultivate their own compassion. Further, the long-term effectiveness of compassion training is not well-understood. Organization-level research, particularly within healthcare settings, could help address these gaps.

Descriptive epidemiology typically characterizes phenomena by person, time, and place. Preliminary evidence—as well as human experience—suggests that compassion is clustered with respect to all three of these parameters. Advancing our scientific understanding of compassion will require more extensive discussion and deliberation to address the heterogeneity of methods, measures, and assumptions currently used by compassion researchers and to develop more standardized approaches. Additional reflection is warranted on potential contributions from various methodological and analytic approaches. Epidemiologic approaches that appear most promising, based on our review, include those commonly used for infectious disease (to understand how compassion is transmitted); chronic disease (which deals with multiple risk factors in complex interactions); mental health (which addresses inner states as well as outer manifestations); and environmental health (which examines the confluence of factors in a particular setting). Application of these epidemiologic methods should be informed by insights from other scientific disciplines engaged in the study of compassion, as well as by in-depth dialogue with spiritual and religious traditions.

Author contributions

DA, HB, AR, and AG contributed to conception and design of the study. HB, AR, SA, EH, and SL performed the literature search and initial entry and analysis of the data. AR, HB, and DA organized and managed the database. AR and DA cross-checked the final database to ensure quality control. DA wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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"Feeling It": Links between elements of compassion and sexual well-being

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Introduction: Compassion may be a particularly important component of a sexual relationship as it facilitates needed self-awareness, understanding, and connection to frame deeply intimate expressions of sexual emotion and vulnerability. Given the lack of research on how broad concepts of compassionate elements may be linked to sexual well-being, we examine how mindfulness (an ability to maintain awareness in the present moment), compassionate relational attitudes (i.e., accessibility, responsiveness, and engagement), and compassionate relational behaviors (i.e., forgiveness and gratitude), are linked to sexual well-being (sexual harmony, orgasm consistency, and sexual frequency), and sexual mindfulness (a state of being mindful during sex) for oneself and one's partner.

Methods: We constructed an actor partner structural equation model with newly married couples (n = 2,111) and regressed sexual outcomes at time 1 and time 2 on each partner's compassionate attitudes, behaviors and mindfulness reported at time 1.

Results: Results showed that cross-sectionally, nearly all elements of one's compassion related to one's own sexual well-being for both partners. Strongest paths included positive significant relations for women between mindfulness and non-judgment and from compassionate relational attitudes and behaviors to sexual harmony. Men's compassionate behaviors were positively related to their own sexual awareness. Perhaps more importantly, women's and men's compassionate behaviors had significant effects on their partner's sexual well-being longitudinally.

Discussion: Implications include an emphasis on compassion as a key mechanism that can increase sexual satisfaction and strengthen relationships, particularly in the critical time of early marriage where patterns of interconnectedness are being established.

KEYWORDS

compassion, mindfulness, sex, relationships, dyadic

Introduction

Compassion is inherently relational. Previous literature has focused on compassionate responding in the individual or compassion development in children and youth (see Seppälä et al., 2017). Research and theory on the formation and expression of compassion within a romantic relationship has focused on self-compassion and has shown a number of positive associations (Lathren et al., 2021). However, researchers have suggested that compassion may be multi-dimensional and include elements such as kindness, common humanity, mindfulness (an ability to maintain awareness in the present moment), and a lack of indifference toward others (Hoisington, 2013; Pommier et al., 2020). These "elements of compassion" are likely essential within early marriage as individuals try to navigate the assumptions and standards created for a romantic relationship (i.e., first five years; Fincham et al., 2006). Compassion within the relationship transcends the individual and thereby facilitates a cohesion between partners that perpetuates relational health. A key piece of relational health in a marriage is sexual well-being, a physiological system that can be activated in response to compassionate partnering, and in turn, strengthen romantic relationships on the whole.

We use the Developmental Model of Marriage Competence (DMMC) as a grounding model for the study (Allsop et al., 2021). Carroll et al. (2006) outline how DMMC is comprised of three key factors that promote formation and maintenance of healthy marital relationships—other-centeredness, personal security, and effective negotiation. Other-centeredness is a particularly salient component and may be especially needed early on in marriage. Compassion is other-centered and will likely add to the development of marriage competence (Carroll et al., 2006) and as Karremans et al. (2017), compassion may also create an other-connectedness in conjunction to other-centeredness. Some other constructs such as forgiveness, gratitude, attachment and mindfulness could also overlap strongly with the elements of personal security (i.e., attachment, mindfulness) and effective negotiation (i.e., forgiveness, gratitude) in a romantic relationship. Thus, in the current study we take a similarly multidimensional view of the factors that contribute to compassionate relational responding and conceptualize such a framework as *relational compassion*.

A framework of relational compassion

Compassion may be defined as an "awareness of the suffering of another coupled with the wish to relieve it" and may also include an "unselfish concern for the welfare of others" (Marriam-Webster Online Dictionary, n.d.). Synonyms for compassion include condolence, pity, empathy, commiseration, leniency, and tolerance. In discussing the landscape of compassion definitions and approaches in the social sciences specifcally, Goetz and Simon-Thomas (2017) further described distinct processes of compassion including (1) an awareness of need in another person, (2) feeling "moved," or having physiological response, (3) appraisal of one's own social role within the context, (4) judgment about the person suffering within the context, and (5) drive to engage in caregiving or helping. As noted, compassion likely moves beyond simple awareness or concern within committed romantic relationships because it is embedded within a context where interaction maintains commitment and connection over time between two people. Thus, a more complex *relational* definition of compassion likely embodies mindfulness, as well as relational attitudes and behaviors that align with Goetz and Simon-Thomas' processes.

In the current study, we use the phrase *relational compassion* as an umbrella term that encompasses compassionate "elements" that relate specifically to romantic relationships. Considering the complexity of what compassion within a romantic relationship (as opposed to self-compassion or generalized compassion) might look like, we operationalize *relational compassion* as the broad, multidimensional use of personal mindfulness (i.e., ability to be fully aware in the present moment), compassionate attitudes (e.g., relational accessibility) and compassionate behaviors (e.g., forgiveness). Recent measurement work on compassion has included the development of scales that measure individuals' compassion specifically (e.g., Raes et al., 2011; Pommier et al., 2020). However, in efforts to expand the ways that compassion might be operationalized in a relationship context, we grouped compassion-adjacent constructs together that represented psychological systems (e.g., attitudes, mindfulness) as well as behavioral systems unique to a relational environment (e.g., forgiveness and gratitude) in line with the DMMC. The resulting constructs could facilitate positive sexual responding, which could additionally be considered *compassionate* responding in that sexual relations are inherently dyadic, vulnerable, and take a great deal of thought and care when done well.

We configured these "groupings" in such a way that each represented a concrete piece of relational compassion that could be improved through intentional, guided effort on the part of the individual or couple. Although working on forgiveness, *per se*, does not exactly mean that an individual is increasing their overall compassion, it could contribute to compassionate responding, or even a compassionate relational outlook/framework within their relationship that then leads to other positive relational outcomes (i.e., sexual well-being). Although each construct might predict sexual well-being individually, the three elements combined can represent a relational mindset or framework (i.e., relational compassion) where the whole is theoretically more than the sum of its parts.

Sexual arousal and well-being represent physiological systems in the body that are sensitive, reactive, and bring pleasure and joy to individuals and couples. Sharing in sexual

expression with a caring partner can build trust and strengthen the bonds between two people (Leavitt et al., 2021a). Relational compassion is likely inherent to such sexual processes as a precursor, an outcome, and potentially an interactive thread that weaves two people together through sexual harmony. However, these relations have never been theoretically or empirically explored. Thus, building on separate, but equally compelling bodies of work, this study will use a novel approach to examine the links between relational compassion and comprehensive measures of sexual well-being.[1] Researchers have called for more comprehensive assessments of sexual well-being that do not rely on unidimensional sexual satisfaction measures (e.g., McClelland, 2010; Leavitt et al., 2021c). In response, we include orgasm consistency, sexual frequency, sexual satisfaction, sexual awareness and non-judgment, and sexual harmony as outcomes in the present study. This expansion in understanding can illuminate how specific elements of relational compassion might be bolstered to facilitate healthier, lasting relationships by way of sexual well-being.

Relationally compassionate elements

Mindfulness

Mindfulness may be one component of compassion that is targeted and supportive of emotional development to alleviate suffering (Germer, 2009; Goetz and Simon-Thomas, 2017). Mindfulness is an ability to remain aware and mentally present in a given moment (Kabat-Zinn, 1990). Being aware has shown a host of positive links with relational and sexual well-being (Harvey et al., 2019; Eyring et al., 2021: Leavitt et al., 2021a). This positive association is likely found because mindfulness plays an important role in creating connection. Karremans et al. (2017) provide a theoretical framework explaining that mindfulness within a relationship helps individuals reevaluate interactions and make more positive assessments of those interactions. Being more aware also helps romantic partners slow down their thought process so their decisions can be more intentional and less reactive. Mindful awareness also helps romantic partners to create a stronger self-other connection, or in other words, awareness facilitates an understanding of how others' responses are influenced by external circumstances. Mindful individuals can take their partner's perspective. In a one-year longitudinal study using adolescents, young people who learned mindfulness techniques later reported increases in overall mindfulness, self- and other-compassion (Stutts et al., 2018). This response aligns with the DMMC (Carroll et al., 2006) as well as Goetz and Simon-Thomas (2017) processes of compassion. Mindful individuals can be more personally secure and intentional about the connections created within the relationship to account for partner preferences and strengthen the marriage.

Relationally compassionate attitudes: Accessibility, responsiveness, and engagement

Attitudes of attachment such as accessibility, responsiveness, and engagement capture elements of compassion between partners. Mikulincer and Shaver (2005) found that these attitudes are foundational to compassionate caregiving whereas relational insecurities interfere with compassionate responding. The presence of physical, emotional, and psychological accessibility (being available) or responsiveness (awareness and sensitivity) from a partner may help the individual endure stress and uncertainty or gain confidence needed for growth and learning (Johnson, 2003). It's important to note that accessibility and responsiveness alone are not enough to create a secure relationship. Creating critical bonding moments that are described as engagement are also essential (Sandberg et al., 2012). If a partner can request closeness or connection and rely on its occurrence, a new bonding experience occurs (Johnson, 2003). This third marker of engagement rounds out the aspects of positive attitudes that align with relational compassion (Johnson, 2003; Sandberg et al., 2012). These attitudes likely create a context that is other-centered and other-connected (Carroll et al., 2006; Goetz and Simon-Thomas, 2017; Karremans et al., 2017), through engaging in responsive conversation that sees the individual's needs and desires.

Relationally compassionate behaviors: Forgiveness and gratitude

Forgiveness is a dispositional tendency that may affect an individual's intrapersonal well-being and relationships (Berry and Worthington, 2001). Forgiveness is defined as strong, positive, other-oriented emotions that supersede the negative emotions of unforgiveness (Worthington and Wade, 1999), and while transgressions are bound to be a part of any relationship, compassion through forgiveness may play an important role. Neff (2003) has suggested that the mechanism through which self-compassion works is not that painful feelings are avoided but instead that an awareness including kindness, understanding, and a sense of shared humanity is adopted. In fact, compassion and forgiveness seem to work hand-in-hand as individuals work to overcome trauma (Ghasem Zadeh et al., 2019; Erskine, 2020). Forgiveness may also help couples work through challenges in their sexual relationship.

Gratitude may also be a behavior that is expressed within a compassionate framework. Kabat-Zinn (1990) described the heartfelt side of mindfulness as "appreciative" and "nurturing," or "heartfelt." Gratitude and compassion have been paired in describing this heartfelt side of mindfulness (Voci et al., 2019). Both gratitude and compassion were found to be mechanisms through which mindfulness linked to psychological outcomes

1 Sex is a broad term and includes a wide range of activities. We are not directive about what activities participants consider "sex," likely resulting in sex and sexual well-being being more inclusive, which is supported by other research on sexual well-being (Leavitt et al., 2021d; Waite et al., 2017).

such as positive relations with others and purpose in life (Voci et al., 2019). Gratitude has shown both direct and indirect (through increased empathy) connections with compassionate love (Kim et al., 2018) as individuals with higher levels of gratitude showed higher levels of compassion by way of being more empathetic. In line with the DMMC, these behaviors may be key to effective negotiation in the relationship as both gratitude and forgiveness represent exchanges where couples agentically offer thanks to their partner and potentially offer grace for mistakes as well (Carroll et al., 2006; Karremans et al., 2017).

Markers of sexual well-being

Sex is both physical and emotional and therefore needs to be examined in a way that captures the multifaceted nature of the experience, particularly for women (Kleinplatz et al., 2009; McClelland, 2010). To accomplish this, we examine sexual harmony, orgasm, sexual frequency, and the two components of sexual mindfulness: awareness and non-judgment as indicators of overall sexual well-being.

Sexual harmony

Sexual harmony builds on the theory of general passion (Vallerand, 2010) and is evidenced by a sexual interest that is not fleeting but instead a core part of a couple's identity and life satisfaction (Busby et al., 2019). Researchers have suggested that standing in contrast to an obsessive or inhibited sexual attitude is harmonious sexual passion (Philippe et al., 2017). Sexual harmony is a balanced, self-directed, and controlled commitment for sex, which leads to positive individual and relational outcomes (Philippe et al., 2017; Busby et al., 2019). Sexual harmony is a balance of sexual needs and attitudes that are in harmony with the holistic relationship. This balance is demonstrated in a longitudinal study that found an intricate bi-directional association of relational and sexual well-being, indicating that both influence each other (McNulty et al., 2016).

Orgasm consistency

Although orgasm is less consistent for women than men, orgasm is important for both to achieve sexual well-being (Leavitt et al., 2021b). Because orgasm is described as the pinnacle of sexual pleasure, it is often used as an indicator of sexual well-being, as well as sexual competence and sexual satisfaction (Haning et al., 2007; Young et al., 1998; Potts, 2000; Komisaruk et al., 2009). Orgasm has been linked with self-compassion such that individuals with greater self-compassion are likely to report greater orgasm consistency and husbands' self-compassion may safeguard against negative effects of distress about sexual problems for both their own sexual satisfaction and their partners' (Ferreira et al., 2020).

Sexual frequency

Although research often connects sexual frequency with sexual satisfaction (Sánchez-Fuentes et al., 2014), some research indicates these measures may not reveal a complete picture of sexual satisfaction for women (Brotto, 2010). Sexual frequency is certainly important for both men's and women's sexual well-being (Frederick et al., 2017), but maybe not as linearly associated as some have suggested (Muise et al., 2016). Muise and colleagues found that the association between frequency and well-being is curvilinear not linear, and sex was not associated with well-being for frequencies more than once a week. So, while sexual frequency is important, it may not always have a linear relationship with sexual well-being.

Sexual mindfulness

As noted, sexual relationships are complex and often filled with additional anxieties due to sharing naked bodies, performance issues, or self-criticism. Sexual mindfulness is a skill built off trait mindfulness, but applied within a sexual context (Leavitt et al., 2019). Not all mindful individuals are able to maintain their mindfulness within the context of heightened anxiety and pleasure of sex. Trait mindfulness certainly contributes to sexual mindfulness but it is not sufficient to achieve sexual mindfulness (Leavitt et al., 2019). Additionally, recent research has shown the significant effects of sexual mindfulness in improving sexual communication, connectedness, sexual functioning, and sexual satisfaction (Leavitt et al., 2021a,e). Consequently, we use the state of achieving sexual mindfulness as a component of sexual well-being that likely derives from the multi-dimensional elements of relational compassion.

Sexual mindful awareness

Leavitt et al. (2019) found that being aware during a sexual experience was associated with sexual satisfaction, as well as relational satisfaction and self-esteem, above and beyond mindfulness alone. Other research has shown that sexual mindful awareness was associated with the individual's and their partner's orgasm consistency, sexual harmony, and relational flourishing (Leavitt et al., 2021c). Being aware during sex likely creates a greater sense of the details surrounding the sexual experience and as Karremans et al. (2017) explain, mindfulness encourages a higher level of executive function, increases emotion regulation, as well as self-other connectedness. This type of presence fosters quality relationships, particularly within a complex sexual relationship. Self-interested and retaliatory impulses are less emphasized as a mindful individual engages in constructive efforts of broader relationship concerns and is attuned to the interests of their partner (Karremans et al., 2017).

Sexual mindful non-judgment

Non-judgment is the second component of sexual mindfulness (Leavitt et al., 2019). To be non-judgmental,

an individual refrains from criticism or negative evaluations during sex. Instead of judgment, the individual can practice curiosity or observation. When conflict arises during sex, the mindful individual can note differences as just that, differences. There is no need to make evaluations that result in pitting partners against one another. Instead of the evaluation, "My partner doesn't care about my pleasure," the individual may be curious about why their partner is disengaged or distracted. These non-evaluative observations allow couples to further investigate differences and find common ground or aligned sexual interests (Rogers, 2016).

Relational compassion and sex

Each relationally compassionate element discussed above can be connected to various aspects of sexual well-being. Though no research we know of has linked *relational compassion* and sexual well-being generally, some "sister" research has evaluated the role of *self*-compassion within circumstances of sexual distress and found that self-compassion is negatively associated with sexual distress, but not necessarily with sexual satisfaction (Santerre-Baillargeon et al., 2018; Michael et al., 2021). Other studies found positive links between mindfulness and sexual well-being (Leavitt et al., 2021c) and compassion and to higher relationship quality generally (McDonald et al., 2020). The present study aims to expand this literature to encompass more comprehensive measures of both compassion and sexual well-being to expand understanding of a dynamic process and promote healthy romantic relationships.

First, mindfulness may contribute to sexual well-being through multiple avenues. Theoretical as well as empirical work indicates that mindfulness contributes to a general sense of compassion toward others in the form of perspective taking (Lim et al., 2015; Karremans et al., 2017, 2020). Being personally aware and fully "present" in a relational context can surely contribute to both sexual frequency and orgasm frequency as each partner stays intimately attuned to the others' physical needs, responding to sexual requests and reacting compassionately to their partner's body through high-quality sexual communication and physical responsiveness. The ability to take another's perspective can enhance awareness of each partner's sexual needs and desires, which can contribute to mutually satisfactory sex that prizes vulnerability, repels self- and partner-judgment, and helps the couple align both physically and emotionally (e.g., sexual harmony). The "shared humanness" aspect encompassed in personal mindfulness may also help a couple relate to one another emotionally during sex as they share a physical and psychological bond.

Secondly, couples who struggle to compassionately relate and respond to their partner (i.e., negative relationally compassionate attitudes) may also show negative sexual patterns. Notably, unhealthy couple dynamics that are anxious or avoidant are associated with lower sexual satisfaction (Busby et al., 2020). However, less is known about how relational attitudes are related to other important dimensions of sexual well-being, which we explore in the present study. Unknowns aside, it makes theoretical sense that couples who are psychologically accessible are more likely to respond positively to requests for sex, or for certain sexual behaviors from one's partner. This accessibility, coupled with responsiveness and engagement, likely provides a safe space where each partner can relate to the other in intimate, physical ways that contribute to sexual satisfaction, harmony, and a consistently pleasurable and unifying sexual experiences. Using our underlying theoretical understanding of other-centeredness, other-connectedness, and compassion (Carroll et al., 2006; Goetz and Simon-Thomas, 2017; Karremans et al., 2017), the present study explores these hypotheses.

Finally, forgiveness as an element of relational compassion may be particularly needed in sexual relationships as sex represents an intimate expression of complex emotion and vulnerable areas of our identity (Kleinplatz et al., 2009). Indeed, it could be that when couples are not "on the same page" about sexual frequency, sexual behaviors, or the sexual dissatisfaction of one or both partners, it is the compassionate ability to forgive that sustains a healthy sexual relationship over time. Couples who can forgive one another likely demonstrate more sense of sexual communal strength, which is an awareness and desire to meet the sexual needs of each other despite challenges (Muise et al., 2016), and is associated with sexual satisfaction. In support of this supposition, men and women who were more forgiving showed a positive connection for not only their own sexual well-being but also for their partner's sexual well-being (Eyring et al., 2021).

Additionally, gratitude has shown a positive association with not only an individual's sexual well-being, but their partner's sexual well-being (Eyring et al., 2021). This is unsurprising as gratitude is complicit with nurturance, unconditional acceptance, deep connection and appreciation. Each of these qualities is sure to facilitate a positive sexual relationship in which partners can express their needs, respond to the other with sympathy and/or gentleness, and work through difficult sexual issues with understanding (e.g., past traumas, infertility concerns, performance concerns). Both forgiveness and gratitude (i.e., relationally compassionate behaviors) could potentially lead to increases in sexual frequency, sexual satisfaction and orgasm consistency, as well as heightened sexual awareness, non-judgment and harmony as both create a context of other-centeredness that likely benefits the early patterns of marriage formation (Carroll et al., 2006; Karremans et al., 2017).

The current study

Given the lack of research on how broad concepts of relational compassion (as opposed to self-compassion or generalized compassion) may be linked to sexual well-being, we

examine attitudes and behaviors that are elements of relational compassion to evaluate their links to sexual harmony, sexual frequency, orgasm consistency, and sexual mindful awareness and non-judgment cross-sectionally (time 1; T1) and over time (time 2; T2). We do so in an actor-partner model such that we can explore ways that relationally compassionate elements influence an individual's own, as well as their partner's, sexual well-being concurrently and 2 years later. Based on previous literature, we hypothesized:

> H1: Husbands' and wives' relational compassion (mindfulness, compassionate attitudes, and compassionate behaviors), would be positively associated with one's own sexual harmony, sexual frequency, orgasm consistency, and sexual mindful awareness and non-judgment both within and across time.

> H2: Husbands' and wives' relational compassion would be positively associated with their spouses' sexual harmony, sexual frequency, orgasm consistency, and sexual mindful awareness and non-judgment both within and across time.

Materials and methods

Sample

Participants for this study were drawn from a larger nationally representative longitudinal study of positive relationship interactions and virtues during the beginning (first five) years of marriage (N = 2,111 couples). Data was initially collected in October of 2015 and the entire sample for the present study was composed of heterosexual couples who had married in 2013 (4%), 2014 (90%), and 2015 (6%) (see James et al., 2022). The majority of couples in the present study had been married approximately two years in Time 1 of our study and four years at Time 2 of our study. The data was dyadic such that participants were married to one another. For the current study, the average age for wives at T1 was 28.0 years old (SD = 5.1) and the average age for husbands at T1 was 29.85 years old (SD = 5.64). Race/ethnicity of participants included: White (66% wives, 65% husbands), Black/African American (9% wives, 11% husbands), Hispanic/Latino (13% wives, 13% husbands), Asian (5% wives, 3% husbands), Multiracial (6% wives, 6% husbands), and Other (1% wives, 2% husbands). Educational attainment included: less than high school (2% wives, 4% husbands), high school (14% wives, 22% husbands), some college (28% wives, 29% husbands), Associate's degree (12% wives, 10% husbands), Bachelor's degree (29% wives, 25% husbands), Master's degree (11% wives, 7% husbands), advanced degree such as Ph.D. or J.D. (4% wives, 4% husbands).

Measures

All scale scores below were standardized into z-scores (outside of control variables) before being entered into the structural equation model. All measures were self-reported.

Mindfulness

Mindfulness at T1 was measured using the Mindful Attention Awareness Scale (15 items; Brown and Ryan, 2003). Items are on a Likert-type scale ranging from 1 (almost always), to 6 (almost never), with higher scores indicating higher state mindfulness (e.g., "I find myself listening to someone with one ear, doing something else at the same time"). The scale had adequate reliability in this sample for both wives and husbands (Chronbach's αs = 0.85,0.86).

Compassionate attitudes

Compassionate attitudes were measured using the Brief Accessibility, Responsiveness, and Engagement (BARE) scale (Sandberg et al., 2012). Respondents responded to statements regarding their personal accessibility, responsiveness, and engagement with their partner on a 12-item scale from 1 (never true) to 5 (always true). Example items included, "I am confident I reach out to my partner," and "My partner listens when I share my deepest feelings." The scale had adequate reliability in this sample for both wives and husbands (Chronbach's αs = 0.78,0.80), with higher scores indicating higher levels of compassionate attitudes.

Compassionate behaviors

Compassionate behaviors included a mean-composite score of each partner's forgiveness and gratitude, where higher scores indicated higher levels of compassionate behavior. Six items came from the Marital Forgiveness Scale and three came from the Gratitude Scale (Fincham et al., 2006; Lambert et al., 2009). Sample items included, "I soon forgive my partner," and "When my partner does something nice for me I acknowledge it." The combined scale had adequate reliability in this sample for wives and husbands (Chronbach's αs = 0.83,0.84).

Sexual frequency

Each partner reported how often they currently had sex with their partner in a single item at T1 and T2. Responses included: 1 = Never, 2 = Less than once a month, 3 = One to three times a month, 4 = About once a week, 5 = Two to four times a week, 6 = Five to seven times a week, 7 = More than once a day.

Sexual satisfaction

Each partner reported how satisfied they were with how often they were having sex in a single item at both timepoints. Responses ranged from 1 = very dissatisfied to 5 = very satisfied.

Orgasm consistency

Participants reported how often they experienced orgasm when they were sexual with their partner (1 = 0–20% of the time, 2 = 21–40% of the time, 3 = 41–60% of the time, 4 = 61–80% of the time, 5 = 81–100% of the time) at T1 and T2.

Sexual harmony

Each partner responded to three items from the Harmonious subscale of the Sexual Passion Scale (adapted from Vallerand, 2010; Lalande et al., 2017). Responses ranged from 1 = never to 5 = very often with higher scores indicating higher harmony. A sample item included, "The sexual activities that I am excited about in my relationship with my partner are in harmony with other things that are a part of me." The scale had adequate reliability in this sample for both wives and husbands at T1 (Chronbach's αs = 0.91,0.90) and T2 (Chronbach's αs = 0.91,0.90).

Sexual awareness

Sexual awareness was assessed using a subscale of the Sexual Mindfulness Measure developed by Leavitt et al. (2019). Participants responded to four items, such as "I pay attention to how sex affects my thoughts and behavior," on a one to five scale ranging from "Never or Rarely True" to "Very Often or Always True." The scale had adequate reliability for wives and husbands at T1 (Chronbach's αs = 0.85,0.82) and T2 (Chronbach's αs = 0.85,0.82).

Sexual non-judgment

Respondents reported their non-judgment by responding to three items, another subscale of the Sexual Mindfulness Measure (Leavitt et al., 2019), that asked how judgmental they were during sex on a 1 (never or rarely true) to 5 (very often or always true) scale, which were then reverse coded (e.g., "During sex, I sometimes get distracted by evaluating myself or my partner"). The scale had adequate reliability for wives and husbands at T1 (Chronbach's αs = 0.85,0.83) and T2 (Chronbach's αs = 0.84,0.82).

Relevant controls

Control variables included participant age (computed from birthdate), education level, and race (response items can be seen in the Participants section). Age can be relevant as sexual frequency, satisfaction and orgasm consistently certainly change across age, even from the span of early to late twenties, particularly for women (Hayes and Dennerstein, 2005). This may be due to childbirth, hormonal fluctuations, and career advancement/change, and other factors. Race is additionally relevant as we know that marital dynamics, and in conjunction, sexual dynamics, differ across context and culture (see debates stemming from Rushton and Bogaert, 1987 to present, e.g., Bharj, 2020).

Procedures

Participants were recruited across a large, nationally representative sample of over 2,000 young married couples in the United States beginning in fall 2015. Participants were recruited using a two-stage cluster stratification sample design. The first stage involved a sample of US counties, and the second involved a sample of recent marriages within them. Selection was based on county population size, marriage, divorce, poverty rates, and the racial-ethnic distribution of the county. Initially, potential participants were contacted by mailed letters that contained a $2.00 bill with an invitation to participate and instructions on how to enroll in the study. Subsequently, follow-up postal mailings, e-mail invitations, and phone calls were made. Those that opted-in to the study were directed to an online Qualtrics survey. Participating couples were given a $50.00 Visa gift card upon completion of the survey. The study was approved by all appropriate IRB bodies.

Analysis plan

All variables were assessed for distributional normality in SPSS 28. Pearson's correlations between all variables were estimated to check for collinearity among predictors in the model. Additionally, one-way ANOVAs and correlations were estimated to determine which control variables should be included in the main analysis. After this was determined, a longitudinal cross-lagged actor-partner model (APIM) was constructed in MPLUS v.8 where T1 and T2 outcome variables (sexual frequency, sexual satisfaction, orgasm consistency, harmony, awareness, and non-judgment) for each partner were regressed on T1 predictors (mindfulness, compassionate attitudes, compassionate behaviors) for each partner, as well as relevant controls (see **Figure 1**). Additionally, T2 outcomes were regressed on T1 outcomes to control for stability in sexual well-being constructs across time. The typical actor-partner independence model (APIM) explores associations between predictors from both partners predicting own and partner outcomes (Cook and Kenny, 2005). We used the APIM framework to explore concurrent and 2-year longitudinal associations between predictors and outcomes. Although some researchers would correlate predictors and outcomes concurrently and explore predictions across time, because the associations we were examining had important concurrent associations as well as longitudinal ones, we predicted outcomes at the same timepoint as well as 2 years later, as has been done in previous research (Cook and Kenny, 2005; Kenny et al., 2006; Pollock Star et al., 2022). Stability paths were included such that T2 outcomes were controlled for at T1. This model allowed us to (1) assess the relative strength of paths from each predictor to each outcome when considered in concert with the other predictors, (2) compare actor effects

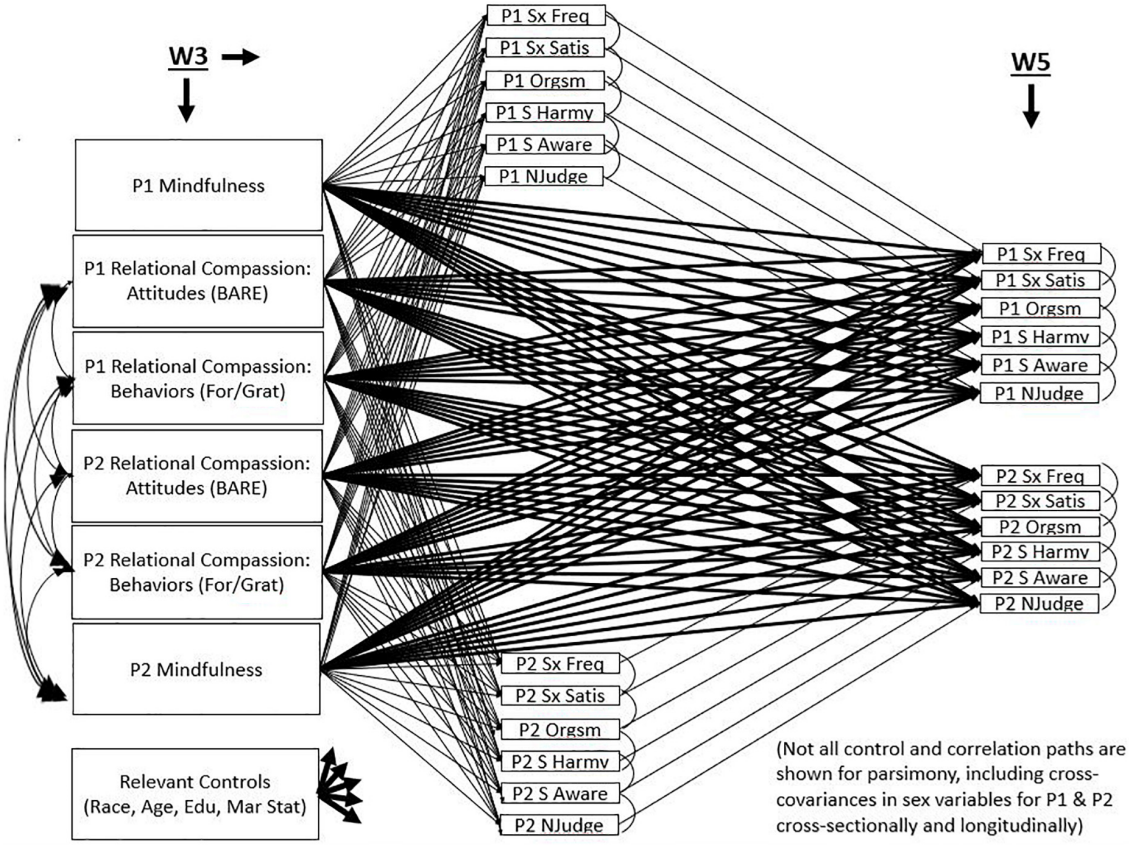

FIGURE 1
Longitudinal actor partner interdependent model showing cross-sectional and longitudinal relations between elements of relational compassion and sexual wellbeing across two years.

to partner effects on sexual well-being, and (3) view actor and partner relations between compassionate constructs and sexual well-being both cross-sectionally and longitudinally 2 years later.

Results

Preliminary analyses

Correlations and descriptive statistics including distributional properties for all variables are in **Table 1**. All correlations were in the expected direction.

Structural equation model

All parameter estimates including R^2 statistics can be seen in **Table 2** and a visual representation of the model can be seen in **Figure 1**. Results will be organized below by timepoint and partner with significant findings highlighted.

Cross-sectional actor associations

Cross-sectionally (T1), the model showed numerous significant associations between relationally compassionate constructs and sexual well-being for wives. Indeed, *mindfulness* was positively related to one's own sexual satisfaction ($\beta = 0.10$, SD = 0.03, $p < 0.001$), orgasm consistency ($\beta = 0.06$, SD = 0.03, $p = 0.04$), and sexual non-judgment ($\beta = 0.21$, SD = 0.03, $p < 0.001$). Similarly, wives' compassionate relational *attitudes* related positively to sexual frequency ($\beta = 0.08$, SD = 0.04, $p = 0.03$) sexual satisfaction ($\beta = 0.07$, SD = 0.04, $p = 0.03$), orgasm consistency ($\beta = 0.14$, SD = 0.04, $p < 0.001$), sexual harmony ($\beta = 0.16$, SD = 0.04, $p < 0.001$), and non-judgment ($\beta = 0.17$, SD = 0.04, $p < 0.001$). Compassionate relational *behaviors* was the only construct to relate to sexual awareness, in the positive direction ($\beta = 0.19$, SD = 0.03, $p < 0.001$), in addition to positively relating to sexual frequency ($\beta = 0.10$, SD = 0.03, $p < 0.01$), sexual satisfaction ($\beta = 0.14$, SD = 0.03, $p < 0.001$), orgasm consistency ($\beta = 0.11$, SD = 0.03, $p < 0.01$), and sexual harmony ($\beta = 0.22$, SD = 0.03, $p < 0.001$).

Husbands showed significant positive relations between all three aspects of relational compassion and their own

TABLE 1 Correlations and descriptive statistics for all study variables (n = 2,177).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. P1 mindfulness	1														
2. P1 compassionate attitudes	0.37***	1													
3. P1 compassionate behaviors	0.23***	0.51***	1												
4. P2 mindfulness	0.24***	0.18***	0.12***	1											
5. P2 compassionate attitudes	0.18***	0.45***	0.31***	0.35***	1										
6. P2 compassionate behaviors	0.13***	0.32***	0.29***	0.22***	0.58***	1									
7. P1 T1 sexual frequency	0.10***	0.17***	0.15***	0.10***	0.14***	0.10***	1								
8. P1 T1 sexual satisfaction	0.20***	0.24***	0.21***	0.16***	0.20***	0.16***	0.58***	1							
9. P1 T1 orgasm consistency	0.15***	0.25***	0.20***	0.08**	0.16***	0.13***	0.24***	0.26***	1						
10. P1 T1 sexual harmony	0.18***	0.36***	0.31***	0.11***	0.27***	0.20***	0.45***	0.47***	0.35***	1					
11. P1 T1 sexual awareness	0.08**	0.19***	0.20***	0.04	0.13***	0.11***	0.25***	0.15***	0.28***	0.46***	1				
12. P1 T1 sexual non-judgment	0.30***	0.30***	0.19***	0.15***	0.19***	0.11***	0.05+	0.13***	0.19***	0.23***	−0.01	1			
13. P2 T1 sexual frequency	0.08**	0.13***	0.13***	0.11***	0.19***	0.15***	0.70***	0.44***	0.19***	0.39***	0.22 ***	0.08**	1		
14. P2 T1 sexual satisfaction	0.13***	0.18***	0.18***	0.21***	0.26***	0.20***	0.44***	0.43***	0.20***	0.37***	0.18 ***	0.13***	0.58***	1	
15. P2 T1 orgasm consistency	0.05+	0.15***	0.10***	0.08**	0.18***	0.12***	0.11***	0.06+	0.14***	0.11***	0.13 ***	0.06+	0.15***	0.11***	1
16. P2 T1 sexual harmony	0.09**	0.22***	0.21***	0.18***	0.35***	0.28***	0.34***	0.28***	0.20***	0.45***	0.25 ***	0.14***	0.45***	0.47***	0.06*
17. P2 T1 sexual awareness	0.01	0.12***	0.13***	0.06+	0.20***	0.23***	0.14***	0.10***	0.14***	0.19***	0.21 ***	−0.02	0.17***	0.07*	0.11***
18. P2 T1 sexual non-judgment	0.11***	0.19***	0.13***	0.27***	0.35***	0.23***	0.07*	0.08**	0.07**	0.10**	−0.03	0.19***	0.08**	0.08**	0.20***
19. P1 T2 sexual frequency	0.11***	0.12**	0.11***	0.09**	0.14***	0.11***	0.52***	0.33***	0.18***	0.29***	0.13 ***	0.06*	0.46***	0.27***	0.06*
20. P1 T2 sexual satisfaction	0.12***	0.11**	0.11***	0.11***	0.10**	0.11***	0.29***	0.44***	0.13***	0.25***	0.09 **	0.08*	0.24***	0.22***	0.05
21. P1 T2 orgasm consistency	0.11***	0.16***	0.11***	0.04	0.11***	0.10***	0.18***	0.19***	0.69***	0.28***	0.23 ***	0.10***	0.15***	0.16***	0.09**
22. P1 T2 sexual harmony	0.15***	31***	0.25***	0.09**	0.25***	0.20***	0.31***	0.33***	0.31***	0.46***	0.25 ***	0.16***	0.26***	0.26***	0.08*
23. P1 T2 sexual awareness	0.10***	0.15***	0.18***	0.07**	0.08*	0.06*	0.20***	0.13***	0.23***	0.33***	0.48 ***	0.05	0.17***	0.16***	0.03
24. P1 T2 sexual non-judgment	0.24***	0.26***	0.18***	0.10**	0.17***	0.10***	0.01	0.09**	0.18***	0.19***	0.07*	0.48***	0.04	0.08**	0.05
25. P2 T2 sexual frequency	0.09**	0.12***	0.12***	0.13***	0.16***	0.12***	0.46***	0.29***	0.16***	0.27***	0.14 ***	0.08**	0.50***	0.32***	0.06+
26. P2 T2 sexual satisfaction	0.07*	0.14***	0.17***	0.18***	0.18***	0.14***	0.27***	0.25***	0.11***	0.24***	0.15 ***	0.05+	0.32***	0.47***	0.02
27. P2 T2 orgasm consistency	0.06*	0.16***	0.10***	0.08*	0.17***	0.11***	0.17***	0.08**	0.20***	0.12***	0.13 ***	0.09**	0.16***	0.10***	0.48***
28. P2 T2 sexual harmony	0.11***	0.21***	0.17***	0.21***	0.32***	0.25***	0.24***	0.20***	0.15***	0.28***	0.18 ***	0.07*	0.32***	0.34***	0.08**
29. P2 T2 sexual awareness	0.04	0.10***	0.07**	0.11***	0.17***	0.19***	0.14***	0.10**	0.08**	0.12***	0.15 ***	0.00	0.13***	0.06*	0.03
30. P2 T2 sexual non-judgment	0.11***	0.17***	0.11***	0.13***	0.26***	0.18***	0.06+	0.07*	0.05	0.14***	0.04	0.13***	0.05+	0.04	0.20***
Mean (SD)	4.22 (0.96)	4.22 (0.66)	4.82 (0.87)	4.33 (0.98)	4.06 (0.68)	4.89 (0.86)	3.70 (1.21)	3.25 (1.22)	3.61 (1.54)	3.24 (1.02)	3.28 (0.88)	3.73 (0.99)	3.69 (1.23)	3.15 (1.27)	4.71 (0.81)
Min/max	1–6	1–5	1.25–6.67	1–6	1.5–5	1.58–6.30	1–7	1–5	1–5	1–5	1–5	1–5	1–7	1–5	1–5
Skew/kurtosis	−0.22/−0.28	−0.76/ 0.30	−0.29/ −0.34	−0.27/ −0.32	−0.53/ −0.26	−0.33/ −0.54	−0.17/ −0.55	−0.23/ −0.89	−0.62/ −1.16	−0.22/ −0.43	−0.21/ 0.10	−0.58/ −0.23	−0.06/ −0.62	−0.13/ −1.06	−3.20 /10.04

(Continued)

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TABLE 1 (Continued)

	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
1. P1 mindfulness															
2. P1 compassionate attitudes															
3. P1 compassionate behaviors															
4. P2 mindfulness															
5. P2 compassionate attitudes															
6. P2 compassionate behaviors															
7. P1 T1 sexual frequency															
8. P1 T1 sexual satisfaction															
9. P1 T1 orgasm consistency															
10. P1 T1 sexual harmony															
11. P1 T1 sexual awareness															
12. P1 T1 sexual non-judgment															
13. P2 T1 sexual frequency															
14. P2 T1 sexual satisfaction															
15. P2 T1 orgasm consistency															
16. P2 T1 sexual harmony	1														
17. P2 T1 sexual awareness	0.31***	1													
18. P2 T1 sexual non-judgment	0.17***	−0.07*	1												
19. P1 T2 sexual frequency	0.24***	0.10***	0.04	1											
20. P1 T2 sexual satisfaction	0.18***	0.10**	0.00	0.54***	1										
21. P1 T2 orgasm consistency	0.16***	0.12***	0.05	0.26***	0.23***	1									
22. P1 T2 sexual harmony	0.30***	0.16***	0.04	0.49***	0.45***	0.43***	1								
23. P1 T2 sexual awareness	0.21***	0.14***	−0.04	0.22***	0.16***	0.27***	0.41***	1							
24. P1 T2 sexual non-judgment	0.10**	−0.02	0.11***	0.12***	0.14***	0.21***	0.29***	0.05	1						
25. P2 T2 sexual frequency	0.31***	0.12***	0.04	0.76***	0.43***	0.20***	0.42***	0.19***	0.11***	1					
26. P2 T2 sexual satisfaction	0.29***	0.02	0.02	0.45***	0.37***	0.17***	0.39***	0.19***	0.10**	0.58***	1				
27. P2 T2 orgasm consistency	0.13***	0.09**	0.21***	0.17***	0.05	0.20***	0.22***	0.08*	0.11**	0.19***	0.12***	1			
28. P2 T2 sexual harmony	0.45***	0.17***	0.17***	0.37***	0.28***	0.20***	0.47***	0.21***	0.17 ***	0.48***	0.49***	0.25***	1		
29. P2 T2 sexual awareness	0.20***	0.42***	0.02	0.19***	0.16***	0.12***	0.21***	0.18***	−0.01	0.19***	0.12***	0.11**	0.30***	1	
30. P2 T2 sexual non-judgment	0.16***	0.07*	0.42***	0.06	0.08**	0.07*	0.15***	−0.05	0.21***	0.10**	0.06*	0.27***	0.26 ***	0.01	1
Mean (SD)	3.32 (0.95)	3.37 (0.82)	4.02 (0.88)	3.53 (1.26)	3.25 (1.17)	4.78 (0.67)	3.50 (1.02)	3.29 (0.87)	3.67 (0.97)	3.52 (1.27)	4.71 (0.78)	3.93 (1.27)	3.51 (0.94)	3.39 (0.79)	4.04 (0.84)
Min/max	1–5	1–5	1–5	1–7	1–5	1–5	1–5	1–5	1–7	1–5	1–5	1–5	1–5	1–5	1–5
Skew/kurtosis	−0.19/ −0.26	−0.20/ 0.07	−0.87/ 0.42	−0.06/ 0.53	−0.26/ −0.81	−3.61/ 13.56	−0.40/ −0.30	−0.13/ −0.06	−0.47/ −0.34	0.01/ −0.63	−3.18/ 10.14	−1.02/ −0.09	−0.35/ −0.09	−0.10/ −0.12	−0.88/ 0.47

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

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TABLE 2 Relations between partner 1 (P1) and partner 2 (P2) relationally compassionate constructs at T1 and sexual well-being for self and partner cross-sectionally (T1) and longitudinally (T2) presented as β (standard deviation).

Outcomes predictors	P1 sexual frequency	P1 sexual satisfaction	P1 orgasm consistency	P1 sexual harmony	P1 sexual awareness	P1 sexual non-judgment	P2 sexual frequency	P2 sexual satisfaction	P2 orgasm consistency	P2 sexual harmony	P2 sexual awareness	P2 sexual non-judgment
Cross-sectional relations (T1 outcomes)												
P1 mindfulness	0.03 (0.03)	0.10 (0.03)***	0.06 (0.03)*	0.05 (0.03)*	0.01 (0.03)	0.21 (0.03)***	0.02 (0.03)	0.03 (0.03)	−0.01 (0.03)	−0.02 (0.03)	−0.05 (0.03)	0.01 (0.03)
P1 compassionate attitudes	0.08 (0.04)*	0.07 (0.04)*	0.14 (0.04)***	0.16 (0.04)***	0.05 (0.04)	0.17 (0.04)***	0.01 (0.04)	0.01 (0.04)	0.09 (0.04)*	0.01 (0.04)**	−0.01(0.04)	0.02 (0.04)
P1 compassionate behaviors	0.10 (0.03)**	0.14 (0.03)***	0.11 (0.03)***	0.22 (0.03)***	0.19 (0.03)***	0.05 (0.03)	0.08 (0.04)*	0.11 (0.04)**	0.02 (0.04)	0.11 (0.03)**	0.06 (0.04)$^{+}$	0.00 (0.03)
P2 mindfulness	0.05 (0.03)$^{+}$	0.07 (0.03)*	0.01(0.03)	0.01 (0.03)	−0.02 (0.03)	0.05 (0.03)	0.05 (0.03)$^{+}$	0.13(0.03)***	0.03 (0.03)	0.07(0.03)*	−0.02 (0.03)	0.17 (0.03)***
P2 compassionate attitudes	0.04 (0.04)	0.05(0.04)	0.01 (0.04)	0.11 (0.04)***	0.02 (0.04)	0.07 (0.04)$^{+}$	0.11 (0.04)**	0.12(0.04)**	0.10 (0.04)*	0.18 (0.04)***	0.04 (0.04)	0.25 (0.04)***
P2 compassionate behaviors	0.01 (0.04)	0.04 (0.04)	0.05 (0.04)	0.01(0.04)	0.03 (0.04)	−0.05 (0.04)	0.08 (0.04)	0.08 (0.04)*	0.03 (0.04)	0.16 (0.04)***	0.24 (0.04)***	0.05 (0.04)
R-squared values for each outcome	0.06 (0.01)***	0.10 (0.02)***	0.08 (0.01)***	0.19 (0.02)***	0.06 (0.01)***	0.14 (0.02)***	0.06 (0.01)***	0.11 (0.02)***	0.04 (0.01)**	0.16 (0.02)***	0.09 (0.02)***	0.15 (0.02)***
Longitudinal relations (T2 outcomes)												
P1 mindfulness	0.06 (0.03)$^{+}$	0.05 (0.03)	0.03 (0.02)	0.03 (0.03)	0.02(0.03)	0.06 (0.03)*	0.03 (0.03)	−0.03(0.03)	0.00 (0.02)	0.01 (0.03)	0.00 (0.03)	0.04 (0.03)
P1 compassionate attitudes	−0.03 (0.04)	−0.04 (0.04)	0.01 (0.03)	0.11 (.04)**	0.02 (0.04)	0.08 (0.04)*	−0.01 (0.04)	−0.01 (0.04)	0.06 (0.04)	0.04 (0.04)	0.04 (0.03)	0.03 (0.04)
P1 compassionate behaviors	0.03 (0.03)	0.08 (0.04)	−0.04 (0.03)	0.07 (0.03)*	0.11 (0.03)**	0.05 (0.03)	0.06 (0.03)	0.12 (0.04)**	0.01 (0.03)	0.02 (0.04)	–0.06 (0.04)$^{+}$	−0.01 (0.04)
P2 mindfulness	0.00 (0.03)	0.04 (0.03)	−0.03 (0.03)	−0.02 (0.03)	0.04 (0.03)	0.00 (0.03)	0.05 (0.03)	0.08 (0.03)**	0.01 (0.03)	0.10 (0.03)**	0.06 (0.03)*	−0.03 (0.03)
P2 compassionate attitudes	0.07 (0.04)	−0.04 (0.04)	0.01 (0.03)	0.04 (0.04)	0.00 (0.03)	0.06 (0.04)	0.06 (0.04)	0.02 (0.04)	0.05 (0.04)	0.11 (0.04)*	−0.01 (0.04)	0.10 (0.05)*
P2 compassionate behaviors	0.04 (0.04)	0.08 (0.04)*	0.02 (0.03)	0.09 (0.04)*	−0.04 (0.04)	−0.04 (0.04)	0.01 (0.04)	0.02 (0.04)	0.01 (0.04)	0.09 (0.04)*	0.13 (0.04)**	0.05 (0.04)
R-squared values for each outcome	0.17 (0.02)***	0.16 (0.02)***	0.43 (0.03)***	0.20 (0.02)***	0.22 (0.02)***	0.26 (0.02)***	0.17 (0.02)***	0.19 (0.02)***	0.26 (0.04)***	0.21 (0.02)***	0.20(0.02)***	0.19 (0.03)***

R-square values for each outcome at each time point. Longitudinal effects control for stability in constructs across 2 years. Controls included race, age, and education where relevant (parameter estimates unshown).
$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

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sexual well-being cross sectionally. Husbands' *mindfulness* was positively related to their own sexual satisfaction (β = 0.13, SD = 0.03, $p < 0.001$), sexual harmony (β = 0.07, SD = 0.03, $p = 0.02$), and non-judgment (β = 0.17, SD = 0.03, $p < 0.001$). Husbands' relationally compassionate *attitudes* were positively related to sexual frequency (β = 0.11, SD = 0.04, $p < 0.01$), sexual satisfaction (β = 0.12, SD = 0.04, $p < 0.01$), orgasm consistency (β = 0.10, SD = 0.04, $p = 0.01$), sexual harmony (β = 0.18, SD = 0.04, $p < 0.001$), and non-judgment (β = 0.25, SD = 0.04, $p < 0.001$). In slight contrast, husbands' relationally compassionate *behaviors* were positively related to sexual satisfaction (β = 0.08, SD = 0.04, $p = 0.046$), sexual harmony (β = 0.16, SD = 0.04, $p < 0.001$), and sexual awareness (β = 0.24, SD = 0.04, $p < 0.001$), but not sexual frequency, orgasm consistency or non-judgment.

Cross-sectional partner associations

Both wives and husbands showed significant relations between their own compassionate predictors and their partner's sexual well-being outcomes at T1. Specifically, wives' relationally compassionate *behaviors* related positively to husbands' sexual frequency (β = 0.08, SD = 0.04, $p = 0.03$), sexual satisfaction (β = 0.11, SD = 0.04, $p < 0.01$), and harmony (β = 0.11, SD = 0.03, $p < 0.01$). Wives' *Mindfulness* showed no significant relations, however wives' relationally compassionate *attitudes* showed one positive significant relation with husbands' orgasm consistency (β = 0.09, SD = 0.04, $p = 0.04$).

In contrast, husbands' *mindfulness* positively related to wives' sexual satisfaction (β = 0.07, SD = 0.03, $p = 0.01$) and their compassionate relational *attitudes* related positively to wives' sexual harmony (β = 0.11, SD = 0.04, $p < 0.01$). There were no significant relations between husbands' relationally compassionate *behaviors* and their wives' sexual well-being.

Longitudinal actor associations

Among wives, relations between T1 relational compassion constructs and T2 sexual well-being showed that their *mindfulness* marginally predicted their own sexual frequency (β = 0.06, SD = 0.03, $p = 0.06$) and sexual non-judgment two years later (β = 0.06, SD = 0.03, $p = 0.03$). Further, wives' compassionate relational *attitudes* were positively related to their own sexual harmony (β = 0.11, SD = 0.04, $p < 0.01$) in addition to their own sexual non-judgment (β = 0.08, SD = 0.04, $p = 0.03$). Finally, relationally compassionate *behaviors* were positively associated with sexual harmony (β = 0.07, SD = 0.03, $p = 0.04$) and sexual awareness (β = 0.11, SD = 0.03, $p < 0.01$).

Husbands showed similar relations, although T1 *mindfulness* longitudinally predicted their own sexual harmony (β = 0.10, SD = 0.03, $p < 0.01$) and awareness (β = 0.06, SD = 0.03, $p = 0.04$), in addition to sexual satisfaction (β = 0.08, SD = 0.03, $p < 0.01$). T1 compassionate relational *attitudes* related to T2 sexual harmony (β = 0.11, SD = 0.04, $p < 0.01$) and sexual non-judgment (β = 0.09, SD = 0.05, $p = 0.04$). Compassionate relational *behaviors* were positively associated with both sexual harmony (β = 0.11, SD = 0.04, $p = 0.01$) and sexual awareness (β = 0.13, SD = 0.04, $p < 0.01$).

Longitudinal partner associations

For longitudinal partner associations, wives' relationally compassionate *behaviors* positively predicted husbands' sexual satisfaction (β = 0.12, SD = 0.04, $p < 0.01$), whereas husbands' relationally compassionate *behaviors* predicted wives' sexual harmony (β = 0.09, SD = 0.04, $p = 0.02$), and sexual satisfaction (β = 0.08, SD = 0.04, $p = 0.04$). No significant paths emerged for either wives' or husbands' T1 *mindfulness* or relationally compassionate *attitudes* on their partner's T2 sexual well-being outcomes.

Discussion

Sexuality is emotional, physical, and relational in nature (Busby et al., 2022), and represents one of the most intimate and vulnerable acts preformed between romantic partners. Indeed, sexuality not only involves physical nakedness, but high-quality sex requires partners to display "emotional nakedness" as well, being willing to be exposed, accessible and nurtured in a safe space. We build on the DMMC and a multifaceted understanding of compassionate processes (Goetz and Simon-Thomas, 2017; Allsop et al., 2021) to show that relational compassion may be a key precursor to sexually bonding experiences as it conveys trust, care, and acceptance. For the present study, we operationalized *relational compassion* using a variety of interrelated measures that capture elements of compassion (i.e., mindfulness, relational attitudes and behaviors)—and found that it may facilitate deeper understanding and connection for newly married couples trying to maintain an intimate relationship through sexual expression. We wanted to explore how specific elements of relational compassion bring immediate links to sexual well-being and what elements may have longer lasting benefits as sex is important in the moment, but can also help sustain a high-quality, lasting relationship (Busby et al., 2022). We discuss the results in terms of the cross-sectional findings and the two-wave time period findings below.

Cross-sectional associations between compassion and sexual well-being

As wives and husbands reported greater relational compassion, we found several positive connections for both actor and partner. Mindfulness and compassionate attitudes (accessibility, responsiveness, and engagement) were connected to most of the individuals' own sexual well-being markers, but neither was associated with own sexual mindful

awareness. This finding is not entirely surprising as sexual mindfulness is more difficult to achieve than simple trait mindfulness due to heightened anxiety and self-evaluations during sexual encounters (Leavitt et al., 2019). This finding shows that trait mindfulness may be necessary, but not sufficient to achieving relational, sexual mindfulness. Findings prompt future study into how partners can practice and incorporate sexual mindfulness into their lives given its positive correlates in previous research (Leavitt et al., 2021c). Compassionate behaviors (forgiveness and gratitude), however, *were* connected to all of the individuals' sexual well-being markers at T1. These findings are aligned with previous research as well as the DMMC (Allsop et al., 2021) and the relational mindfulness framework (Karremans et al., 2017). It may be that in an immediate way, compassionate behaviors represent a potent balm for relationships, with forgiveness and gratitude (within the relationship context) prompting individuals be more introspective and connected to their partner, which in turn facilitates individual sexual behaviors and well-being. More than just alleviating distress (Santerre-Baillargeon et al., 2018; Michael et al., 2021), compassionate behaviors provide targeted and supportive emotional and relational comfort to the self (Germer, 2009), which then encourages an accepting sexual environment (Leavitt et al., 2021e).

In addition to individual outcomes, we found that an individual's mindfulness and compassionate attitudes and behaviors were also connected to their *partner's* sexual well-being. Wives' relationally compassionate behaviors, but not their mindfulness or compassionate attitudes, were associated with multiple markers of their husbands' sexual well-being. Husbands may be particularly sensitive to compassionate behaviors of forgiveness and gratitude, which are acts of other-connectedness (Karremans et al., 2017; Allsop et al., 2021). Previous research has shown that forgiveness and gratitude are two ways that mindfulness may work to benefit couples' relational and sexual well-being because they open up lines of communication, prompt perspective taking, and help partners work through challenges (Goetz and Simon-Thomas, 2017; Eyring et al., 2021). The present findings support this work, showing that particularly for husbands, their partner's willingness to remain committed and engaged despite faults can enhance their sexual well-being. Wives' gratitude was additionally important, perhaps signifying how a husband's sexual well-being can be sustained through feeling that they are appreciated and meeting their wife's physical and emotional needs. Such positive psychological thoughts around acceptance and appreciation may help husbands more fully enjoy the physical closeness inherent to sexual experiences (Allsop et al., 2021).

Husbands' mindfulness and relationally compassionate attitudes were particularly important for their wives' sexual well-being. Husbands' higher mindfulness was associated with wives' higher sexual frequency and sexual satisfaction. Additionally, relationally compassionate attitudes of accessibility, responsiveness, and engagement were associated with feelings of harmony within the sexual relationship as well as feeling less judgmental during sex. It could be that as men focus on awareness and on bonding with their partner in deep emotional ways, they create an environment conducive to physical intimacy where their wife is comfortable seeking physical intimacy. Additionally, men's compassionate attitudes may create more other-centeredness and other-connectedness that enables wives' sexual well-being via feelings of acceptance, confidence, certainty and love despite personal insecurities (Johnson, 2003; Allsop et al., 2021). These compassionate attitudes may create critical bonding moments (Sandberg et al., 2012) that help women in particular feel more connection and thereby experience a more enjoyable, vibrant sexual interaction. It is also possible that husbands' close attention (i.e., mindfulness) to sensation enhances wives' sexual experience, which then promotes greater frequency because past experiences were positive.

These findings highlight how husbands' accessibility and responsiveness might create a safe space for wives to feel more aligned with their partner (i.e., sexual harmony) and tuned-in to the experience rather than being distracted or depreciated by self-judgment. Future work should explore these relations more thoroughly to understand reciprocity and contextual elements around sexual relationships, particularly how husbands can create safe, nurturing environments for wives to express sexual needs.

Links over time between compassion and sexual well-being

The two-wave findings in this study were not as pronounced as the cross-sectional associations, but this is not entirely unexpected. There may be a number of temporal effects of relational compassion on sexuality. Mindfulness, along with compassionate attitudes and behaviors may be more effective at the time when they are demonstrated and may not necessarily carry over long periods of time (Eyring et al., 2021; Smedley et al., 2021). However, we did find some associations across time periods. For the individual, wives' mindfulness significantly predicted their own sexual non-judgment two years later. This is likely due to the ability to be fully present in the moment, enjoying sexual sensations. This may create a pattern of focusing on pleasurable sensations and not ruminating on one's performance or physical appearance during sex, which facilitates non-judgment over time. Conversely, wives' compassionate relational attitudes predicted their own sexual harmony and non-judgment and relationally compassionate behaviors predicted their own sexual harmony and awareness two years later. In contrast to personal mindfulness, it appeared that more relational elements of compassion, including other-centeredness

and other-connectedness, acceptance and nurturance of their partner led to wives' own psychological connection to their sexuality, which in turn bonds them to their partner. Indeed, earlier mindsets that focus on personal sensation as well as relational connection may set a tone for later sexual acceptance and connection (Karremans et al., 2017).

Husbands showed similar associations: mindfulness predicted their own sexual harmony, awareness and sexual satisfaction two years later. Husbands' compassionate relational attitudes predicted sexual harmony and non-judgment, and compassionate relational behaviors predicted their own harmony and awareness two years later. The findings regarding sexual awareness are particularly positive, as more sexual mindful awareness is certainly associated with a better sexual well-being overall (e.g., Leavitt et al., 2020, 2021c). Karremans et al. (2017) framework explains that increased mindful awareness, and we would argue relational compassion, may facilitate a better understanding of how other's behaviors are impacted by external circumstances (Block-Lerner et al., 2007). Therefore, as men increase their own mindfulness and overall relational compassion, the more they might understand how their wife's sexual behavior may be impacted by things she cannot control (e.g., stressful work environment, parenting, etc.). Studies also suggest that mindfulness (we would include relational compassion) can increase empathy, understanding, gratitude and even forgiveness of a spouse's actions (Block-Lerner et al., 2007; Birnie et al., 2010; Eyring et al., 2021). These compassionate skills likely increase feelings of interconnectedness (Brown and Ryan, 2003), which will increase sexual well-being, as evidenced in our model.

Partner effects across time periods showed that for wives, relationally compassionate behaviors positively predicted husbands' sexual satisfaction (and sexual awareness marginally), whereas husbands' relationally compassionate behaviors predicted wives' sexual harmony and sexual satisfaction two years later. Surprisingly, mindfulness and relationally compassionate attitudes were not associated across time periods to sexual well-being outcomes. These findings should be further investigated. It may be that some elements of compassion are only immediately impactful as described by framework Karremans et al. (2017) and may not have long lasting impact. For example, mindfulness is concerned with being fully present in a particular moment. Additionally, being accessible and responsive at one time point may not have lasting effects as circumstances change and partners may not have the capacity to always respond in this way. Indeed, partners may need to consciously work to have relationally compassionate attitudes at all times to see lasting effects, particularly in the early years of a marriage. It may be that the power of compassion is immediate connection and benefits are fleeting. However, we find it interesting that compassionate behaviors carried the most weight in the model across time periods for both partners. This finding underscores the importance of gratitude and forgiveness in maintaining the kind of relationship that can enable lasting sexual satisfaction and harmony. A significant body of literature has shown the positive benefits of both forgiveness and gratitude to marriage quality and length (Fincham et al., 2006; Gordon et al., 2011). Our study corresponds with this work, but furthers it by showing relationally compassionate behaviors contribute to *sexual* well-being in marriages specifically. Understanding what elements of compassion are short-lived and what elements may have more lasting effects is salient for couples, therapists, and educators in promoting high-quality sex and overall relationships. In the present study, we found that mindfulness and compassionate attitudes of awareness, responsiveness and engagement should be fostered for short-term benefits, but lasting effects may be most supported by promoting compassionate behaviors of forgiveness and gratitude. Both the short term and long-term benefits are likely due to the other-connectedness that compassion provides (Carroll et al., 2006; Goetz and Simon-Thomas, 2017; Allsop et al., 2021). It is likely that forgiveness and gratitude are related to future mindfulness and compassionate attitudes, which subsequently relate to sexual well-being in a mediational way. We hope to see these associations tested in the future. However, at the time being we advise individuals and relationship educators to prize relational compassion, and specifically forgiveness and gratitude, as tangible skills for promoting healthy sexuality.

Strengths and limitations

This research on relational compassion is preliminary and needs further exploration. Our data came from a US nationally representative longitudinal study. Although we only used two waves of the longitudinal date, we were able to measure cross-sectional and longitudinal effects across two years. All participants in our sample were newly married and primarily in their 20s and 30s; thus, conclusions are generalizable only to this subgroup. This is both a strength and a limitation as additional research will need to clarify whether these findings apply to couples in other demographic categories. We cannot rule out changes in relationships due to maturation, historic events, or repeated testing and note that we did not have a "total length of relationship before marriage" variable to be used as a control. Future research could examine how relationally compassionate elements link to sexual well-being in couples in mid- and late life relationships, same-sex relationships, across various relationship types, lengths and cohabitation practices, and other important demographic groups.

We also suggest that future researchers continue to expand the way that compassion might be measured within relationships. Although we consulted many definitions of compassion, (e.g., Goetz and Simon-Thomas, 2017), and crafted a relational framework that included mindfulness, attitudes, and behaviors, there may be other ways to conceptualize compassion (i.e., prosociality, targeted sympathy, intimate

knowledge) that are worth exploring. Similarly, although we present a fairly robust battery of measures of sexual well-being, we recognize that some factors are likely left-out, including more comprehensive measures of sexual satisfaction. Our study represents a first foray into the relations between compassion and sex within relationships, and we hope that future work builds on this study to explore mediators, moderators, and potential transactional relations between constructs over time in pursuit of deeper understanding on what relational compassion looks like and how it operates to strengthen and sustain relationships through healthy sexuality.

Finally, we note that participants were each expressly asked to take the survey independently from their spouse and were provided different survey links. However, we cannot be positive that every participant adhered to these instructions, which could compromise validity. Future research could take more precautions against self-report bias as well as partner influence during the survey.

Conclusion

Despite limited effects across waves of data, this study showed that women's sexual well-being was driven cross-sectionally by husbands' relationally compassionate attitudes (accessibility, responsiveness, and engagement) and across two time periods by husbands' relationally compassionate behaviors (forgiveness and gratitude), whereas husbands' sexual well-being was driven both cross-sectionally and across the two time periods by wives' relationally compassionate behaviors of forgiveness and gratitude. Results provide initial evidence of how compassionate behaviors, particularly for women, can enhance and sustain their sexual connection with their partner within the moment. In contrast, compassionate behaviors from both partners had lasting effects on sexual satisfaction and women's perceptions of sexual harmony even two years later. In this article, we show how compassion can not only help individuals, but can also be conceptualized as a relational construct that enhances marriages, partnerships, and sexuality. Indeed, relational compassion, and particularly relationally compassionate *behaviors*, may be a key facilitator of sexual well-being, particularly for newly married couples.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Brigham Young University Internal Review Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AF, CL, and JY conceptualized the theoretical model. AF and JY undertook analyses and wrote Method and Results. CL and AP primarily wrote the literature review. All authors contributed to the Discussion, editing, and formatting.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Promoting prosocial behavior in an unequal world

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Amid a global pandemic and the climate crisis, there is an increasing need to understand how to promote largescale, coordinated action between different groups. Yet certain factors such as inequality can hinder cooperation. We aimed to establish how to orient groups toward a superordinate goal when they have unequal resources. Participants were divided into two 'countries' and asked to assemble LEGO bricks into food (by building pieces in a certain order) to prevent starvation among 'the people'. One 'country' had few LEGO bricks whereas the other had an abundance, and the only way to maximize food creation was for the groups to work together. We assessed the efficacy of three diverse interventions on superordinate behavior and attitudes: compassion meditation training (Study 1), lower inequality (Study 2), and the introduction of a pro-sharing group norm by a confederate (Study 3). Compassion meditation training and altering the degree of inequality between groups did not have a clear effect on collaborative action. Only the introduction of a pro-sharing group norm enhanced sharing behavior, made participants feel more cooperative and reduced fears of being compassionate toward others. Our findings speak to the importance of leadership in promoting coordinated action to address challenges that face the superordinate group.

KEYWORDS

compassion, superordinate behaviour, norms, cooperation, competition, inequality

Introduction

In the 21st century, we are facing large scale collective action problems that may have catastrophic consequences – from vaccine hoarding in a global pandemic to the ongoing refugee crises around the globe (Casey, 2021; Rouw et al., 2021). It is clear that, in order to solve these crises, we need compassionate and coordinated action from the global community – that is, we need to act as one. However, reality tells us that we do not always adopt superordinate goals such as these, particularly when our interests conflict with those who are different from us. Indeed, as classic social psychological research has shown, strong 'us' versus 'them' dynamics undermine the potential for coordinated action to achieve superordinate goals (Sherif, 1958). Such intergroup divisions are all the more difficult to bridge when there are high levels of inequality between groups whereby one group has

more resources than another (Sánchez-Rodríguez et al., 2018). In the current work, we study two unequally resourced groups that have the option to work together to achieve a superordinate goal. Across three studies, we explore whether diverse interventions (individual, structural, and normative) can overcome barriers to compassionate and cooperative action across group boundaries.

Superordinate goals help to overcome the intergroup divide

Muzafer Sherif was one of the first to discuss the importance of superordinate goals – goals where two or more groups need to cooperate to achieve a particular outcome (Sherif, 1958; Haslam, 2018). In the Robbers Cave experiment, Sherif coordinated a summer camp with several young boys where they were separated into two groups. Unbeknownst to the boys, the summer camp was a disguise for a larger goal – to explore how individuals compete and cooperate when they are members of different groups. The two groups quickly fell into conflict, and cooperation could only be achieved when the experimenters introduced a superordinate goal. The findings show that when people are divided into groups, intergroup conflict can arise, and individuals often pursue the goal of their ingroup at the expense of their outgroup counterparts (Gaertner et al., 2000).

Since these original studies, research has reinforced that an intergroup divide can be bridged when groups adopt superordinate goals (Sherif, 1958; Gaertner et al., 2000; DiBenigno, 2018; Martinez-Ebers et al., 2021). However, there are many socio-structural factors that prevent group members from embracing such superordinate goals. One obstacle might be the magnitude of the resource gap between the groups. If this is perceived to be too large, group members at opposite ends of the wealth spectrum may see the groups as too different and this might affect coordinated action (Jetten and Peters, 2019). Group resource inequality not only enhances the perceived difference *between* groups (e.g., the rich and the poor become more distinct categories, it also increases perceptions of similarities *within* groups (e.g., those within a poor category are perceived to be more similar, Jetten et al., 2017). Indeed, resource inequality enhances 'us' versus 'them' divisions (Sánchez-Rodríguez et al., 2018), and there is evidence that inequality, therefore, leads to less compassionate behavior toward others (Côté et al., 2015; Sands, 2017; Kirkland et al., 2019, 2021; Tanjitpiyanond et al., 2022).

Failing to overcome the ingroup-outgroup divide can have negative consequences when groups need to cooperate to achieve superordinate goals. We are interested in investigating potential interventions to reduce intergroup competition in this context—with the ultimate aim of increasing compassionate action in line with a superordinate goal. We focus on three possible interventions. The first targets individualistic solutions and we test the power of compassion training aimed at making individual group members feel and act more compassionately. Our reasoning builds on past research that has shown that compassion training (i.e., engaging in compassion meditation exercises), can foster compassionate action (Leiberg et al., 2011; Condon et al., 2013; Trautwein et al., 2020).

Second, interventions that change the structural context may offer an effective method to elicit compassion by altering or shifting group dynamics. We reason that if, relative to low economic inequality, high economic inequality exacerbates the ingroup-outgroup divide (Sánchez-Rodríguez et al., 2018) and erodes prosocial behavior (Côté et al., 2015; Sands, 2017; Kirkland et al., 2020), reducing the degree of inequality may foster greater adoption of superordinate goals.

Third, another potentially effective intervention focuses on informal leaders altering group norms that promote acting for the common good and breaking down 'us' versus 'them' barriers. Leaders that focus on achieving desired superordinate outcomes might be particularly influential when there are no established group norms and when people therefore look to others for appropriate actions on how to behave (Jetten et al., 1996; Smith and Louis, 2008, 2009; Orlando, 2020). Past research has demonstrated that group norms can have a significant impact on the behavior of other group members (Reicher et al., 2006; Tarrant et al., 2009; Nook et al., 2016; Lay et al., 2020), and may influence the adoption of superordinate goals.

The present research

If we are to understand how to foster compassionate action in the face of large-scale problems, we need to understand what individual, structural and normative factors may shift group behavior. The current study aimed to gain a better understanding of effective ways of orienting individuals toward superordinate, compassionate behavior when they are embedded in an unequal intergroup context. In particular, we assessed the efficacy of compassion meditation training (Study 1), lower levels of structural inequality (Study 2), and the introduction of a pro-sharing group norm by an informal leader (Study 3). If we are to tackle some of the pressing issues of the 21st century such as climate change and future pandemics, we need to establish which interventions are most likely to lead to collaborative action that gives priority to superordinate goals.

Study 1

Several scientific studies have demonstrated that compassion meditation practices can promote prosocial behavior and compassionate responding (Leiberg et al., 2011; Condon et al., 2013; Weng et al., 2015; Luberto et al., 2018). To date, most of these have demonstrated an effect of long-term compassion meditation practice (eight-to-nine weeks), but there is less research about the effect of short-term compassion meditation on behavior. Brief interventions, such as 10-min meditations (Kirby

and Baldwin, 2018), as well as self-compassion re-framing have led to changes in self-report levels of motivation and feelings (Chwyl et al., 2021), but the researchers did not assess how behavior might be impacted. Past work has also shown that cueing individuals to the needs of others results in more prosocial behavior in dictator games (Brañas-Garza, 2007). In each of these studies however, an individual is typically asked to make a compassionate decision individually, yet little is known about whether compassion meditation can affect decisions made by groups, and specifically, group contexts where there is an unequal distribution of resources. This is important to understand as many compassionate acts in the real world need to be made by groups rather than individuals, and also occur in a broader ecological context.

Here we aimed to assess the effect of a brief compassion meditation on the adoption of a superordinate goal when groups are unequal. To achieve this, we exposed participants to one of two 10-min meditation exercises: compassion meditation or a focussed imagery meditation. Participants were then divided into groups and asked to complete a food assembly task to make food for starving people. As exposure to compassion meditations appear to enhance compassion toward others (Leiberg et al., 2011; Trautwein et al., 2020), we hypothesised that all participants would behave more compassionately by working collaboratively after being exposed to a compassion meditation compared to a focussed imagery meditation.

Method

Ethical clearance of the study was obtained in line with the ethical review processes of the Human Research Ethics Committee (protocol number: 2018002500).

Transparency and openness

This study, including the hypotheses and analytical approach, were preregistered on the Open Science Framework (OSF). We note in the method and results sections below which measures were confirmatory and exploratory. All data, materials (where feasible) and R script has also been made available on OSF. See the following link for these resources: https://osf.io/fjp6b/?view_only=b51cca6755654a76b8d1c8d77a3cfa53.[1] For each study, we report all data exclusions (if any), all manipulations and how the sample size was determined.

1 We pre-registered additional hypotheses regarding a dependent variable: entitled behavior as measured by more taking of sweets (Piff et al., 2012). However, this variable falls outside our primary research concerns and we have elected not to include any information about it here. However, descriptions of this variable and findings have been included in Supplemental materials 1.

Design summary

Our study design was inspired by an activity used with high school students in a non-scientific setting (Schairer, 2018). *Compassion It*—an organization that aims to invoke more compassionate action in the world—ran compassion workshops with students in grade 10 in San Diego, USA. At the conclusion of these workshops, the students were assigned to groups that represented high (e.g., USA) and low (e.g., Dominican Republic) income countries. All countries were tasked with the same goal, to produce as much 'food as they could' using LEGO bricks in a specified time. The countries either had an abundance (high income) or not enough (low income) LEGO bricks. Critically, how they should go about achieving this goal was ambiguous; the teenagers were not told whether they should compete or cooperate with the other nations. The students were free to move around the room during the exercise and observe the other countries and their resources. During the exercise, none of the high-income countries spontaneously shared any LEGO bricks with the low-income countries even when those low-income countries asked for help. This suggests that inequality may be a suppressor of behavior in line with a superordinate goal. However, even though these findings are noteworthy, the activity was designed as a learning opportunity rather than a scientifically valid study and these findings should be interpreted with caution given the lack of experimental control.

In the current study, we transformed the activity by *Compassion It* into a rigorous and highly controlled experimental design (Schairer, 2018). Participants were randomly assigned to groups that represented either a high or a low resource country and each country was presented with LEGO bricks, whereby the high resource group had an abundance of LEGO bricks and the low resource group had very little. Participants were asked to assemble LEGO bricks into food items to ensure that "no one will starve." Critically, the means by which participants should achieve this goal was ambiguous; we did not tell the groups to compete or cooperate.

The compassionate, superordinate goal was to maximize the food creation to ensure no one will starve, and any behavior that contributed to this goal (e.g., working together) was considered an indication of compassion. To achieve this, we coded for three forms of compassionate behavior: (1) initiating sharing of items, resulting in a transfer of LEGO bricks from the high resource group to the low resource group, (2) the amount of food pieces made, and (3) the efficiency (i.e., speed) of food making. We further included several self-report measures that broadly measured competitive and cooperative attitudes toward the other group, group cohesion and fears of showing and receiving compassion.

Participants and design

The sample was comprised of 283 participants (178 female, 103 male, 1 gender-diverse, 1 no response) and were 21.36 years-old on average ($SD = 4.28$). Based on a sample size calculation on Pangea, we required a minimum sample size of

152 to detect a medium effect size with 80% probability. This effect size was deemed appropriate based on findings regarding competitive sentiments under situations of high inequality (Sánchez-Rodríguez et al., 2018). We aimed to achieve this sample size at a minimum and collected larger numbers until the participant pool was exhausted. The data was not analyzed until data collection ceased. Participants were recruited from either a first-year pool of psychology students from a large urban university (in exchange for course credit) or from a paid-pool and were reimbursed $10 per half an hour of participation. Participants reported several demographic variables including their age, gender, level of education, ethnicity, total pre-tax income and subjective SES. Subjective SES refers to where one feels they fit into society relative to others in terms of job prestige, education, and income on a 10-rung ladder (where 1 = bottom of society and 10 = top of society). On average, participants reported having middle class backgrounds ($M = 5.09$, $SD = 1.81$). See Supplementary materials 2 for the full demographic description of the sample used.

The current study employed a 2 (condition: compassion meditation, focussed imagery meditation) by 2 (resource group: high, low) between-subjects design, and participants were randomly assigned to a condition and resource group. We were interested in the effect of these independent variables on outcomes described in greater detail below.

Procedure

Before the study began, the table and chairs were arranged in a way to clearly separate two groups: the high resource group and the low resource group. Each session contained between 4 and 12 participants. In the event of odd numbers, the extra participant was assigned to the high resource group. The table held two transparent containers with LEGO bricks, with one container assigned to each resource group. Images of these containers can be provided to readers upon request from the corresponding author. The high resource group container held 500 colored LEGO bricks (red, yellow, green and blue) and 100 non-colored bricks (black, white, grey, beige and brown). In contrast, the low resource group container contained only 100 colored bricks and 500 non-colored LEGO bricks. Importantly, the valued resource in this context was colored LEGO bricks, whereas non-colored bricks held no value.

As participants entered the room, they were randomly assigned to sit at the high or low resource group side of the table (see Supplementary materials 3 for the randomization procedure). After consent was obtained, participants were asked to listen to a 10-min meditation audio track which was played aloud to the entire group. Each session was randomly assigned to engage with a compassion meditation track or a focussed imagery track. The compassion track began with basic meditation instructions, before telling participants about the definition of compassion, asked them to contemplate the definition and imagine engaging in compassionate behavior. Our focussed imagery meditation condition served as an ideal control task, as it contained basic meditative practices (e.g., focussing on breathing and one's body in space) but did not contain any information about compassion. In line with past approaches (Hutcherson et al., 2008; Kirby and Baldwin, 2018), this allowed us to isolate the effect of reflecting on being compassionate from the practice of general mindfulness. See Supplementary materials 4 for full scripts of each meditation.

The experimenter then told participants they were separated into two 'countries': Nasherland and Lindithia (see Supplementary materials 5 for the full script). We chose fictitious countries as real countries may prime stereotypes in participants' minds about behavior in that specific culture and the use of fictitious nations has been successful in past experiments (Jetten et al., 2015; Sprong et al., 2019). Participants read a basic description of their country which contained demographic information such as the local delicacy, the population and the climate (see Supplementary materials 6 for the country descriptions). The experimenter then told participants the aim was to create as much food as possible within a 5-min period to prevent starvation. Participants were told one piece of food could be created by assembling LEGO bricks in the following order (from bottom to top): blue, green, yellow, red. Participants were then shown an image of a correctly assembled food item. This image can be provided to readers upon request from the corresponding author. These instructions were purposefully ambiguous; we did not tell the groups to cooperate or compete as we were interested in how they would interpret the ambiguous situation. As such, if participants asked if they could share bricks, they were told "The aim is to make as much food as possible so no one will starve." We pilot tested the LEGO brick distribution to ensure the high resource group could not finish assembling their LEGO bricks in the time given whereas the low resource group would always finish assembling their pieces with excess time left. Implicitly, it was clear that the only way to maximize food creation was for the groups to work together.

The groups then had 5 min. to assemble food, and the participants were then asked to complete a questionnaire at the conclusion of the task (see Supplementary materials 7 for full questionnaire given to participants).[2] Participants were then debriefed and thanked for their participation.

Measures

Compassionate behavior

We defined compassionate behavior as actions that would contribute to the superordinate goal of creating food for the starving people more broadly. Here, any action that results in maximizing food creation preventing starvation (as this would reduce suffering) was counted as compassionate behavior. First, we assessed whether individuals initiated sharing (yes or no) as well as the amount of LEGO bricks that were transferred from the high to low resource group per individual. Importantly, sharing

2 We only analyzed the variables from the survey that were central to our primary aims. However, the full survey can be located on OSF.

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TABLE 1 Behaviors that were or were not considered as initiating sharing, by resource group for all studies.

	High resource group	Low resource group
Sharing	Shares LEGO brick/s spontaneously	Requests high resource group to share LEGO brick/s, and high resource group shares
	Pools LEGO bricks with low resource group	Takes LEGO brick/s from high resource group and high resource group allows it
		Pools LEGO bricks with high resource group
No sharing	Discuss sharing within group	No request and no taking of LEGO brick/s from other group
	Vague response to low resource group request, and no clear giving	
	No response to low resource group request	
	No offer to low resource	

Participants could be classified as engaging in more than one behaviour.

could be initiated by the high or low resource group. Table 1 demonstrates the kinds of behavior that were counted as initiating sharing per resource group, and whether that instance of sharing was initiated by the high or low resource group. This coding system meant that both the high and low resource group could engage in the sharing of LEGO bricks between the groups. In addition, we assessed the number of correctly assembled food pieces made per individual. Finally, we assessed the food making efficiency (number of pieces assembled per minute) of each resource group.[3]

Fears of compassion

The questionnaire contained a fears of compassion scale (Gilbert et al., 2011), as past work has found people can be fearful of being compassionate to others because it could result in resource loss (Gilbert et al., 2011) and be fearful of receiving compassion from others due to obligations to return the help (Cameron et al., 2019). We included these measures as exploratory additions to the study, as fears of giving and receiving compassion may be a significant barrier to coordinated action. Participants were asked 10-items that reflected fears of *giving* compassion (e.g., "People will take advantage of me if they see me as too compassionate") and 13 items that gauged fears of *receiving* compassion (e.g., "I worry that people are only kind and compassionate if they want something from me"). Responses per item were scored from 0 (*do not agree at all*) to 4 (*completely agree*), and the responses were added together for each participant to achieve a total score. For fears of giving compassion, the total score could range from 0 (*least fear*) to 40 (*greatest fear*), and for fears of receiving compassion, the total score could range from 0 (*least fear*) to 52 (*greatest fear*). The fears of giving and fears of receiving compassion scales both yielded acceptable reliability ($\alpha = 0.84$ and $\alpha = 0.87$, respectively).

Group dynamics and cohesion

In the current study, the means (i.e., compete or cooperate) by which the groups should achieve the goal (i.e., create as much food so no one starves) was purposefully ambiguous. To assess the participants' interpretation of these ambiguous instructions, we included three exploratory questions to ascertain whether they interpreted the task as competitive or cooperative. Participants were asked "To what extent did you feel this task was a competition between the two countries?," "To what extent did you feel this task was a cooperative task between the two countries?" and "To what extent did you feel the context was one of "US" (my group) versus "THEM" (the other group)." Responses were scored on a scale from 1 (*not at all agree*) to 10 (*strongly agree*). We further asked two exploratory questions to gauge how participants felt about the cohesiveness of their group, as strong ingroup unity may act as a suppressor of coordinated action. Specifically, participants were provided with the following statements: "I felt a sense of unity within my group" and "I felt that people in my group seemed to be on the same wavelength." Responses were scored on a scale from 1 (*not at all agree*) to 10 (*strongly agree*), and an average score of these two items was created ($\alpha = 0.86$).

Attention checks

Finally, participants were asked several questions probing their attention to the inequality as well as a manipulation check to assess feelings of compassion. First, inequality salience was measured with the following question: "During the activity, to what extent did you notice the groups were unequal?." This question was scored on a scale from 1 (*not at all aware*) to 10 (*extremely aware*). Second, we included a measure to ensure the high resource group felt like they had a greater capacity to complete the task compared to the low resource group: "My group had enough LEGO bricks to complete the task." Responses were scored from 1 (*not at all agree*) to 10 (*strongly agree*). Participants were also asked "To what extent did listening to the audio track make you feel more compassionate?," and responses were recorded on a scale from 1 (*not at all agree*) to 10 (*strongly agree*).

Analytical approach

In our design, individual behavior was potentially impacted by the behavior of their group members. For example, if one group member decided to share, this may have influenced other group members to share as well. To adjust for this non-independence of

3 Because we were not able to ascertain the efficiency for each individual (due to practical constraints with the video recorded footage), we have reported the overall efficiency of the resource group.

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data, all individual level measures were analyzed in Linear Mixed Models with 'group' (i.e., the specific resource group one was a part of) as the random intercept.

Results

See Supplementary materials 8 for the full results for each analysis, including mean differences between conditions and resource groups. An independent samples *t*-test showed that there was no significant difference in the sizes of groups randomly allocated to the compassion meditation and focussed imagery conditions, $t(280.99) = 1.32$, $p = 0.187$. This variable was thus not considered further. The conditions and resource groups also did not differ in terms of age and gender. See Supplementary materials 9 for the means and standard deviations per condition, per resource group for each of the dependent variables.

Attention checks

Overall, participants were highly cognizant of the unequal resources between the two groups ($M = 6.66$, $SD = 3.19$). An LMM was conducted on the effect of resource group and condition on the extent to which the participants noticed the inequality. There were no differences between resource groups, $F(1, 56.89) = 0.50$, $p = 0.482$, or conditions, $F(1, 56.89) = 2.28$, $p = 0.137$, in the extent to which participants noticed the inequality. Likewise, there was no significant interaction between resource conditions and compassion manipulation conditions, $F(1, 56.89) = 3.45$, $p = 0.069$.

We further assessed the extent to which participants felt they had enough LEGO bricks to complete the task. An ANOVA[4] revealed a significant effect of resource group, $F(1, 278) = 313.62$, $p < 0.001$, where the high resource group ($M = 8.71$, $SD = 2.12$) indicated more strongly than the low resource group ($M = 3.62$, $SD = 2.68$) that they had enough LEGO bricks to complete the task. However, there was no significant effect of condition, $F(1, 278) = 0.03$, $p = 0.852$, and no condition by resource group interaction, $F(1, 278) = 0.04$, $p = 0.846$.

Finally, we assessed whether participants felt more compassionate after listening to the compassion compared to the focussed imagery meditation as a manipulation check. An ANOVA revealed participants in the compassion meditation condition ($M = 5.49$, $SD = 2.34$) felt more compassionate compared to those in the focussed imagery condition ($M = 4.26$, $SD = 2.38$), $F(1, 267) = 18.29$, $p < 0.001$. Moreover, there was no significant effect of resource group on feelings of compassion, $F(1, 267) = 0.06$, $p = 0.805$, nor was there a significant interaction between resource group and condition, $F(1, 267) = 0.42$, $p = 0.516$.

4 For all three studies, ANOVAS were conducted where LMMs produced ICC values that were indistinguishable from zero.

Compassionate behavior

In total, 15.1% of participants initiated some form of sharing. A GLMM was conducted to establish the effect of resource group and condition on whether an individual initiated sharing (yes or no). Results revealed no significant effect of resource group, $X^2(1) = 0.56$, $p = 0.456$, or condition, $X^2(1) = 0.29$, $p = 0.590$, nor a significant interaction between the two variables, $X^2(1) = 0.69$, $p = 0.407$. See Supplementary materials 10 for the number of times each category of sharing behavior was observed.

Altogether, individual participants initiated the sharing of 2.93 ($SD = 12.67$) LEGO bricks on average. A GLMM assessed the effect of resource group and condition on the number of LEGO bricks transferred when sharing was initiated. For this model, we used a Poisson distribution and the square root link function due to the exponential nature of the dependent variable. Results revealed no significant effect of resource group, IRR = 0.82, $p = 0.204$, or condition, IRR = 1.08, $p = 0.647$, on the number of LEGO bricks transferred when sharing was initiated. Additionally, there was no significant interaction observed between the two variables, IRR = 1.24, $p = 0.184$.

Collapsed across conditions and resource groups, participants assembled 9.35 ($SD = 4.52$) food pieces on average. The effect of condition and resource group on the number of food pieces made was assessed using an LMM. More food pieces were made by the high resource group ($M = 10.79$, $SD = 4.93$) compared to the low resource group ($M = 7.83$, $SD = 3.46$), $F(1, 66.37) = 18.36$, $p < 0.001$. However, there was no significant difference observed between the conditions and the number of food pieces assembled, $F(1, 66.37) = 1.17$, $p = 0.284$, nor was there a significant interaction between the two variables, $F(1, 66.37) = 0.07$, $p = 0.789$.

On average, the groups made approximately 6.93 ($SD = 2.82$) food pieces per minute. We assessed the effect of condition and resource group on the efficiency of LEGO brick assembly (number of pieces made by groups per minute) using a two-way ANOVA. The high resource group worked faster ($M = 8.58$, $SD = 2.60$) compared to the low resource group ($M = 5.24$, $SD = 1.92$), $F(1, 77) = 41.83$, $p < 0.001$. However, there was no significant difference in work rate based on condition, $F(1, 77) = 0.03$, $p = 0.857$, nor was there a significant interaction between condition and resource group, $F(1, 77) = 0.08$, $p = 0.773$.

Exploratory analyses

We conducted several exploratory Linear Mixed Models examining the effect of condition and resource group on fears of compassion as well as group dynamics and cohesion. As demonstrated in Table 2, those in the low resource group felt their groups were more cohesive ($M = 6.99$, $SD = 2.33$) relative to those in the high resource group ($M = 5.25$, $SD = 2.29$).

Discussion

Study 1 assessed the effect of compassion meditation on working toward a shared and superordinate goal when groups

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TABLE 2 Linear mixed models for Study 1 exploring the effect of condition and resource group on fears of compassion, as well as group dynamics and cohesion.

		Resource group		Condition		Resource group × Condition	
Outcome variable	M *(SD)*	*F*	*p*	*F*	*p*	*F*	*p*
Fears of giving compassion	20.14*(7.58)*	0.12	0.734	3.21	0.077	<0.01	0.996
Fears of receiving compassion^	17.84*(9.11)*	0.12	0.731	0.63	0.426	0.08	0.783
Feelings of competitiveness	4.92*(3.05)*	0.01	0.905	0.15	0.704	1.65	0.202
Feelings of cooperativeness	4.32*(2.77)*	0.19	0.665	3.63	0.060	0.11	0.739
"Us" versus "Them"	5.32*(2.65)*	0.34	0.562	0.09	0.760	0.02	0.896
Group cohesion	6.05*(2.46)*	22.43	<0.001***	0.30	0.588	0.03	0.854

^Indicates results from a two-way between-groups ANOVA due to singular fit warnings for LMMs. ***$p < 0.001$.

have unequal resources. Overall, we found little evidence that a short-term compassion meditation resulted in greater compassionate behavior. This null effect occurred despite participants reporting feeling more compassionate after the compassion meditation relative to the focussed imagery condition. This contrasts prior work that suggests compassion meditations promote and foster compassionate actions (Trautwein et al., 2020). The finding also suggests that while brief compassion training may increase feelings of compassion, this may not translate into more compassionate behavior.

Study 1 demonstrated that a brief standalone compassion meditation did not result in greater collaboration across boundaries of groups that are unequal. It appears that this individualistic approach (i.e., where one is made to feel compassionate as an individual) may not be effective when individuals are members of groups. Here, the dynamics of the group may have a strong influence on an individual's behavior, and interventions that target structural elements may instead be more effective. Lower inequality, for example, is thought to reduce "us" versus "them" dynamics between different resource groups (Jetten et al., 2017), potentially paving the way for greater coordinated action.

Study 2

In line with classic social identity theorizing (Tajfel and Turner, 1979), Study 2 examined whether the structural context shapes group behavior. We proposed that structural factors, as opposed to individual factors (such as inducing individual-level compassion), may be a more important determinate of whether groups adopt superordinate goals. Previous research has shown that intergroup competition is lower when individuals or groups have more equal resources than when inequality of resources is high (Jetten et al., 2017; Sánchez-Rodríguez et al., 2018), and cooperation declines when inequality in resources is highly visible (Nishi et al., 2015). Following from this research, we explored whether lower (compared to high) inequality would result in more behavior that is in line with a superordinate goal. To examine this, we placed participants in two groups where the difference in group resources was either moderately or extremely unequal.[5] Since lower inequality reduces competition, we expected that participants in groups that experienced moderate inequality would be more likely to act in line with a superordinate goal relative to groups in extreme inequality.[6]

Method

Our methods and analytical approach were identical to that described in Study 1, apart from the deviations detailed below.

Participants and design

The sample was comprised of 173 participants (122 female, 48 male, 1 gender-diverse, 2 prefer not to say or no response) and were 20.98 years-old on average ($SD = 4.75$). Our approach to sample size and recruitment was identical to that described in Study 1. On average, participants reported having a middle-class background ($M = 5.58$, $SD = 1.68$). See Supplementary materials 2 for the full demographic description of the sample used.

The current study employed a 2 (condition: extreme inequality, moderate inequality) by 2 (resource group: high, low) between-subjects design, where participants were randomly assigned to a condition and a resource group.[7]

5 To test this, we heightened inequality relative to Study 1 (rather than lowered inequality). This decision was made because, in our paradigm, groups that possess equal resources would have no superordinate reason to collaborate. Hence, heightening the differences between groups is the only feasible way to test the role of inequality in this paradigm.

6 We originally preregistered a null hypothesis by mistake (i.e., that there would be no difference between groups), and believe this does not accurately reflect the body of research existing at the time. We have changed our hypothesis to better reflect the state of the literature prior to creating this study.

7 It is worth noting that this manipulation creates a natural confound. That is, when the inequality changes between the groups (i.e., moderate versus extreme), we also change the level of resources each group has; the low resource group in moderate inequality has more resources than the low resource group in extreme inequality. However, this is unavoidable as manipulating the gap between the low and the high resource group also varies the absolute amount of wealth each group has.

We were interested in the effect of these independent variables on several outcomes including compassionate behavior, fears of compassion and group cohesion.

Procedure

We followed an identical procedure to that described in Study 1 with a few exceptions. First, participants did not listen to an audio meditation and instead were given the task instructions immediately after giving their consent. Second, participants experienced one of two LEGO brick distributions. In line with Study 1, participants in the moderate inequality condition were in a context where the high resource group was given 500 colored and 100 non-colored bricks and the low resource group was given 100 colored and 500 non-colored bricks. We increased the magnitude of this inequality in the extreme inequality condition, where the high resource group had 560 colored and 100 non-colored bricks and the low resource group was given 40 colored and 500 non-colored bricks. In addition, those in the extreme inequality condition were given additional information about the wealth of their country (i.e., Lindithia was extremely poor and Nasherland was extremely rich; see Supplementary materials 11 for the full country descriptions for this condition).

Measures

All measures were identical to Study 1 (cohesion measure: $\alpha = 0.83$, fears of giving compassion: $\alpha = 0.84$, fears of receiving compassion: $\alpha = 0.89$). However, we did not include the manipulation check measure that assessed how compassionate participants felt in response to the meditation.

Results

In total, 31 experimental sessions were used for the final sample and group sizes ranged from four to nine. The full results for each analysis from Study 2 can be found in Supplementary materials 8. An independent samples t-test was conducted to establish whether the conditions differed in the size of the groups, and results revealed no significant difference between the extreme and moderate inequality conditions, $t(155.42) = 0.38$, $p = 0.708$. Group size was thus not considered further. The conditions and resource groups also did not differ in terms of age and gender. See Supplementary materials 9 for the means and standard deviations per condition, per resource group for each of the dependent variables.

Attention checks

Overall, participants were highly cognizant of the unequal resources between the two groups ($M = 7.96$, $SD = 2.73$). An LMM was conducted on the effect of resource group and condition on the extent to which the participants noticed the inequality. There were no differences between resource groups, $F(1, 51.10) = 0.72$, $p = 0.401$, or conditions, $F(1, 51.10) = 2.26$, $p = 0.139$, in the extent to which participants noticed the inequality. Likewise, there was no significant interaction between the two variables, $F(1, 51.10) = 0.02$, $p = 0.879$.

We further assessed the extent to which participants felt they had enough LEGO bricks to complete the task. An LMM was used to assess the effect of resource group and condition on this variable. A significant effect of resource group was found, $F(1, 56.55) = 68.23$, $p < 0.001$, where the high resource group ($M = 8.34$, $SD = 2.53$) felt more so than the low resource group ($M = 3.84$, $SD = 3.06$) that they had enough LEGO bricks to complete the task. However, there was no significant effect of condition, $F(1, 56.55) = 0.002$, $p = 0.969$, and no condition by resource group interaction, $F(1, 56.55) = 2.39$, $p = 0.128$.

Compassionate behavior

In total, 28.3% of participants initiated some form of sharing. A Generalized Linear Mixed Model (GLMM) was conducted to establish the effect of resource group and condition on whether an individual initiated sharing (yes or no). Results revealed no significant effect of resource group, $X^2(1) = 0.02$, $p = 0.896$, or condition, $X^2(1) = 0.37$, $p = 0.543$, nor a significant interaction between the two variables, $X^2(1) = 0.02$, $p = 0.878$. See Supplementary materials 10 for the number of times each category of sharing behavior was observed.

Altogether, individual participants initiated the sharing of 5.27 ($SD = 13.63$) LEGO bricks on average. A GLMM assessed the effect of resource group and condition on the number of LEGO bricks transferred when sharing was initiated. For this model, we used a Poisson distribution and the square root link function due to the exponential nature of the dependent variable (see Figure 1). The low resource group ($M = 9.22$, $SD = 18.18$) initiated the sharing of more LEGO bricks compared to the high resource group ($M = 1.71$, $SD = 5.52$), IRR = 0.50, $p = 0.004$. Likewise, more

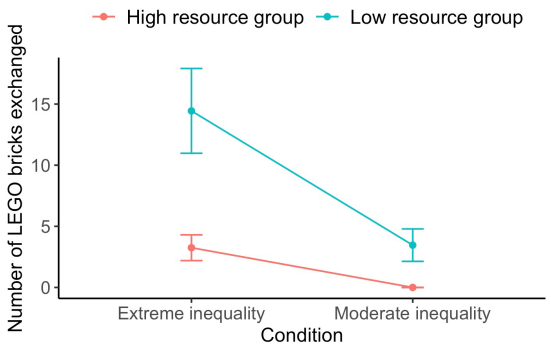

FIGURE 1
Average number of LEGO bricks transferred when sharing was initiated per condition and resource group for Study 2. Error bars represent standard errors.

LEGO bricks were transferred in instances of sharing in the extreme ($M = 8.54$, $SD = 17.33$) compared to the moderate inequality condition ($M = 1.65$, $SD = 5.94$), IRR = 1.80, $p = 0.012$. However, there was no significant interaction observed between the two variables, IRR = 0.81, $p = 0.365$.

Collapsed across conditions and resource groups, participants assembled 11.14 ($SD = 5.65$) food pieces on average. The effect of condition and resource group on the number of food pieces made was assessed using a Linear Mixed Model (LMM). More food pieces were made by the high resource group ($M = 13.47$, $SD = 4.95$) compared to the low resource group ($M = 8.55$, $SD = 5.26$), $F(1, 53.43) = 25.89$, $p < 0.001$. However, there was no significant difference observed between the conditions and the number of food pieces assembled, $F(1, 53.43) = 3.43$, $p = 0.070$, nor was there a significant interaction between the two variables, $F(1, 53.43) = 0.04$, $p = 0.849$.

On average, the groups made approximately 6.78 ($SD = 2.41$) food pieces per minute. We assessed the effect of condition and resource group on the efficiency of LEGO brick assembly (number of pieces made by groups per minute) using a two-way ANOVA. The high resource group ($M = 8.08$, $SD = 2.32$) worked faster compared to the low resource group ($M = 5.47$, $SD = 1.69$), $F(1, 58) = 25.70$, $p < 0.001$. However, there was no significant difference in work rate based on condition, $F(1, 58) = 1.73$, $p = 0.193$, nor was there a significant interaction between condition and resource group, $F(1, 58) = 0.34$, $p = 0.561$.

Exploratory analyses

We conducted several exploratory Linear Mixed Models examining the effect of condition and resource group on fears of compassion as well as group dynamics and cohesion. As demonstrated in Table 3, those in the low resource group ($M = 14.84$, $SD = 8.49$) reported lower fears of receiving compassion relative to those in the high resource group ($M = 19.11$, $SD = 10.24$). Those in the extreme inequality condition ($M = 7.24$, $SD = 2.32$) felt there was a greater cohesion in the resource group compared to those who experienced moderate inequality ($M = 6.04$, $SD = 2.22$).

Discussion

In Study 2, we analyzed the effect of the degree of inequality on the adoption of behavior directed toward a superordinate goal. We found no consistent support for our hypothesis and results show that participants in the moderate inequality condition did not behave in line with a superordinate goal more than those in the extreme inequality condition. Overall, we found that there were no differences in whether sharing was initiated (yes or no) between conditions. However, when sharing *was* initiated in the extreme inequality condition, more LEGO bricks were involved in that transfer compared to moderate inequality. Importantly, we found no differences in the extent to which participants noticed the inequality, and both conditions yielded ceiling effects; inequality was highly salient to participants in both conditions. Low resource participants also initiated sharing more than high resource participants and reported reduced fears of receiving compassion. Moreover, our manipulation did not result in differences in feelings of competitiveness or cooperativeness. However, extreme inequality did result in greater cohesion with the group, suggesting that when differences between groups are enhanced, participants feel more united with their ingroup (Jetten et al., 2017; Jetten and Peters, 2019).

These results in combination suggest that our manipulation of the degree of inequality did not promote the adoption of compassionate behavior and attitudes. Instead, interventions that alter the normative structure, such as an informal leader promoting a pro-sharing group norm, may result in more compassionate action when groups are unequal.

Study 3

The behavior of others around us, and in particular, the members of our ingroup, can have a dramatic effect on how we choose to act (Brown and Pehrson, 2019). In particular, highlighting norms about what individuals *should* do tends to enhance prosocial behavior (Capraro et al., 2019; Capraro and Perc, 2021; Capraro et al., 2022). We also typically favor members

TABLE 3 Linear mixed models for Study 2 exploring the effect of condition and resource group on fears of compassion, as well as group dynamics and cohesion.

		Resource group		Condition		Resource group × Condition	
Outcome variable	*M*(*SD*)	*F*	*p*	*F*	*p*	*F*	*p*
Fears of giving compassion	20.01*(7.24)*	3.21	0.080	<0.01	0.957	0.88	0.354
Fears of receiving compassion	17.11*(9.67)*	7.24	0.009**	0.43	0.516	0.52	0.475
Feelings of Competitiveness	5.47*(2.97)*	1.67	0.203	0.93	0.340	0.82	0.369
Feelings of Cooperativeness	4.11*(2.91)*	0.13	0.722	1.93	0.171	0.34	0.563
"Us" versus "Them"^	5.74*(2.73)*	1.41	0.237	0.25	0.616	0.59	0.444
Group cohesion	6.71*(2.35)*	0.43	0.514	6.41	0.014*	0.62	0.434

^Indicates results from a two-way between-groups ANOVA due to singular fit warnings. *$p < 0.05$, **$p < 0.01$.

of our own group over members of other groups, even if the group membership is dictated by something as arbitrary as a similar colored shirt (Navarrete et al., 2012). However, when group members promote a norm that helps outgroup members, ingroup favoritism can be overridden (Reicher et al., 2006). Likewise, when participants are prompted to reflect on what they *should* do, they are less likely to favor the ingroup over the outgroup (Bilancini et al., 2020). Ambiguous situations (e.g., not knowing whether groups should compete or work together) present a particular challenge for groups (Clark and Word, 1972; Orlando, 2020). Because of this, an individual who introduces a pro-sharing group norm can become an informal leader and guide their group toward superordinate action. Past research has shown that informal leaders who offer cognitive alternatives – that is, alternatives to the current reality – can have a powerful impact on the behavior of other members (Haslam and Reicher, 2007; Zhang et al., 2013).

Study 3 aimed to explore the influence of a pro-sharing group norm on the emergence of superordinate, compassionate behavior when groups are unequal. To assess this, we utilized the same design from the moderate inequality condition in Study 2. This time, a confederate was planted in the high resource group. In our pro-sharing group norm condition, the confederate gradually prompted sharing between the groups with increasing intensity over the five-minute task period. This was compared to a control condition where the confederate instead discussed their enjoyment of LEGO bricks. While the confederate was acting as a high resource group member, they had the potential to sway the behaviour of members from both the high and low resource group. In line with prior research (Tarrant et al., 2009; Nook et al., 2016; Lay et al., 2020), we hypothesised that more compassionate behavior would be exhibited by all participants in the pro-sharing group norm condition compared to the control condition.

Method

Our methods and analytical approach were identical to the moderate inequality condition in Study 2, with exceptions outlined below.

Participants and design

The sample was comprised of 160 participants (112 female, 48 male) and were 20.36 years-old on average ($SD = 3.30$). Our approach to sample size and recruitment was identical to that described in Study 1. On average, participants reported having a middle-class background ($M = 5.59$, $SD = 1.68$). See Supplementary materials 2 for the full demographic description of the sample used.

The current study employed a 2 (condition: pro-sharing group norm, control) by 2 (resource group: high, low) between-subjects design, and participants were randomly assigned to a condition and a resource group. We were interested in the effect of these independent variables on a number of outcomes including compassionate behavior, competitive sentiments, fears of compassion and group dynamics.

Procedure

The study followed an identical procedure to the moderate inequality condition in Study 2 with a few exceptions. Participants either experienced the implementation of a pro-sharing group norm or a control condition, and this was achieved by including a confederate in the high resource group. The confederate took on an informal leadership position in the group and spoke only during the LEGO brick assembly task. In both conditions, they spoke at one-minute intervals and were instructed to only speak to group members when spoken to. In the pro-sharing group norm condition, the prompts escalated in their intensity. The confederate first pointed out the LEGO brick inequality, then created an injunctive norm where they suggested sharing. Eventually they themselves physically shared bricks. In the control condition, the confederate spoke about their enjoyment of LEGO bricks at each minute interval. The specific prompts are outlined in Table 4. The confederate was instructed to work at a similar rate to the other group members. We chose to have a control confederate rather than a no confederate condition to control for any effects consistent discussion might have on participant behavior. That is, a confederate who speaks frequently – regardless of what they speak about – might promote a different group dynamic and this may change how participants behave.

Measures

All measures were identical to Study 2 (cohesion measure: $\alpha = 0.82$, fears of giving compassion: $\alpha = 0.81$, fears of receiving compassion: $\alpha = 0.89$).

Results

An independent samples *t*-test was conducted to examine whether the size of the groups were identical across the

TABLE 4 Script for the confederate across both conditions for Study 3.

	Pro-sharing group norm	Control
Prompt 1	It looks like they do not have enough LEGO bricks	I like playing with LEGO bricks
Prompt 2	Do you think we should share our LEGO bricks?	Do you like playing with LEGO bricks?
Prompt 3	I think we should share with them	It's been a long time since I played with LEGO bricks
Prompt 4	Here, have some LEGO bricks (shares 4 LEGO bricks)	LEGO bricks are really fun

The four LEGO bricks shared by the confederate at prompt 4 were not counted in the sharing score.

conditions. Results revealed a significant difference such that groups were smaller in size in the pro-sharing group norm condition ($M = 2.36$, $SD = 0.77$) compared to the control condition ($M = 3.11$, $SD = 0.76$), $t(151) = -6.15$, $p < 0.001$. This difference emerged despite careful random allocation procedures, and we thus used group size as a covariate in all analyses. The full results for each analysis from Study 3 (including the role of group size for each analysis) can be found in Supplementary materials 8. The conditions and resource groups did not differ in terms of age and gender. See Supplementary materials 9 for the means and standard deviations per condition, per resource group for each of the dependent variables.

Attention checks

Overall, participants were highly cognizant of the unequal resources between the two groups ($M = 8.15$, $SD = 2.43$). An LMM was conducted on the effect of resource group and condition on the extent to which the participants noticed the inequality. Those in the pro-sharing group norm condition ($M = 8.64$, $SD = 1.92$) noticed the inequality more compared to those in the control condition ($M = 7.75$, $SD = 2.72$), $F(1, 57.69) = 6.21$, $p = 0.016$. However, there were no differences between resource groups in the extent to which participants noticed the inequality, $F(1, 63.71) = 0.80$, $p = 0.374$. Likewise, there was no significant interaction between the two variables, $F(1, 62.43) = 0.51$, $p = 0.480$.

We further assessed the extent to which participants felt they had enough LEGO bricks to complete the task. An ANCOVA revealed a significant effect of resource group, $F(1, 154) = 370.15$, $p < 0.001$, where the high resource group ($M = 9.27$, $SD = 1.62$) felt they had enough LEGO bricks to complete the task more so than the low resource group ($M = 2.84$, $SD = 2.25$). However, there was no significant effect of condition, $F(1, 154) = 2.51$, $p = 0.115$, and no condition by resource group interaction, $F(1, 154) = 0.66$, $p = 0.418$.

Compassionate behavior

In total, 40.6% of participants initiated some form of sharing. A GLMM was conducted to establish the effect of resource group and condition on whether an individual initiated sharing (yes or no). Results revealed that participants were more likely to initiate sharing in the pro-sharing group norm condition (63.9%) compared to the control condition (21.6%), $X^2(1) = 18.32$, $p < 0.001$. There was no significant effect of resource group, $X^2(1) < 0.01$, $p = 0.945$, nor a significant interaction between the two variables, $X^2(1) < 0.01$, $p = 0.972$. See Supplementary materials 10 for the number of times each category of sharing behavior was observed.

Altogether, individual participants initiated the sharing of 6.02 ($SD = 17.08$) LEGO bricks on average. A GLMM assessed the effect of resource group and condition on the number of LEGO bricks transferred when sharing was initiated. For this model, we used a Poisson distribution and the square root link function due to the exponential nature of the dependent variable. More LEGO bricks were transferred in instances of sharing in the pro-sharing group norm condition ($M = 11.00$, $SD = 22.92$) compared to the control condition ($M = 1.94$, $SD = 8.20$), IRR = 2.88, $p < 0.001$. Results additionally revealed no significant effect of resource group, IRR = 1.26, $p = 0.375$, and there was no significant interaction observed between the two variables, IRR = 1.02, $p = 0.926$.

Collapsed across conditions and resource groups, participants assembled 10.58 ($SD = 4.44$) food pieces on average. The effect of condition and resource group on the number of food pieces made was assessed using an LMM (see Figure 2). More food pieces were made by the high resource group ($M = 12.72$, $SD = 4.05$) compared to the low resource group ($M = 8.83$, $SD = 3.98$), $F(1, 59.36) = 18.78$, $p < 0.001$. Furthermore, more food pieces were assembled in the pro-sharing group norm condition ($M = 12.14$, $SD = 3.85$) compared to the control condition ($M = 9.31$, $SD = 4.51$), $F(1, 57.46) = 6.30$, $p = 0.015$. However, there was no significant interaction between the two variables, $F(1, 60.41) = 0.19$, $p = 0.661$.

On average, the groups made approximately 6.53 ($SD = 2.36$) food pieces per minute. We assessed the effect of condition and resource group on the efficiency of LEGO brick assembly (number of pieces made by groups per minute) using a two-way ANCOVA. The high resource group worked faster ($M = 8.08$, $SD = 2.08$) compared to the low resource group ($M = 4.97$, $SD = 1.42$), $F(1, 59) = 88.50$, $p < 0.001$. Those in the pro-sharing group norm condition ($M = 6.52$, $SD = 2.24$) were also more efficient at making food relative to those in the control condition ($M = 6.54$, $SD = 2.53$), $F(1, 59) = 5.96$, $p = 0.018$. Accounting for group size, the estimated marginal mean for efficiency in food assembly was higher for the pro-sharing group norm condition ($M = 7.04$, $SE = 0.28$) compared to the control condition ($M = 5.95$, $SE = 0.30$). However, there was no significant interaction between condition and resource group, $F(1, 59) = 1.36$, $p = 0.248$.

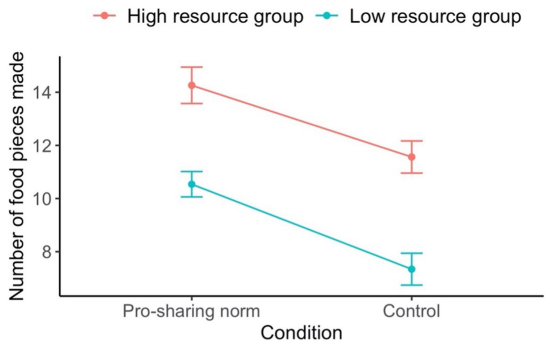

FIGURE 2
Number of food pieces made by individuals on average per condition and resource group for Study 3. Error bars represent standard errors.

TABLE 5 Linear mixed models for Study 3 exploring the effect of condition and resource group on fears of compassion, as well as group dynamics and cohesion.

		Resource group		Condition		Resource group × Condition	
Outcome variable	*M(SD)*	*F*	*p*	*F*	*p*	*F*	*p*
Fears of giving compassion	20.64*(7.02)*	<0.01	0.960	3.54	0.066	4.37	0.041*
Fears of receiving compassion	18.02*(9.86)*	0.12	0.734	0.88	0.353	0.85	0.360
Feelings of Competitiveness^	5.32*(2.89)*	10.30	0.002**	1.84	0.177	3.55	0.061
Feelings of Cooperativeness	4.75*(2.97)*	0.03	0.866	19.42	<0.001***	0.01	0.922
"Us" versus "Them"	5.55*(2.73)*	3.68	0.060	5.29	0.025*	2.63	0.110
Group cohesion	6.33*(2.20)*	0.10	0.758	<0.01	0.957	0.46	0.501

^Indicates results from a two-way between-groups ANCOVA due to singular fit warnings. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

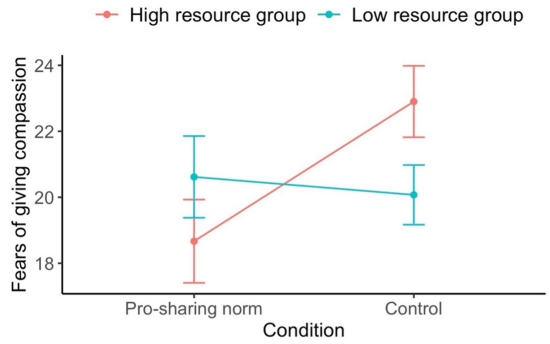

FIGURE 3
Average fears of giving compassion per condition and resource group for Study 3. Higher values indicate greater fears of giving compassion. Error bars represent standard errors.

Exploratory analyses

We conducted several exploratory Linear Mixed Models examining the effect of condition and resource group on fears of compassion as well as group dynamics and cohesion. As demonstrated in Table 5, there was a significant interaction between resource groups and conditions on fears of giving compassion (see Figure 3). Follow up simple effect analyses revealed a significant effect for the high resource group only, $F(1, 55.3) = 7.64$, $p = 0.008$, such that the high resource group members in the compassionate norm condition ($M = 18.67$, $SD = 7.25$) had reduced fears of being compassionate compared to high resource group members in the control condition ($M = 22.90$, $SD = 6.84$). Moreover, those in the low resource group ($M = 6.00$, $SD = 2.76$) felt more like the context was competitive compared to those in the high resource group ($M = 4.53$, $SD = 2.85$). Participants in the pro-sharing group norm condition ($M = 6.21$, $SD = 2.64$) felt the context was more cooperative compared to those in the control condition ($M = 3.56$, $SD = 2.68$). Likewise, participants in the pro-sharing group norm condition ($M = 4.93$, $SD = 2.49$) felt the context was less one of "us" versus "them" compared to those in the control condition ($M = 6.06$, $SD = 2.83$).

Discussion

Study 3 revealed the effect of a confederate who took on an informal leadership role in the group and changed the status quo by introducing a pro-sharing group norm. We found that a fellow group member who promotes sharing can have a significant influence on the behavior of other groups members—participants were more likely to initiate sharing, transferred more LEGO bricks between the groups, worked faster and made more food pieces when a confederate suggested sharing. Importantly, participants in this condition felt that the context was more cooperative and less one of 'us' vs. 'them', and the high resource participants had reduced fears of being compassionate. Together, these findings suggest that a member who imbeds a pro-sharing group norm within a group can have a powerful influence on the behavior and mentality of other group members—their leadership behavior decreases intergroup competition, and compassionate action can be achieved.

General discussion

When Covid-19 surged, wealthy countries hoarded vaccines, and poorer countries – who were not only battling poverty but also the devastating impact of the virus – were left without (Rouw et al., 2021). How do we promote compassionate action under these conditions? Here we aimed to understand effective ways of orienting individuals toward a superordinate, compassionate goal when they were embedded in unequal groups, *via* an individualistic intervention (Study 1: compassion meditation training), structural intervention (Study 2: altering inequality), and a normative intervention promoting a different way to respond to the status quo (Study 3: pro-sharing group norm). We found little evidence that compassion meditation and varying the degree of inequality enhanced the adoption of compassionate action. However, when a confederate took the lead by introducing a pro-sharing group norm, participants engaged in more compassionate behavior and adopted a collaborative approach to the task.

The introduction of a pro-sharing group norm resulted in enhanced compassionate action and attitudes, and this finding is in line with past work suggesting norms can have a significant shift on group behavior (Sherif, 1958; Gaertner et al., 2000; Reicher et al., 2006; Tarrant et al., 2009; Nook et al., 2016; DiBenigno, 2018; Lay et al., 2020; Martinez-Ebers et al., 2021). Additionally, past research shows that individuals who offer a cognitive alternative to the current status quo can become informal leaders and sway the behavior of their group (Haslam and Reicher, 2007). Here participants transferred more LEGO bricks between the groups, interpreted the task as cooperative, worked faster and, critically, created more food for 'starving people'. Moreover, the high resource group had reduced fears of being compassionate relative to the control condition, suggesting that the introduction of a pro-sharing group norm paved the way for group members to feel more positive about behaving compassionately toward others. It remains unclear however if the groups would adopt superordinate behavior if the confederate was instead a member of the low resource group, and this is a promising direction for future research. It is also unclear whether the confederate introduced a norm of sharing as intended or whether their comments drew attention to the unequal resources, and this instead prompted sharing. While participants reported noticing the inequality more when the confederate introduced the sharing norm, they were still highly aware of the inequality in the control condition. Nonetheless, future research should include questions about how participants view the norms of the group and assess whether this altered by condition.

On the other hand, our individualistic intervention – a compassion meditation – did not promote compassionate action or attitudes. While participants reported feeling more compassionate, there was no evidence that this translated to behavior – a phenomenon that is in line with past research demonstrating a gap between attitudes and behavior (Blake et al., 2014; Liu et al., 2016). This further suggests that while compassion meditations may alter attitudes (Chwyl et al., 2021) and behavior in some settings (Condon et al., 2013), such interventions may be too individualistic to affect compassion in a group setting. However, we only assessed the effect of short-term interventions and longer-term interventions may instead prove fruitful. Likewise, our structural intervention – varying the degree of inequality between the groups – also did not result in any meaningful changes in compassionate actions or attitudes. While enhanced inequality did lead to more LEGO bricks being transferred between the groups (likely in response to a clearer need for more LEGO bricks), this did not result in more food pieces being made. This intervention also did not impact attitudes, and this may have been because the situation invoked two competing motivations; while the need for sharing was more tangible under extreme inequality, unequal resources (whether extreme or slightly less so) suppress compassionate action (Côté et al., 2015; Sands, 2017; Kirkland et al., 2020).

Together, these three studies have revealed several insights about human behavior in a previously unexplored context. We assessed the effect of three different interventions from diverse literatures to establish which approach is most effective. The efficacy of these interventions was measured across a variety of behavioral and self-report outcomes, giving us greater certainty of the effects. In addition to theoretical contributions, these studies also have significant practical applications. In a world of increasingly complex social dilemmas, there have been growing discussions about how to promote a more compassionate world – for example by getting rich countries to assist poor countries in their acquisition of Covid-19 vaccinations (Rouw et al., 2021). Our work suggests that leadership by one individual, whether it be an individual person or possibly an individual country, may set a norm that can have a positive domino effect on compassionate actions more broadly.

Limitations and future research

Despite these strengths, our work has produced several questions that warrant future research. While our experimental approach allowed us to gain a high degree of control, the assembly of LEGO bricks is distantly related to the acquisition of real-world resources. Thus, future work is needed to assess effects of these kinds of manipulations in real-world settings. Additionally, the endowments were windfall gains, and people tend to be less generous with resources when they are instead earned (Carlsson et al., 2013; Li et al., 2019). To test this possibility, future work should compare the effect of windfall versus earned resources on intergroup interactions in this context. Moreover, future work may wish to also vary the degree of inequality within-groups (e.g., by providing individuals within the same group with differing numbers of LEGO bricks) and explore how this interacts with between-group inequality.

We have also defined compassion as any action that aims to maximize the food creation for 'starving people' and placed behavior such as sharing and food assembly under this definition. However, this may not be the only motivation that is driving participants to engage in sharing and food creation. For example, high resource participants may feel pity or awkwardness directed toward the low resource group due to their lack of LEGO bricks. Future work should directly assess the motivations that drive participant sharing behavior and establish whether these are compassionate in origin. We also did not directly compare interventions across studies, and future research may wish to test which manipulations yield the largest effect size. Finally, participants were disproportionately female, largely comprised of first-year students and came from a W.E.I.R.D. population (Western, Educated, Industrialized, Rich and Democratic).

Future work should extend upon these findings in more representative and culturally diverse samples.

In conclusion

The human capacity for compassion is one of our most extraordinary traits, yet we do not always help those who are suffering. Here we aimed to establish how to foster compassionate action and promote the adoption of a superordinate goal under situations of group inequality. We assessed the effect of three interventions: compassion meditation, altering the degree of inequality, and implementing a pro-sharing group norm. Compassion meditation and changing the degree of inequality had no meaningful effect on compassionate action. The introduction of a pro-sharing group norm instead had a marked influence on the behavior and attitudes of the unequal groups. This work offers new insights into the feasibility of different interventions to foster compassionate behavior, which may be critical in promoting a more unified world.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: Open Science Framework: https://osf.io/fjp6b/?view_only=b51cca6755654a76b8d1c8d77a3cfa53.

Ethics statement

The studies involving human participants were reviewed and approved by Human Research Ethics Committee at the University of Queensland (protocol number: 2018002500). The participants provided their written informed consent to participate in this study.

Author contributions

KK, JJ, MW, and JK designed the experiments and provided feedback on the manuscript. JK and KK supervised data collection. KK conducted analyses and interpreted the results. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1021093/full#supplementary-material

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Prosocial behavior in toddlerhood and early childhood: Consistency across subtypes and over time

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Introduction: Young children show their capacity for compassion and their desire to enhance the welfare of others in multiple ways. The present study sought to address gaps in knowledge regarding prosociality in the early years. Specifically, the study examined whether different subtypes of prosociality are interrelated, whether they are consistent over time, as well as the meaning of young children's spontaneous versus cued prosocial behavior.

Methods: In a longitudinal sample (*N* =151), three subtypes of prosocial behavior—instrumental helping, compassionate helping (comforting), and sharing—were assessed using behavioral tasks in toddlerhood (18months) and early childhood (36months).

Results: Consistent with hypothesis, partial convergence was found between the different prosociality subtypes at each age. There was also modest continuity over time, both within and across prosocial subtypes. Moreover, at both ages, when children helped or shared spontaneously, they also provided more assistance in the task. Children's tendency to assist spontaneously was partially consistent across situations by early childhood.

Discussion: The findings indicate that a moderately stable disposition toward prosociality is already evident during early ontogeny. Moreover, different subtypes of prosocial behavior are distinct yet interrelated in the early years, suggesting they have both common and unique underlying mechanisms. Lastly, young children's spontaneous (versus cued) prosocial action appears to reflect both motivational and cognitive processes.

KEYWORDS

prosocial behavior, childhood, compassion, individual differences, longitudinal study

1. Introduction

Prosocial behavior, defined as benevolent acts toward others without direct benefit to the self (Eisenberg et al., 2006), is considered one of the cornerstones of a harmonious society and a testament to the human potential for compassion (Davidov et al., 2016). Prosociality is a multifaceted construct, encompassing a variety of ways in which children (or adults) can try to assist or further the needs of others (Dunfield et al., 2011; Brownell, 2013; Paulus, 2018). Prosocial behavior is seen early in development: By the second year of life, infants can already perform a variety of prosocial acts (Brownell, 2013; Paulus, 2018). Even during the first year, some infant behaviors may reflect simple prosocial actions (Liddle et al., 2015; Hammond et al., 2017). Moreover, young children seem eager to be helpful, seeking opportunities to assist others (Dahl, 2015) and taking pride in their helping (Hepach et al., 2017). There are considerable individual differences in early prosocial

behavior: Whereas some children help or share frequently, others do so more rarely or selectively (Newton et al., 2016; Schachner et al., 2018). To gain further insight into the nature of these early individual differences, the present study examined their consistency across different subtypes of prosociality and across age. Our focus was, therefore, on concurrent and longitudinal associations, not on mean-level changes.

As we discuss below, examining these two forms of consistency in the same study can help shed light on fundamental questions regarding the nature and organization of early prosocial development. In particular, it can elucidate whether early prosocial behavior is trait-like or, rather, predominantly situational in nature, and if the former is true then whether young children's prosocial disposition is broad or domain-specific (Penner et al., 2005; Kärtner et al., 2014; Knafo-Noam et al., 2015). As reviewed below, very few studies have examined consistency in prosocial behavior from toddlerhood to early childhood, particularly across different subtypes of prosociality (Kärtner et al., 2014; Paulus et al., 2015; Schachner et al., 2018). The present study addresses this gap.

1.1. Subtypes of prosociality and their interrelations

As noted above, prosociality is multidimensional, and encompasses different forms, or subtypes, of assisting or benefitting others. The most common classification of early prosocial behaviors is action-based, distinguishing between three types of prosocial acts: helping instrumentally, compassionate helping, and sharing (Dunfield et al., 2011; Brownell, 2013; Paulus, 2018). Instrumental helping refers to helping another individual complete an unattained pragmatic goal, such as getting an out-of-reach object or overcoming a physical obstacle (Warneken and Tomasello, 2006, 2007). The target of help has un unfulfilled goal, but typically does not express overt distress (if distress is expressed, the task is usually classified differently; Davidov et al., 2016; Newton et al., 2016). Compassionate helping (sometimes labeled "comforting") includes helping or offering verbal or physical comfort to another in distress (Knafo et al., 2008; Newton et al., 2016). And sharing involves giving one's own limited material resources to another individual (Brownell et al., 2013a; Newton et al., 2016).

There is ample evidence that these three subtypes of prosociality are distinct. First, although all three subtypes can be observed during the second year of life, their prevalence differs considerably: Instrumental helping is a common and frequent behavior in toddlerhood, whereas compassionate helping and sharing are much more rare, likely because these are more challenging behaviors for young children to enact, particularly toward strangers (Warneken and Tomasello, 2006; Knafo et al., 2008; Svetlova et al., 2010; Dunfield et al., 2011; Davidov et al., 2021). Second, these different forms of prosociality were shown to be linked with different antecedences and correlates (Paulus, 2018). For example, socio-cognitive factors such as joint attention and self-other differentiation were found to predict instrumental but not compassionate helping (Kärtner et al., 2014), whereas emotional talk (Drummond et al., 2014), parenting style, and child's temperament (Schuhmacher et al., 2017) were all found to be more strongly associated with compassionate helping than with instrumental helping. Third, distinct neural pathways were also found to underlie instrumental and compassionate helping (Paulus et al., 2013).

Although the three subtypes of prosocial behavior are clearly distinct, they may still draw in part on common processes or mechanisms; for example, multiple subtypes may stem from the same motivation, and/or require some of the same cognitive abilities (Davidov et al., 2016). Such commonalities between subtypes of prosociality should be reflected by intercorrelations between them. There are, however, mixed findings in the literature regarding the interrelations among different subtypes of prosociality during the early years of life. Whereas some studies found no links between subtypes (Dunfield et al., 2011; Dunfield and Kuhlmeier, 2013; Kärtner et al., 2014; Paulus et al., 2015), others found modest convergence between them, when they were assessed concurrently (Sommerville et al., 2013; Brownell et al., 2013b; Newton et al., 2016; Schachner et al., 2018). Moreover, a study with 3.5-year-old twins found a positive correlation between their observed sharing and comforting behaviors, and this shared variance was accounted for in large part by common genetic factors (Knafo-Noam et al., 2018). And for 7-year-old twins, a general prosociality factor was identified, which was largely heritable and accounted for substantial portions of the variance in five different facets of prosociality, reported by mothers (Knafo-Noam et al., 2015); interestingly, in addition to the common factor, there were also unique genetic factors specific to each prosociality subtype. Thus, each subtype appears to have both common and unique mechanisms or features (Davidov et al., 2016).

Taken together, prior work points to a complex pattern, in which the three subtypes of prosociality are distinct on the one hand, yet often (but not always) converge partly on the other hand. Some of this inconsistency may be due to measurement issues, as even small differences in methodology can influence the degree and nature of prosocial behavior being assessed, and thus also the consistency of the child's behavior across different measures (Thompson and Newton, 2013; Davidov et al., 2016). To shed further light on commonalities between subtypes of prosociality, additional systematic evidence is needed, particularly using multiple measures and with attention to issues of measurement error. The present study sought to address this gap, by examining the consistency of children's prosocial responses both across subtypes and over time. We reasoned that this information could help distinguish between different possibilities regarding the nature of early prosocial development.

The first possibility is that early prosociality is not yet consistent or trait-like at all, but rather determined solely by situational and transient factors. If that is the case, then children's prosocial responses should show little consistency both across subtypes and over time. Conversely, a second possibility is that even early in life prosocial behavior is trait-like, such that different forms of prosociality manifest, at least to some extent, the same core disposition or capabilities. Potential common mechanisms are other-oriented motivations (e.g., concern for others), and/or social-cognitive capabilities (the ability to understand what others need and how to assist them, e.g., theory of mind; Eisenberg et al., 2006, 2016). If that is true, then moderate consistency should be evident both across situations and over time; in particular, longitudinal links should be evident not only within, but also across, subtypes. The third possibility is that early prosociality does not reflect any general trait or disposition, nor is it merely situational, but rather it is domain-specific in nature (Kärtner et al., 2014). In this case, different subtypes of prosociality reflect distinct, separate sensitivities and capabilities, that develop largely independently of one another. If that is true, then longitudinal associations should be stronger within the same subtype of prosociality than across different subtypes. We therefore examined the associations among the three forms of prosociality at both 18 and 36 months.

1.2. Consistency across age in prosocial behavior

Longitudinal studies found positive associations between the same measure of prosocial behavior at different ages, suggesting modest

consistency of individual differences over time (Eisenberg et al., 2015). For example, continuity was found from toddlerhood to early childhood in observed empathic concern for others in distress, a response which promotes compassionate helping (Knafo et al., 2008; Paz et al., 2022). Consistency was also found across early childhood for global questionnaire measures of prosociality, reported by parents (Girard et al., 2017; Jambon et al., 2019), and across middle childhood for parent-reported compassionate helping and cooperation, but not for observed sharing (Malti et al., 2016). In a study which assessed instrumental helping, compassionate helping, and sharing across early childhood (age 4.5 to 6 years), all three subtypes showed continuity of individual differences over this period (albeit fairly weakly for instrumental helping; Schachner et al., 2018). In another study, instrumental helping and compassionate helping (comforting) each showed modest continuity from 15 to 18 months (Kärtner et al., 2014; sharing was not assessed).

Nevertheless, systematic evidence is still needed regarding the consistency of individual differences in the three subtypes of prosociality between toddlerhood, when these behaviors emerge, to early childhood, when they are more prevalent and ingrained (Dahl, 2015). Given the vast, transformational changes that take place during this time period in children's cognitive and social capabilities—including huge strides in language development, theory of mind, regulatory abilities, interactions with peers, and more—it is important to examine whether the tendency to act prosocially, by helping, sharing, and comforting, shows consistency across this period (Hay and Cook, 2007). The current study therefore examined continuity from 18 to 36 months.

Moreover, very little is known about the longitudinal links across different subtypes of prosociality (as opposed to within each type), which have often not been reported (Kärtner et al., 2014; Schachner et al., 2018). In one longitudinal study that examined links across subtypes of prosociality, instrumental helping at 18 month and compassionate helping at 24-months were not associated with each other or with sharing at 60-months (Paulus et al., 2015); however, this study did not assess longitudinal consistency within each subtype, making it hard to interpret the lack of associations across subtypes. Given the paucity of research, more work is needed to systematically examine the longitudinal consistency of prosociality, particularly across different subtypes of prosocial behavior. The present study addressed this gap.

1.3. Consistency in spontaneity of prosocial behaviors

As a secondary question, the present study also examined consistency in another aspect of children's prosocial responding—its degree of spontaneity. Within each subtype, prosocial action can vary in the level of communication between the child and the needy other. This variability can be conceived of as a continuum, ranging from completely spontaneous assistance, evoked by the other's need in the absence of any communication with the child (e.g., no eye contact, speech, gestures), through cued assistance, when the other hints to varying degrees that help is needed from the child or what help is wanted, and up to assistance given in response to very explicit cueing or direct requests, which can amount to compliance.

More explicit communication increases the likelihood of prosocial action (Svetlova et al., 2010), but it can also have other effects that are not yet well understood. Specifically, it is possible that when children assist spontaneously, their behavior is underlain by a different motivation than when they assist following direct prompts: Spontaneous prosocial behavior may reflect a genuine motivation to benefit the other, whereas cued or prompted prosocial action may be due to external pressure or a desire to adhere to social norms (Eisenberg et al., 2016). In support of this motivational interpretation, toddlers who shared after fewer cues were also found to share more with the other, suggesting they had greater intention to benefit the other (Pettygrove et al., 2013). Alternatively, it is possible that, at least for young children, spontaneous and prompted prosocial action may not differ in their underlying motive. When young children help only following cues, this may be due to their limited cognitive skills and thus their failure to comprehend how to offer help in the absence of explicit signals (Svetlova et al., 2010), rather than a reflection of less caring on the child's part. In this case, the added cues serve as scaffolding, assisting the young child to better understand the situation and how to function in it. In support of this cognitive interpretation, studies found that compared to older toddlers, younger toddlers need more communicative cues in order to help (Svetlova et al., 2010; Brownell et al., 2013a). Moreover, better theory of mind abilities predicted young children's spontaneous sharing, even after controlling for age (Wu and Su, 2014).

In the present study, we tried to shed light on the meaning of early spontaneous prosocial behavior, by examining its consistency—within the same task and over time. If spontaneous prosocial action is associated with greater amounts of assistance at the task, this would suggest that spontaneous responses likely reflect a stronger motivation to assist the other compared to prompted prosocial behavior. If instead (or in addition), cued or requested prosocial behavior in toddlerhood predicts spontaneous prosocial action in early childhood, then the cognitive interpretation of early spontaneous vs. prompted prosocial behavior would be supported. In addition, we explored whether spontaneity of prosocial action is consistent across subtypes and over time, questions not yet addressed by prior work.

1.4. The present study

The current study examined children's prosocial behaviors longitudinally, at ages 18 and 36 months. At each age, behavioral tasks examining instrumental helping, compassionate helping, and sharing were administered. The study focused on three main research questions. First, we asked whether different types of prosocial behavior converge in toddlerhood (18 months) and early childhood (36 months). In line with some previous findings, we expected partial convergence, such that different subtypes of prosocial behavior would be modestly intercorrelated at each age (Sommerville et al., 2013; Newton et al., 2016; Schachner et al., 2018). Such finding would rule out the possibility that early prosocial behavior is purely situationally-determined.

Second, we examined the consistency over time of these different subtypes of prosocial behavior. Based on prior work (see above), we expected modest continuity in prosocial behavior from toddlerhood to early childhood. However, we did not make a specific prediction regarding the pattern of longitudinal associations within vs. across subtypes, given the paucity of prior work on this issue. As noted above, if consistency over time is shown to be substantial within each form of prosociality yet weak between different forms, this would suggest that early prosociality is domain-specific, with different prosociality subtypes developing independently and drawing on distinct mechanisms. In contrast, a pattern of similar associations within and across subtypes

would suggest that different forms of prosociality are manifesting, at least to some extent, common underlying disposition and mechanisms (Kärtner et al., 2014; Knafo-Noam et al., 2015, 2018; Paulus et al., 2015; Schachner et al., 2018).

Third, we examined consistency and change in spontaneous vs. prompted prosocial behavior. To this end, in several tasks at each age, children had the opportunity to assist either spontaneously or following cues, as well as to assist a little vs. a lot. We examined whether children who act spontaneously also assist more at the task, predicting a positive association between these two aspects (Pettygrove et al., 2013); such associations would suggest that even at a young age, spontaneous prosocial behavior may signal a stronger other-oriented motivation than cued prosocial action. We further examined whether the tendency to assist spontaneously converges across tasks, both concurrently and across age. To our knowledge, previous studies did not examine the consistency of early spontaneous prosocial behavior; therefore, we did not have a specific hypothesis regarding these associations.

2. Methods

2.1. Participants

The sample consisted of 151 Israeli children (51% girls) assessed in their homes at two time-points; 138 children participated at both ages (at 18 months: $N = 147$, $M_{age} = 18.37$ months, $SD = 0.58$; at 36 months: $N = 142$, $M_{age} = 36.95$ months, $SD = 0.85$). This research is part of a larger longitudinal study following a community sample across the first 3 years of life (Davidov et al., 2021; Paz et al., 2022). No *a priori* power analysis was conducted to determine the sample size for the specific research questions of the current paper; however, prior studies that examined similar questions typically had smaller samples (Kärtner et al., 2014; Schachner et al., 2018).

Families were recruited through a major hospital in Jerusalem. A month after giving birth mothers received a letter about the study, and a month later they were recruited to the study by phone. Ethics approvals were obtained from Hadassah Medical Center, Israel's ministry of health, and The Hebrew University's IRB.

Families were all Jewish. The sample was predominantly of middle to low-middle SES. The median monthly family income reported by the parents (8,500–12,500 NIS) was lower than the average family monthly income in Israel at the time (18,671 NIS per month; Israel Central Bureau of Statistics, 2017). For 27% of the families, monthly income was below the 30th income percentiles, 29% were in the 30th–40th percentile range, 35% were between the 40th–70th, and 10% reported incomes above the 70th percentile. The sample was relatively educated, with 76% of mothers having a university degree. There was considerable variability in religiosity, with 29% of the mothers identifying as secular, 20% as traditional, 34% as religious, and 17% as ultra-orthodox. The number of children per family ranged from a single child to nine children ($M = 2.84$, $SD = 1.77$).

2.2. Procedure

Assessment was carried out at children's homes by trained female experimenters. Only those procedures and measures relevant to the current report are detailed below. At each age, five prosociality tasks were administered: two instrumental helping tasks (out-of-reach object, finding a lost object); two compassionate helping tasks toward another in distress (distress simulations of mother and experimenter); and one task of sharing a limited resource (snack) with a sad experimenter. In five of the 10 tasks (18 months: sharing and instrumental out-of-reach; 36 months: sharing, instrumental out-of-reach, and compassionate helping to the sad experimenter) children had an opportunity to assist spontaneously, before any cue regarding how to do so was given, or to assist following cues; in the remaining five tasks, no cues were given as to how to assist (see below).

Because of young children's limited patience, the emotional nature of some tasks, and the research questions (which focused on the links between tasks, rather than on mean-level comparisons), the order of tasks at each visit was fixed and not counterbalanced. The order of the tasks was determined in an attempt to maximize children's completion of as many tasks as possible (for example, by interspersing the more stressful, distress-related tasks with other, neutral-affect tasks), and keeping the setting as ecologically valid as possible (for example, by performing the lost toy instrumental task immediately after that toy had been used in a preceding activity; see Supplementary material online for the order of the tasks). Children's responses to all the tasks were videotaped for later coding. At the end of each home visit, the family received a gift card of 50 NIS (approximately $15) and a toy for the child.

Each task at each age was coded by a main coder (out of a team of graduate and undergraduate research assistants). For each task at each age, another coder independently rated a subset of 20% of the videos, randomly selected, for calculation of inter-rater reliability. In case of discrepancies, the rating of the main coder was always used.

2.3. Measures

2.3.1. Instrumental helping

At each age, two tasks were administered by the experimenter—one task of helping to return an out-of-reach object and one task of searching for a lost object. All tasks were performed using neutral vocalization and demeanor, without expressing any distress or urgency.

2.3.1.1. Out of reach pen—18months

In this task, based on Warneken and Tomasello (2006), the experimenter pretended to unintentionally drop her pen in the child's direction. The simulation lasted 30 s, and no eye contact was made with the child throughout. For the first 15 s, the experimenter looked at the pen and uttered "my pen" a few times in a neutral tone of voice. Then for the last 15 s, she reached out and tried to grab the pen, expressing effort to reach it but without any demonstration of distress. If the child brought the pen to the experimenter, the simulation ended. Children's help (bringing the pen to the experimenter) was coded on a dichotomous scale, with 0 = *did not help*, 1 = *helped*. Inter-rater reliability (based on 20% of the videos) was kappa = 1.00.

Upon careful inspection, we noticed that in some of the cases the experimenters started reaching for the pen right away (instead of first just looking and exclaiming "my pen," without reaching, as was intended); these children ($n = 61$) did not differ from the children for whom the two-stage procedure was implemented properly ($n = 86$) in the probability of helping to pick up the pen, with 53% helping in the former group and 52% helping in the latter, $\chi^2(1) = 0.16$, $p = 0.90$. We therefore used the helping score of the entire sample in the analysis. However, spontaneous helping (that is, before the experimenter started reaching) could only be coded for the latter children. The spontaneous helping score included 3 levels, with 0 = did not help, 1 = helped, but not spontaneously (only after the experimenter reached), 2 = helped

spontaneously (before the experimenter reached for the pen). Inter-rater reliability (based on 20% of the videos) was ICC = 0.99.

2.3.1.2. Out of reach crayons—36 months

In this task the experimenter pretended to accidentally drop a box of crayons. The experimenter waited for 5 s looking at the scattered crayons, then started to collect them slowly for 30 s, without making eye contact with the child. If the child helped the experimenter, she thanked the child briefly and continued collecting the crayons until the time was over. The time window for spontaneous helping was shorter in this task than in the pen task (5 vs. 15 s), because we were concerned that waiting 15 s at this age would appear artificial to children (and waiting 5 s at 18 months was too brief for children to respond).

Children's helping attempts were coded from videos using coding software (INTERACT© by Mangold). Several scores were derived: (a) a 3-point helping score, with 0 = *did not help*, 1 = *helped a little*, and 3 = *helped a lot*. (b) spontaneous helping—whether the child began helping before the experimenter started collecting the crayons, with 0 = *did not help*, 1 = *helped but not spontaneously*, 2 = *spontaneous helping*. (c) duration of helping—a continuous score reflecting the proportion of seconds the child helped out of the total duration of the task. (d) number of crayons collected, on a 0–3 scale, with 0 = *none*, 1 = *one crayon*, 2 = *some* (2–3 crayons), 3 = *many* (four crayons or more). Inter-rater reliabilities (based on 20% of the videos) were high, Intraclass correlation (ICC) ranging from 0.92 to 0.95. Similar tasks have demonstrated validity in prior work (e.g., Bryan et al., 2014).

2.3.1.3. Searching lost ball—18 months

This task was an adaption of other searching tasks used in prior work for testing instrumental helping (e.g., Liszkowski et al., 2006). During the home visit, the experimenter collected all the toys that had been used in a previous activity back into her bag and pretended she could not find a ball, which was clearly visible to the child (we verified beforehand with the mother that the child knew what the word "ball" means). The experimenter pretended to search for the ball for 30 s while saying out loud: "where is my ball?," "I need to find it," in a neutral tone of voice, without making direct eye contact with the child and without expressing any distress. If the child brought the ball to the experimenter or put it in her bag, the simulation was over. Children's helping attempts were rated from the videos on a dichotomous scale, with 0 = *did not help,* and 1 = *helped* (if the child either brought the ball to the experimenter, put it in her bag, looked for the ball intensely without finding it, or pointed at the ball in an attempt to draw the experimenter's attention to it). Inter-rater reliability (based on 20% of the videos) was kappa =1.00.

2.3.1.4. Searching lost keys—36 months

This task was also adapted from previous searching tasks (e.g., Liszkowski et al., 2006). When the child was sitting across from her, ready to play a game, the experimenter put down her keys next to her, stating out loud that she is putting them there so she would not lose them. While playing the game with the child the experimenter "accidentally" placed a sheet of paper over the keys. At the end of the game (approximately 10 min after putting down the keys), the experimenter wondered where her keys were, pretending she forgot where she had put them. Then she looked for the keys in her belongings for 30 s before finding them. If the child found the keys and brought them to the experimenter, the simulation was over; likewise, if the child repeatedly pointed at the keys, the experimenter found them and the simulation was over. Helping was coded on a 3-point scale, with 0 = *did not help,* 1 = *helped a little* (the child made mild effort to help the experimenter), 2 = *helped a lot* (the child brought the keys to the experimenter, showed her where they were, or helped her look for them intensely without finding them). Inter-rater reliability (based on 20% of the sample) was ICC = 0.94.

2.3.1.5. Data reduction for instrumental helping

At each age, a composite total score of instrumental helping was created as a 3 levels scale, with 0 = did not help in either task, 1 = helped in one of the tasks, and 2 = helped in both tasks.

2.3.2. Compassionate helping

At each age, two distress simulations were performed, one by the experimenter and one by the mother. At 18 months, both simulations portrayed the mother/experimenter getting hurt and crying. At 36 month, the mother repeated a shorter version of the same pain simulation, whereas the experimenter performed another simulation portraying sadness, as described below.

2.3.2.1. Pain simulation—18 and 36 months

The experimenter pretended to bump her knee while sitting in front of the child, and the mother pretended to hurt her finger while playing with a pounding toy. Upon getting "hurt," the victim cried for 60 s when children were 18 months old (medium intensity cries for 30 s, and then subsiding for another 30 s). When the children were 36 months-old, a shorter version of the simulation was used, which was more appropriate at this age (the full length simulation felt too intense for the older children); the mother therefore cried for 40 s (20 s at medium intensity and then subsiding for another 20 s). At the end of the simulations, the victim made eye contact with the child, smiled, and assured the child that she was now alright. Attempts to help and comfort the distressed experimenter/mother included physically comforting her (e.g., patting, kissing, calming words; but not seeking comfort *from* the mother), trying to recruit help on her behalf (e.g., from another adult), bringing an object to her, and so on. As helping frequency at 18-months was low (see below), compassionate prosocial behavior was scored dichotomously, with 0 = *not shown*, and 1 = *shown by the child*. Inter-rater reliabilities, based on 20% of the videos coded by a second, independent rater were high, with kappa values ranging from 0.85 to 0.94.

2.3.2.2. Sadness simulation—36 months

The experimenter did not perform the pain simulation at this age, but rather a sadness simulation (we thought that children at this age might be suspicious if two similar pain simulations were presented to them). The experimenter told the child excitedly that she brought her favorite doll (unisex doll of a cartoon figure) but then "discovered" that the doll's arm had been broken. She feigned sadness for 50 s, without making eye contact, alternating between holding the doll (first 30 s), trying to fix it, and placing it between her and the child (remaining 20 s). Finally, the experimenter succeeded in fixing the doll and was happy. If the child was able to fix the doll at any point, the simulation ended. Similar simulations have been used to measure young children's empathy and prosociality (e.g., Dunfield and Kuhlmeier, 2013). Prosocial behavior in this task was coded dichotomously (0 = *not shown*, 1 = *shown*), as well as on a 4-point scale reflecting the extent of assistance shown by the child: 0 = *none*, 1 = *brief* (a single or weak attempt), 2 = *moderate* (child tried to help/comfort a few times, or made a single intense or complex attempt), 3 = *prolonged* (child repeatedly and substantially engaged in prosociality).

A 3-point spontaneity score was also coded, reflecting whether the child tried to fix the doll spontaneously, that is, even before the experimenter demonstrated how it might be repaired by trying to fix it herself, with 0 = *no prosocial behavior*, 1 = *acted prosocially, but not spontaneously*, 2 = *spontaneous prosocial action*. Inter-rater reliabilities, based on 20% of the sample, ranged from ICC = 0.97 to 1.00 for all the codes.

2.3.2.3. Data reduction for compassionate helping

At each age, a composite total score of compassionate helping was created as a 3 levels scale, with 0 = not shown in either task, 1 = shown in one of the tasks, and 2 = shown in both tasks.

2.3.3. Sharing

The same sharing task was performed at both ages by the experimenter. However, slight changes were made in the cues presented to the child, in order to accommodate children's developmental level, as was done in similar simulations measuring costly sharing in prior work (Dunfield et al., 2011; Dunfield and Kuhlmeier, 2013).

2.3.3.1. Sharing a snack—18 and 36 months

The experimenter told the child that she brought a snack for both of them (we verified with the mothers that the child liked this snack). While pouring the snacks into two bowls, the experimenter "discovered" that her bag of snack was empty. Handing over the full bowl to the child, she looked at her empty bowl and simulated distress. The 60 s simulation was built gradually with three progressive stages, in order to give the children more opportunities to understand how to assist the experimenter (Svetlova et al., 2010). At each age, these stages included: First, an un-cued phase, to enable spontaneous sharing. This consisted of 30 s during which the experimenter pretended to be sad for having no snack, while avoiding eye contact with the child (looking at her empty bowl) and, at 18 months only also additional 15 s in which the experimenter initiated eye contact with the toddler, shifting her gaze between the infant and the bowls (this behavior was very implicit for 18 month-olds, in contrast to the older children). The second phase was an explicit but non-verbal cue to share. At 18 months this consisted of the experimenter extending her hand toward the child while holding her bowl, still looking sad and alternating her gaze between the bowls and the child for 15 s; this cue was considered too strong for 36 month-olds, and therefore at this age the explicit cue consisted of the experimenter making eye contact with the child and altering her gaze between the child and the two bowls while looking sad, for 20 s. The final stage at both ages was a direct verbal request: the experimenter asked the child directly, only once, if the child would like to give her some of his/her snack. If the child shared any amount at any stage, the simulation ended.

Two codes were used: (a) Stage of sharing, a 4-level scale with 0 = *did not share*, 1 = *compliance* (shared after direct verbal request), 2 = *cued sharing* (shared when experimenter's hand was extended at 18 months, or when eye contact was made at 36 months), 3 = *spontaneous sharing*. (shared before the latter cues, noted for a code of 2, were given) (b) The amount of snack shared by the child, a 4-level scale with 0 = *did not share*, 1 = shared *one piece*, 2 = shared *some* (a handful), 3 = shared *most of his/her snack*. Inter-rater reliabilities (ICCs, based on 20% of the videos) ranged from 0.93 to 0.99. Thirteen episodes at 18 months could not be coded, due to experimenter error or parental interference.

2.3.4. Control variables

Mothers completed a demographic questionnaire at each home visit, and items from it were examined as potential control variables (e.g., maternal age in years, years of maternal education, a 7-point family income item). Child temperament was reported by mothers at 12-months using the short form of the Infant Behavior Questionnaire-Revised (Putnam et al., 2014). This questionnaire includes 91 items, rated on 1–7 scales, assessing 14 aspects of temperament, which comprise three broad temperamental dimensions: Negative Emotionality, Positive Affectivity/Surgency, and Orienting/Regulatory Capacity. These three broad dimensions (average scores) were examined as potential control variables in the present study (for the psychometric properties of this instrument, see Putnam et al., 2014).

3. Results

3.1. Descriptive statistics and preliminary analyses

Descriptive information is presented in Table 1 for the instrumental and compassionate helping tasks and in Table 2 for the sharing task. As can be seen, at both 18 and 36 months, the majority of children helped instrumentally at least once (72% and 76%, respectively; about a quarter of the children at each age helped in both instrumental tasks). Wilcoxon Test, a non-parametric test for paired samples, comparing the rates of instrumental helping (total score) at 18 and 36 months, showed no significant change with age, $Z = -0.387$, $p = 0.699$. In contrast, the majority of 18 month-olds did not show compassionate helping toward either the distressed experimenter or mother (with only 41% acting prosocially in at least one task, more typically toward the distressed mother). Similarly, the majority of toddlers did not share their snack with the distressed experimenter (with only 37% sharing at any stage of the task at 18 months; see Table 2). These two prosocial behavior subtypes were more prevalent by 36 months, with 65% of the children showing compassionate helping in at least one task (approximately equally toward the mother and the experimenter), and 72% of the children sharing with the experimenter, at any stage of the task, at this age. Wilcoxon Tests showed that the increase with age was significant for both compassionate helping, $Z = 4.77$, $p < 0.001$, and sharing, $Z = 4.73$, $p < 0.001$.

The rates of spontaneous prosocial behavior are also included in Tables 1, 2. For instrumental helping, 85% of the toddlers who helped in the pen task at 18 months did so spontaneously, within 15 s (when only the first 5 s were examined, 35.6% of the helpers did so spontaneously). At 36 months, 40% of the children who helped pick up the scattered crayons did so spontaneously (i.e., in the first 5 s, before any cue was given). For sharing behavior, spontaneous sharing of the snack was rare at 18 months, with only 10% of the sharers doing so, compared to 21% of sharers at 36 months. For compassionate helping, only one task at 36 months enabled both spontaneous and cued assistance, and 61% of the children tried to help the sad experimenter fix her doll before any cue regarding how to do so was given.

Additional analyses showed that none of the prosocial behavior scores, for any of the tasks at either age, was significantly associated with the demographic variables, including: maternal age, all *r*s between −0.11 and 0.12, $p > 0.192$, maternal education, *r*s between −0.09 and 0.13, $p > 0.127$, and family income, *r*s between −0.12 and 0.14, $p > 0.126$. Likewise, child's gender was not significantly associated with the prosociality scores, albeit two gender difference approached significance (for Ball 18-months $t = -1.93$, $df = 139$, $p = 0.055$, $M_{male} = 0.44$ (0.50) $M_{female} = 0.60$ (0.49); for Pen 18-months $t = 1.78$, $df = 139$, $p = 0.077$,

TABLE 1 Descriptive statistics for instrumental and compassionate helping tasks.

Measure[a]	Prevalence (% of children who assisted at all)	M (SD)[b]	% who assisted spontaneously[c]
Instrumental helping			
Pen 18 m (0–1)	52.5%		84.44%[d]
Bal 18 m (0–1)	52.5%		
Crayons 36 m (0–1)	59.2%		40.47%
Keys 36 m (0–2)	45.1%	0.83 (0.90)	
Instrumental-total 18 m (0–2)	71.9%	1.06 (0.79)	
Instrumental-total 36 m (0–2)	76.1%	1.04 (0.72)	
Compassionate helping (comforting)			
Pain mother 18 m (0–1)	37.1%		
Pain experimenter 18 m (0–1)	10.2%		
Pain mother 36 m (0–1)	40.3%		
Sad experimenter 36 m (0–3)	46.5%	1.08 (1.29)	61.66%
Compassionate-total 18 m (0–2)	40.8%	0.46 (0.60)	
Compassionate-total 36 m (0–2)	64.8%	0.85 (0.73)	

[a]The rating scale of each prosocial measure is noted in brackets following the variable name.
[b]Means and SDs for dichotomous measures are not shown (because they are redundant with the %s reported in the first column).
[c]Calculated out of those children who assisted at the task (to any extent), in tasks where both spontaneous and cued assistance were possible.
[d]The rate shown is for spontaneous helping within 15 s; for spontaneous helping within the first 5 s, the rate was 35.55% of the helpers.

TABLE 2 Descriptive statistics for sharing task.

	18 months	36 months
Prevalence (% who shared at all)	36.9%	72.1%
M (SD) stage of sharing[a]	0.61 (0.89)	1.14 (0.99)
M (SD) amount shared[a]	0.64 (0.95)	1.40 (1.05)
Out of those who shared, % of children sharing…		
Spontaneously	10.4%	20.8%
After a non-verbal cue (cued)	43.8%	15.8%
After a verbal request (compliance)	45.8%	63.4%

[a]0–3 rating scale.

$M_{male} = 0.60$ (0.49) $M_{female} = 0.45$ (0.50); for all others measures, *t*s ranged from 0.014 to 1.36, all $p > 0.178$). Of the three temperament measures, Positive Affectivity/Surgency at 12-months was correlated with several prosocial scores: total instrumental helping at 18 months, total compassionate helping at 36 months, and with both amount and stage of sharing at 36 months, all *r*s between 0.20–0.25, *ps* from 0.021 to 0.003. No other associations with temperament were found. Only Positive Affectivity/Surgency was therefore included as a control variable.

3.2. Consistency of individual differences across prosocial subtypes and age

3.2.1. Overview of analysis

To examine our main research questions regarding convergence across prosociality subtypes and continuity over time, we used two sets of analyses. First, for a simple examination of consistency, we computed the correlations between the prosociality measures, using the total instrumental and compassionate helping scores and the two sharing scores (stage and amount) at each age. Both zero-order correlations and partial correlations controlling for Positive Affectivity/Surgency, were examined. However, correlations between observed variables can be substantially affected by differences in measurement error between the various scores. To mitigate this problem, a second set of analyses used Structural Equation Modeling (SEM), in which latent variables of the prosocial subtypes were estimated at each age from the observed task scores, and the concurrent and longitudinal associations among the prosocial subtypes were then examined among the latent variables (which partial out measurement error; Stephenson and Lance Holbert, 2003; Coffman and MacCallum, 2005). The Analysis was conducted using the lavaan package in R (Rosseel, 2012). Full information maximum likelihood (FIML) was used for treating missing data with Maximum likelihood estimator (ML). All observed scores were standardized prior to being entered into the models.

As a preliminary step to the SEM analysis, we examined separate measurement models at each age. First, a single factor model was examined, in which all six observed prosocial scores loaded on a single prosociality factor. Support for this model can indicate that the different subtypes of prosociality all reflect the same general, global prosocial disposition. The single factor model was then compared to a model containing three latent prosocial variables corresponding to the three subtypes—instrumental, compassionate, sharing—each estimated from two observed scores. For instrumental and compassionate, the two relevant tasks at each age were used as the observed indicators, and for sharing at both ages, stage of sharing and the amount of snack shared were used as the two observed indicators. The covariances between the latent factors were also estimated at each age, to examine the concurrent links between subtypes of prosociality. Better fit for the 3-factor model compared to the 1-factor model would support the interpretation that the three subtypes of prosociality are distinct and likely underlain by different mechanisms. Finally, we conducted the main SEM analysis,

modeling the regression pathways between all latent factors at 18-months and all latent factors at 36 months (in addition to the concurrent covariances), in order to examine the longitudinal associations both within and across the subtypes of prosociality.

3.2.2. Links between observed prosocial behavior scores (correlations)

Table 3 presents the correlations between the different forms of prosociality within age (Pearson correlations are presented; Spearman correlations were highly similar, see Supplementary Table S1). Consistent with hypothesis, the findings show partial convergence between different subtypes of prosociality within age, at both 18 and 36 months. At 18 months, toddlers who offered compassionate helping also helped more in the instrumental tasks and shared more from their snack. Instrumental helpers also tended to share their snack at an earlier stage. Similarly, at 36 months, compassionate helping was linked with greater instrumental helping as well as with sharing of larger amounts and at an earlier stage. Partial correlations, controlling for the temperament dimension of Positive Affectivity/Surgency, were virtually identical (see Supplementary Table S2).

Table 4 presents the longitudinal associations between the different forms of prosociality. As shown, modest associations emerged both within and across subtypes. Correlations within each subtype, located on the diagonal, emerged for all subtypes (marginally for instrumental helping). Correlations across subtypes, located off the diagonal, were also found, and were similar in magnitude to the links within subtypes. Thus, instrumental and compassionate helping at 18 months were both significantly associated with sharing amount at 36 months, and sharing amount and stage at 18 months were marginally associated with instrumental helping at 36 months. The pattern of Spearman correlations was very similar (see Supplementary Table S3), as were the partial correlations, controlling for children's Positive Affectivity/Surgency (see Supplementary Table S4).

3.2.3. Links between latent prosocial behavior variables (SEM)

The single factor models showed poor fit to the data at both 18 months, $\chi^2 = 32.08$, $df = 9$, $p < 0.001$, CFI = 0.87, TLI = 0.79, RMSEA = 0.132, SRMR = 0.087, and 36 months, $\chi^2 = 20.21$, $df = 9$, $p < 0.001$, CFI = 0.92, TLI = 0.86, RMSEA = 0.094, SRMR = 0.065. In comparison, the 3-factor measurement model fit the data well at both 18 months, $\chi^2 = 8.80$, $df = 6$, $p = 0.185$, CFI = 0.98, TLI = 0.96, RMSEA = 0.056, SRMR = 0.061, and 36 months, $\chi^2 = 7.08$, $df = 6$, $p = 0.313$, CFI = 0.99, TLI = 0.98, RMSEA = 0.036, SRMR = 0.039. The fit for the 3-factor model was significantly better than that for the single factor model at both 18 months, χ^2 difference test = 23.28, $df = 3$, $p < 0.001$, and 36 months, χ^2 difference test = 13.12, $df = 3$, $p = 0.004$. However, at both ages, the covariance matrix of the latent factors was not positive-definite, suggesting a different structure may suit the data better. Specifically, high covariances between two of the latent variables, instrumental and compassionate, indicated possible linear dependency or redundancy between them, which may suggest they are not both needed for capturing the structure of the data (Wothke, 1993). Further examination indeed revealed that a 2-latent factor model was most appropriate for the data at both ages. In this model, instrumental and compassionate helping were combined into one latent factor, "instru-compassionate," which was estimated from all four observed instrumental and compassionate scores; the second latent factor was sharing, which was estimated from the two observed scores of the sharing task (stage and amount). This model had a positive-definite covariance matrix, and showed excellent fit to the data at both 18 months, $\chi^2 = 10.27$, $df = 8$, $p = 0.256$, CFI = 0.99, TLI = 0.98, RMSEA = 0.043, SRMR = 0.035, and 36 months, $\chi^2 = 5.20$, $df = 7$, $p = 0.635$, CFI = 1.00, TLI = 1.03, RMSEA < 0.001, SRMR = 0.038 (at 36 months, a covariance between two observed scores, sad experimenter and sharing stage, was also added to the measurement model, to prevent a negative estimation of the variance of sharing stage). The covariance between the

TABLE 3 Correlations between different subtypes of prosociality at each age.

	Instrumental total	Compassionate total	Sharing stage	Sharing amount
Instrumental total	–	0.34**	0.18*	0.11
Compassionate total	0.27**	–	0.13	0.19*
Sharing stage	0.10	0.26**	–	0.83**
Sharing amount	0.12	0.24**	0.74**	–

$^{\dagger}p \leq 0.10$.
$^{*}p < 0.05$.
$^{**}p < 0.01$ (all two-tailed).
Pearson correlations are presented. Correlations at 18 months are presented above the diagonal, and correlations at 36 months are presented below the diagonal.

TABLE 4 Longitudinal links from 18 to 36 months, between different subtypes of prosocial behavior.

	18 months			
	Instrumental total	Compassionate total	Sharing stage	Sharing amount
36 months				
Instrumental total	0.15†	0.00	0.16†	0.17†
Compassionate total	0.07	0.24**	−0.05	−0.05
Sharing stage	0.12	0.07	0.22*	0.15†
Sharing amount	0.19*	0.23**	0.24**	0.23*

$^{\dagger}p \leq 0.10$.
$^{*}p < 0.05$.
$^{**}p < 0.01$ (all two-tailed).
Pearson correlations are presented.

two latent factors (instru-compassionate and sharing) was significant at both 18 months, β = 0.30, $p = 0.002$, and 36 months, β = 0.34, $p = 0.014$.

The 2-factor model fit the data better than the single factor model at both 18 months, χ^2 difference test = 21.96, $df = 1$, $p < 0.001$, and 36 months, χ^2 difference test = 15.00, $df = 2$, $p < 0.001$, and its fit was not significantly different from that of the three-factor model at both ages, χ^2 difference tests < 1.32, $p > 0.51$. Therefore, the 2-factor measurement models, which reflects both convergence and differentiation between subtypes of prosociality, were used in the longitudinal SEM.

For the SEM, we modeled four longitudinal regression paths between the 18 months and 36 months latent factors. The model had reasonable fit $\chi^2 = 72.03$, $df = 48$, $p = 0.014$, CFI = 0.93, TLI = 0.91, RMSEA = 0.058, SRMR = 0.062. The model is presented graphically in Figure 1 and standardized parameter estimates are reported in Table 5. As can be seen, three of the four regression paths were significant or close to significance. Within subtypes, the longitudinal pathways from 18 to 36 months approached significance for both instru-compassionate and sharing. Across subtypes, instru-compassionate helping at 18 months predicted sharing at 36 months (but early sharing did not predict subsequent instru-compassionate helping).

3.3. Spontaneous vs. cued prosocial behavior: Its consistency and meaning

To examine the role of spontaneous prosocial behavior, we took three steps. First, we examined whether the tendency to assist spontaneously was consistent across different tasks, within each age (two tasks at 18 months, three tasks at 36 months). Second, we examined whether the tendency to assist spontaneously was consistent across age. Finally, we addressed the links between spontaneity and degree of prosocial behavior, by examining whether children who assisted spontaneously also tended to assist more in the task (e.g., helped for a longer duration, or shared greater amounts) than children who assisted only following prompts.

At 18 months, there was no association between spontaneous helping in the instrumental task (pen) and spontaneous sharing of the snack, $\chi^2(6) = 4.51$, $p = 0.608$ (the results did not change when spontaneous helping in the pen task was examined within the first 5 s, instead of 15 s). At 36 months, two of three potential associations were significant: Children who helped spontaneously in the instrumental task (dropped crayons) were also more likely to do so in the compassionate helping task (sad experimenter—broken doll): $\chi^2(4) = 10.93$, $p = 0.027$; and children who shared their snack spontaneously were also more likely to show spontaneous compassionate helping: $\chi^2(6) = 20.98$, $p = 0.002$. Thus, some consistency in spontaneous helping across different prosociality tasks appeared to emerge by early childhood (36 months). Notably, for the two prosocial tasks that correspond to those used in toddlerhood (instrumental out-of-reach and sharing), the tendency to assist spontaneously was unrelated at 36 months either, $\chi^2(6) = 8.83$, $p = 0.184$.

As for longitudinal associations, only one significant link was found: between spontaneous sharing at 18 and 36 months (no other longitudinal links emerged for spontaneity of sharing, and none were found for spontaneity of instrumental helping in the pen task, either when the first 5 s or the first 15 s were considered as spontaneous helping, χ^2 between 1.08 and 7.61, all $p > 0.107$). Table 6 presents the cross-tabulation of sharing stages at the two ages, $\chi^2(9) = 17.19$, $p = 0.046$. As shown, toddlers who shared spontaneously at 18 months were significantly more likely to also share spontaneously at 36 months, $Z = 2.70$, $p = 0.007$. Interestingly, toddlers who shared after being given a non-verbal cue at 18 months also tended to

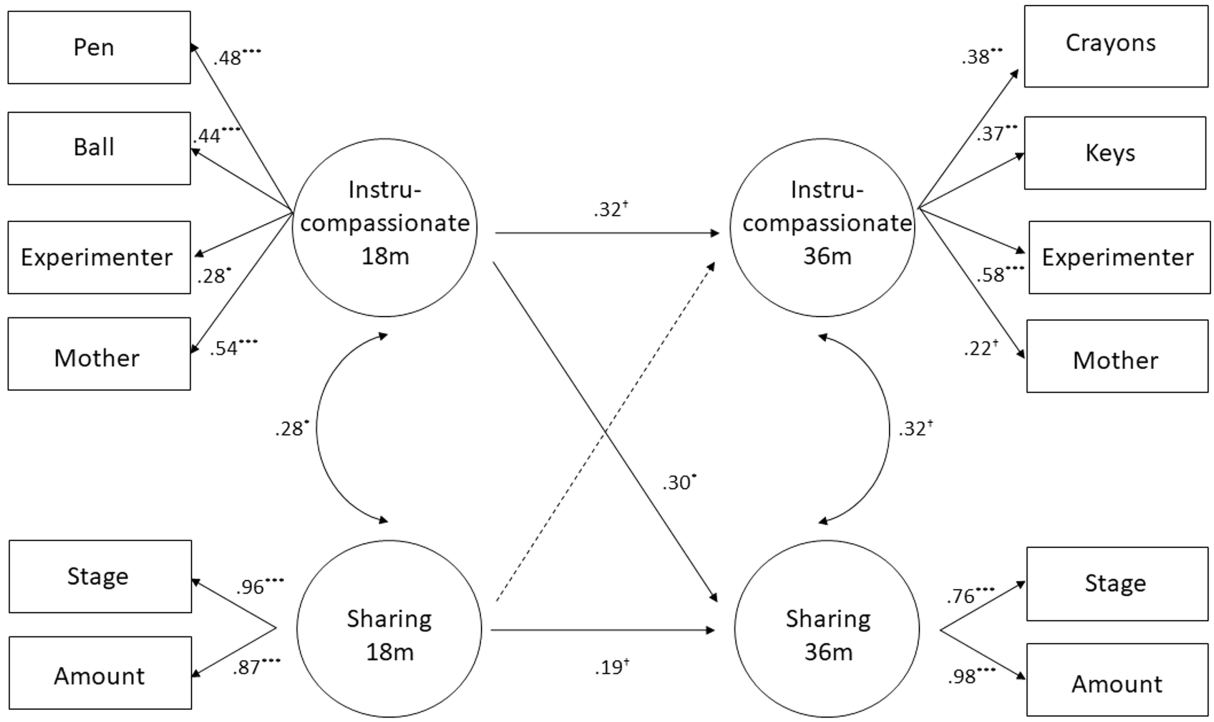

FIGURE 1
SEM model examining concurrent and longitudinal associations between latent variables of the two factors prosociality subtypes at 18 and 36months. Significant paths and covariances appear in solid arrows, with standardized coefficients, and non-significant ones are in dotted arrows. †p <0.10; *p <0.05; **p <0.01; ***p <0.001 (all two-tailed).

TABLE 5 Standardized parameter estimates from final SEM model.

Latent variable	Observed indicators	Estimate	*p*
Instru-compassionate 18 m	Pen	0.48	<0.001***
	Ball	0.44	<0.001***
	Distressed experimenter	0.28	0.016*
	Distressed mother	0.54	<0.001***
Sharing 18 m	Stage	0.96	<0.001***
	Amount	0.87	<0.001***
Instru-compassionate 36 m	Crayons	0.38	0.002**
	Keys	0.37	0.004**
	Distressed experimenter	0.58	<0.001***
	Distressed mother	0.22	0.078†
Sharing 36 m	Stage	0.81	<0.001***
	Amount	0.92	<0.001***
Longitudinal regressions			
Instru-compassionate 36 m	Instrumental 18 m	0.32	0.096†
	Sharing 18 m	0.05	0.761
Sharing 36 m	Instrumental 18 m	0.30	0.030*
	Sharing 18 m	0.19	0.078†
Concurrent covariances			
Instru-compassionate 18 m	Sharing 18 m	0.28	0.038*
Instru-compassionate 36 m	Sharing 36 m	0.32	0.074†

Model fit indexes: $\chi^2 = 72.03$, df = 48, $p = 0.014$, CFI = 0.93, TLI = 0.91, RMSEA = 0. 058, SRMR = 0.062.
†$p < 0.10$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$ (all two-tailed).

TABLE 6 Cross-tabulation of sharing stages at 18 and 36 months.

	36 months			
	No sharing (*n* = 33)	Compliance (*n* = 54)	Cued (*n* = 14)	Spontaneous (*n* = 20)
18 months				
No sharing (*n* = 78)	24 (1.2)	33 (−0.7)	10 (0.6)	11 (−1.0)
Compliance (*n* = 19)	7 (1.0)	10 (0.8)	2 (−0.2)	0 (−2.1)
Cued (*n* = 19)	2 (−1.8)	9 (0.3)	2 (−0.2)	6 (1.9)
Spontaneous (*n* = 5)	0 (−1.4)	2 (−0.2)	0 (−0.8)	3 (2.7)

$\chi^2(9) = 17.19$, $p = 0.046$. Cells indicate the frequency (*n*) of each combination and, in brackets, the adjusted standardized residual, which reflects the difference between the expected and observed values as a Z score; all values greater than |1.96| are significant at $p < 0.05$ or less.

later share spontaneously at 36 months, $Z = 1.90$, $p = 0.057$. Conversely, toddlers who shared only after a direct request (compliance) were unlikely to share spontaneously by 36 months, $Z = -2.10$, $p = 0.036$ (see Table 6). In fact, there was also evidence that compliant sharers were reluctant to share: When compliant sharing and non-sharing were collapsed into one category, toddlers who showed either of these behaviors at 18 months were likely to also behave similarly at 36 months, compared to toddler who shared after a cue or spontaneously at 18 months, $Z = 2.2$, $p = 0.028$.

Finally, in four of the tasks, children had the opportunity to show variability in the level of spontaneity as well as in the amount of assistance they provided (make more attempts to fix the doll, and pick up more crayons at 36 months; share more from their snack at 18 and 36 months). Consistent with prediction, in all these tasks spontaneous prosociality was associated with greater assistance. For sharing, the correlation between stage of sharing and amount shared (excluding non-sharers from this analysis, so as not to inflate the correlations) was significant at both 18 months, $r = 0.31$, $p = 0.032$, and 36 months $r = 0.36$, $p < 0.001$ (see also Supplementary Table S5 for the cross-tabulation of sharing stage and amount). Similarly, in the sad experimenter task at 36 months, children who helped spontaneously also received a higher mean rating of their overall attempts to help or comfort the experimenter, reflecting greater attempts and effort to help, $t(58) = -7.27$, $p < 0.001$, respective means for spontaneous and cued: 2.86 ($SD = 0.42$) and 1.78 ($SD = 0.73$). And in the out-of-reach instrumental task at 36 months, children who helped spontaneously also helped more than the children who helped only after a cue (i.e., after the experimenter started to collect the fallen objects

herself): They picked up more dropped items, $t(82) = -2.91$, $p = 0.002$, respective means (on a 0–3 scale): 2.97 ($SD = 0.17$) and 2.60 ($SD = 0.73$), and they helped for a longer duration of the time (expressed as proportion of seconds the child helped out of the total duration of the task), $t(82) = -8.01$, $p < 0.001$, respective means: 0.91 ($SD = 0.08$) and 0.52 ($SD = 0.28$). Thus, in all cases, spontaneous prosocial behavior was consistent with greater amounts of assistance to the needy other.

4. Discussion

The current study examined the early development of three main prosociality subtypes: instrumental helping, compassionate helping (or comforting), and sharing, from toddlerhood to early childhood. Whereas prior work has typically focused on mean levels of early prosocial behaviors (e.g., Warneken and Tomasello, 2006; Svetlova et al., 2010; Dunfield et al., 2011), our focus was on patterns of individual differences in these behaviors, particularly their consistency. Using a large longitudinal sample of typically developing children, we examined three main questions: Whether children's tendency to assist in one way is linked to their tendency to act prosocially in other ways?; Whether children's tendency to assist at 18 months is linked to their tendency to act prosocially at 36 months, both within the same subtype of prosociality and across subtypes?; And whether children's tendency to help others spontaneously is consistent across subtypes of prosociality and across age, as well as linked to greater degrees of assistance? Together, these three questions address fundamental issues regarding the meaning and structure of early prosocial behavior, particularly, whether it reflects a dispositional tendency, and how broad and stable this tendency appears to be.

4.1. Consistency of children's prosocial responses across subtypes and age

Consistent with hypotheses and in line with prior work (Sommerville et al., 2013; Brownell et al., 2013a; Newton et al., 2016; Schachner et al., 2018), the findings indicate that different types of prosociality converge partly in both toddlerhood and early childhood. The present study also provided new information, by showing that this partial convergence across subtypes occurred not only concurrently, but also longitudinally. This was shown both at the level of the observed variables (correlations), after controlling for temperament (partial correlations), as well as at the level of latent variables (SEM), thus reducing potential biases due to differences in measurement error (Stephenson and Lance Holbert, 2003; Coffman and MacCallum, 2005) and controlling for concurrent associations in the model. At the correlational level, at each age children who assisted a needy other in one way were also more likely to assist her in other ways. Moreover, toddlers who acted prosocially in one way at 18 months were more likely to show that same prosocial behavior at 36 months, and also more likely to show other types of prosocial behavior in early childhood. The SEM results, even more than the correlations, revealed the interrelatedness of different subtypes of prosociality. Thus, at both ages, instrumental and compassionate helping measures loaded on the same latent factor. Moreover, this combined factor was significantly associated with the sharing latent factor at each age as well as longitudinally.

This evidence of consistency in children's prosocial behavior across subtypes and age support the notion that a moderately stable disposition (or temperamental dimension) toward prosociality is already evident during early ontogeny (Knafo et al., 2008; Knafo and Israel, 2012). Thus, toddlers' and young children's prosocial responses are not determined solely by situational or transient factors, but are also a reflection of trait-like tendencies to assist others and further their needs (or not to do so). The extent of a child's tendency to act prosocially is likely co-determined by genetic and socialization factors, and their interplay (Dahl and Brownell, 2019).

At the same time, there was also evidence for differentiation between the subtypes of prosociality. First, at both ages a single factor model did not fit the data well; two latent factors were needed in order to capture the structure of the data. Moreover, although instrumental helping and compassionate helping loaded on the same latent factor, they had very different patterns of frequencies and change with age. Instrumental helping was much more frequent than compassionate helping at 18 months. Furthermore, compassionate helping increased substantially from 18 to 36 months, whereas the frequency of instrumental helping did not change across this same period. Thus, instrumental and compassionate helping are distinct, yet interrelated, subtypes of prosociality.

Instrumental and compassionate helping likely loaded on the same latent factor because they share key motivational or cognitive underlying mechanisms (see below). Sharing scores, on the other hand, loaded on a different factor. Unlike instrumental and compassionate helping, sharing involved a tangible cost to the self—that is, giving up one's own valued resources for the benefit of the experimenter; this feature may have distinguished sharing from the other forms of helping. We note that the specific factor structure of prosocial subtypes may vary across different studies as a function of children's age and features of the methodology (Thompson and Newton, 2013; Knafo-Noam et al., 2015, 2018). For example, in the current study, the two indicators of the sharing latent factor came from the same task, rather than from separate tasks. As well, all measures used structured observations, with the experimenter serving as the target of prosocial action in most of the tasks. Altering these or other features may affect the factor solution. But more important than the specific factor structure is the overall meaning of the results—namely, that prosocial subtypes are both distinct and interrelated. This complex pattern suggests that different facets, or subtypes, of prosocial behavior have both common and unique underlying mechanisms (Knafo-Noam et al., 2015; Davidov et al., 2016).

Common mechanisms that promote multiple forms of prosociality, thereby leading to associations between them, include both motivational and cognitive factors. For example, strong other-oriented motivation, such as concern for others' welfare or sensitivity to others' needs, can compel children to try and assist needy others in different ways (Eisenberg et al., 2016). And social-cognitive capabilities, such as the ability to understand others' needs and wishes (e.g., Theory of Mind, perspective taking), may also promote assistance in multiple situations (Eisenberg et al., 2006). Interestingly, however, broad temperamental dimensions, such as the tendency to show positive affectivity, did not account for the associations between prosociality subtypes in the current study.

The more specific mechanisms contributing to each subtype likely reflect unique elements inherent to specific forms of prosociality. For example, the child's ability to regulate the negative emotional arousal induced by another's distress should be primarily relevant in compassionate helping situations (Davidov et al., 2016), whereas an

understanding of ownership is specifically relevant for sharing (Brownell et al., 2013a). Both the common and more specific cognitive, affective, regulatory, and motivational mechanisms are likely influenced by genetic factors, as well as by environmental factors, such as social interactions with caregivers (Knafo-Noam et al., 2015; Dahl and Brownell, 2019).

4.2. Spontaneous vs. prompted prosocial behavior

The present study was one of the first to delve into the meaning and development of spontaneous vs. cued prosocial behavior. Developmentally, the findings showed that children's tendency to help spontaneously, before any cue regarding helping expectations or how to assist is given, is at least somewhat consistent across situations by early childhood (36 months). Moreover, spontaneity of sharing, in particular, showed consistency from 18 to 36 months. Further research, assessing additional relevant situations in toddlerhood, is needed in order to clarify whether the tendency to assist others spontaneously might already show consistency across situations at this age.

Regarding the meaning of young children's spontaneous vs. cued sharing, some aspects of the findings provided support for a motivational interpretation, and another aspect suggested a cognitive interpretation. According to a motivational interpretation, spontaneous prosocial action reflects a stronger other-oriented motivation compared to cued prosocial behavior, indicating a stronger desire to assist the other and to see the other satisfied; the cognitive interpretation suggests that young children may not assist spontaneously not because they do not care, but because they do not yet understand how to help the other person and thus need cues to overcome the cognitive gap (Svetlova et al., 2010; Wu and Su, 2014). Although different, the two explanations are not mutually exclusive; for example, they may apply to different children or to different situations. Indeed, different features of the current findings appear to support each explanation. The finding that toddlers who at 18 months shared following a non-verbal cue tended to become spontaneous sharers at 36 months is consistent with the cognitive interpretation. Thus, it appears that at a younger age some children needed a cue in order to understand how to assist the other, whereas at a later age those same children no longer needed the cue and were thus able to share spontaneously.

At the same time, the finding that children who acted spontaneously also assisted the other more in the task appears to support the motivational explanation (Pettygrove et al., 2013). Toddlers and young children who shared spontaneously gave the experimenter more of their snack, and children who helped spontaneously dedicated more time and effort to picking up the crayons or to fixing the doll. These findings support the motivational explanation, because if the difference in helping was only due to cognitive barriers, then once children understood (from the cue) how to assist the other, they should have done so to the same extent. This is particularly true in the sharing and crayons tasks, where spontaneous action did not provide a greater opportunity to help (in the sharing task, the procedure ended once the child shared any amount, and in the crayons task the period for spontaneous action was only 5 s); in the broken doll task, the first 30 s enabled spontaneous helping and the task continued when children helped, so children who acted spontaneously had more time to provide greater assistance. However, the consistent findings across the four tasks, and similar prior findings (Pettygrove et al., 2013), indicate that the association between spontaneity and amount of assistance is not merely a confound. Taken together, then, the present findings suggest that spontaneous vs. cued prosocial behavior in young children reflects both cognitive and motivational processes.

The current study also shows that prosocial behavior (sharing) that occurs only after a direct request (i.e., compliance), is likely not motivated by other-oriented concerns. In contrast to toddlers who shared after a non-verbal cue, those who shared only after a direct request at 18 months were unlikely to share spontaneously at 36 months, and were prone to once again share only after a request or not at all at the later age. Together with the fact that they shared the smallest amounts among the children who shared, these findings indicate that compliant prosocial behavior was likely motivated not by concern for the other's well-being, but rather by a more self-focused motive (such as a desire to escape an uncomfortable situation; Eisenberg et al., 2016). More research is needed in order to examine this possibility, not only in sharing tasks (as in the current study) but in additional subtypes of prosociality as well.

4.3. Limitations and future directions

The current findings should be interpreted in light of some limitations. The study included only one sharing task at each age, and thus the sharing latent factor was based on two different responses from the same task (stage and amount), rather than on two independent tasks, which may have affected the results. Moreover, the five prosocial tasks were not counterbalanced, and the mother was the target of assistance only in the assessment of compassionate helping (one task). These features of the design precluded the comparison between the different prosociality subtypes (which indeed was not our focus; we were primarily interested in the associations between the different subtypes).

Furthermore, not all tasks included an option for spontaneous vs. cued helping, and only in the sharing task children were asked directly if they wanted to help the other. As well, in the pen task, the sample for examining spontaneous helping was reduced due to experimenter errors. Thus, it is unclear whether the findings regarding spontaneous helping apply equally to all three subtypes of prosociality, and further research is needed to better understand the meaning of spontaneous prosocial actions in different situations, particularly in toddlerhood. It should also be noted that differences in measurement error could affect the pattern of associations between measures; although we tried to address this issue by examining latent variables, it would also be important to see whether the present results are replicated in future studies, using a variety of different measures.

Nevertheless, this study also has considerable strengths. It uses longitudinal data and multiple observational measures. Furthermore, it is one of the first studies to examine the associations between the three subtypes of prosociality both concurrently and longitudinally, the first to do so from toddlerhood to early childhood, and one of the only studies to address the consistency and meaning of spontaneous vs. cued prosocial action.

The findings raise interesting questions for future research. One future direction is to identify the common mechanisms that lead to the shared variance between subtypes of prosocial behavior in the early years, as well as the mechanisms contributing uniquely to specific subtypes. Motivational, emotional, cognitive, biological, regulatory, and socialization processes may all be implicated; a better understanding of their respective roles and

their interplay will deepen understanding of early prosocial development. Second, it would be of interest to examine whether the associations among subtypes of prosocial behavior in the early years vary as a function of the socio-cultural context. Different cultures emphasize different forms of prosociality (Köster et al., 2016; Davidov and Grusec, in press) and this may alter the development, meaning, and consistency of different prosociality subtypes. Third, from an applied direction, it could be valuable to investigate children who consistently show little or no prosocial behavior during the early years (Paz et al., 2022). Better understanding of the factors that contribute to this tendency, of the risks that this tendency poses for children's adaptive functioning both concurrently and longitudinally, and of the factors that augment or mitigate such risk, would be highly useful for designing effective prevention programs.

In conclusion, the present findings contribute to a better understanding of the early development of compassion and its different manifestations in young children. In particular, they show that already at 18 months, children manifest their capacity to care and their desire to enhance the welfare of others in multiple ways – ways which are distinct yet interrelated, and modestly consistent during early development.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Hadassah Medical Center, Israel's Ministry of Health, and The Hebrew University's IRB. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MD, RR-H, and CZ-W developed the overall study concept. YP, MD, TO, MH, RR-H, and CZ-W contributed to the study design. Data collection was coordinated by YP and TO who also performed a significant portion of the experiments and training of the other experimenters. The coding scheme was adapted by MD, YP and YP, MH, and TO coded the children's responses. YP performed the data analysis and drafted the manuscript, with the aid and supervision of MD and critical comments from TO, MH, RR-H, and CZ-W. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.950160/full#supplementary-material

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Path of intuitive compassion to transform conflicts into enduring peace and prosperity: Symmetry across domains of reiterated prisoner's dilemma, dyadic active inference, and Mahayana Buddhism

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Conflicts are increasingly intensified among the members of the community, making it almost impossible to extend compassion—defined as a wish to relieve others from suffering—from one side to the other, especially when both sides believe that "life is a battle of us the good *vs*. them the evil." Is compassion even relevant to conflicts? The answer depends on how a conflict is framed in one's perception. If a conflict is perceived in a frame of zero-sum competition, then compassion is meaningless in such a "tug-of-war" mindset. Conversely, if perceived in a non-zero-sum frame—as demonstrated in reiterated prisoner's dilemma (rPD) in which two players may interdependently render win–win, lose–lose, win–lose, or lose–win scenarios by their actions—then compassion can help achieve the most preferable outcomes for all in a "dyadic dance" mindset. In this article, we present a path of intuitive compassion by pointing to symmetry across three distinct domains of rPD, dyadic active inference, and Mahayana Buddhism. In each of these domains, conflicts serve as points of bifurcation on a bidirectional path, and compassion as a conflict-proof commitment to carrying out the best strategies—even if assessed for one's own sake only—that consistently produce optimal payoffs in rPD, minimal stress in dyadic active inference, and limitless joy of ultimate enlightenment in Mahayana Buddhism. Conversely, a lack of compassion is caused by invalid beliefs that obscure the nature of reality in these domains, causing conflicts to produce even more conflicts. These invalid beliefs are produced by mistakes of over-reduction, over-separation, and over-compression in the mind, and therefore, a person's mindset is overly compressed from a multidimensional frame to a one-dimensional frame. Taken together, intuitive compassion is not about how to balance one's self-serving goals with altruistic ones. Rather, it is a conflict-proof commitment to transforming conflicts into enduring peace and prosperity according to the ultimate nature of reality. The work presented here may serve as a preliminary science-informed introduction to a genre of time-tested compassion meditations, i.e., *lojong* mind training, for the world laden with conflicts, starting from the conflicts in close relationships to those in geopolitics.

KEYWORDS

conflict, intuition, compassion, Mahayana Buddhism, dyadic active inference, prisoner's dilemma, *lojong*, meditation

1. Introduction

From two kids competing for a toy to two countries competing for land, conflicts are ubiquitous in communities, either big or small. By *conflict,* we focus on any zero-sum competition between two sides in which a gain for one side means a loss for the other (so the sum for both is equal to zero). By *community,* we refer to a group of *interdependent* entities living together in a specific sphere of existence, ranging from a household to the whole planet. Of course, conflicts are only the tip of the iceberg of deeper systemic problems in a community, and therefore, conflicts will not cease until the underlying problems are addressed and cease to exist. Unfortunately, efforts to create social and economic conditions that favor cooperation and care over dominance and control are often met with great difficulty (Gilbert, 2021). There are many threats to the unity of a community, either coming from inside, such as a few elites exploiting the rest of the community in a winner-takes-it-all manner (Giridharadas, 2019), or from outside, such as disinformation campaigns by hostile foreign entities weakening the cohesion and unity at home (U. S. Department of State et al., 2022).

When more people are frustrated by various systemic problems, people will look for quick solutions to fix the problems in polarizing ways. However, actions to fix outer problems may originate from problems within our mind such that conflicts may be proliferated by those actions. Unfortunately, when community members are too occupied in in-fighting, they fail to be united against their common threats and, conversely, their common threats will exploit any in-fighting to further weaken their community. For example, people in the United States are overexposed to disinformation-saturated social media to the extent that there is no consensus on almost all public affairs, e.g., abortion right, gun right, climate change crisis, universal healthcare, vaccination, mask wearing, or even the legitimacy of the results of the 2020 Presidential election in the society. Polarization is at a historical high with deep and extensive partisan antipathy (Pew Research Center, 2014), and such divide grows even wider when facing the COVID-19 pandemic—the supposedly common threat that should have united the people (Pew Research Center, 2020). Public trust in the government has been eroding over decades, and ironically, a political party member's trust in government can go higher or lower, depending on whether the president is one of *us* or *them*, respectively (Pew Research Center, 2022). Many people in the United States seem to be influenced by the meme of "*life is a battle of us the good and them the evil*". As this meme is a mixture of "good intention" (caring for others) and "bad idea" (at the expense of the opponent's humanity) (Lukianoff and Haidt, 2018), a firm grip of it may proliferate, rather than eliminate, conflicts.

As problem-solving requires a community to weather through one conflict after another until underlying problems are appropriately addressed and uprooted, each conflict in the community is like a steppingstone on a bidirectional path (refer to Figure 1 for an illustration). How community members walk on each steppingstone will decide which direction they are heading on the path, either forward to a future with fewer conflicts and more peace and prosperity or backward to the opposite. To strengthen the capacity of members in a community to move in a desirable direction on the path is to give the community a fighting chance to uproot its problems underlying conflicts.

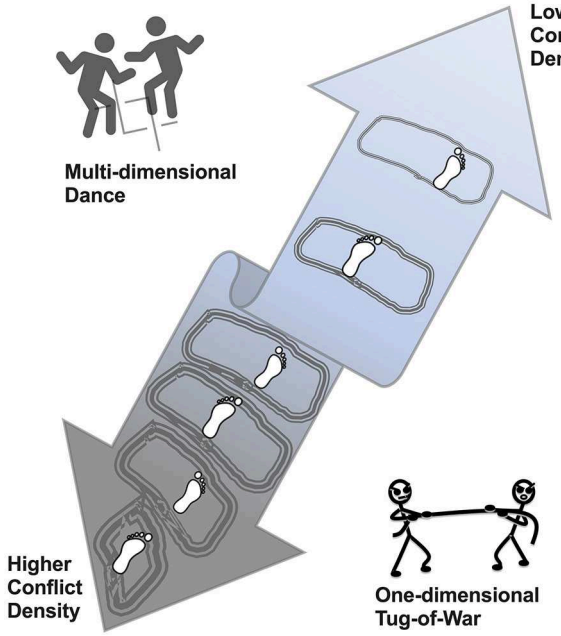

FIGURE 1
An illustration of a path for a dyadic relationship like reiterated prisoner's dilemma. The central double-arrow ribbon symbolizes the bidirectional path for movement of a dyadic relationship such as that between players in a reiterated prisoner's dilemma. Inside the ribbon, irregular shapes symbolize conflicts as stepping stones on the path, wherein each conflict means that there is a win–lose or lose–win scenario happening in the reiterated prisoner's dilemma. The footprints on those stepping stones symbolize a player's movement in a direction from bottom to top, showing that the conflict density would decrease along the way, probably due to his or her practice of Tit-for-Tat with Forgiveness strategy. The icon on the upper left corner indicates that the nature of the reiterated prisoner's dilemma is non-zero-sum, like a multidimensional dance. The icon on the lower right corner indicates that the nature of the reiterated prisoner's dilemma is misattributed to zero-sum, like a one-dimensional tug-or-war.

Along this line, previously, we postulated the neural basis underlying the bifurcation of conflict response in a dyadic active inference framework and introduced compassion as an intervention that aims to ensure that each conflict response is heading in the right direction (Ho et al., 2021).

In this article, we add the Game Theory of reiterated prisoner's dilemma (rPD) (Poundstone, 1992) to our previous work and present a path of intuitive compassion (PIC) that points to a symmetry across three distinct domains, namely, rPD, dyadic active inference, and Mahayana Buddhism. We describe these domains in the following order, with a geometric form, i.e., a regular tetrahedron, to represent their theoretical and practical symmetry in Figure 2.

The first domain is the theory and practice of rPD. rPD demonstrates that mutual cooperation is not only evolutionarily plausible but also preferable under certain circumstances. In practice, a strategy, i.e., Tit-for-Tat with forgiveness (TTF), is mathematically proven to yield the most favorable outcomes in rPD. The theory and practice aspects of rPD are

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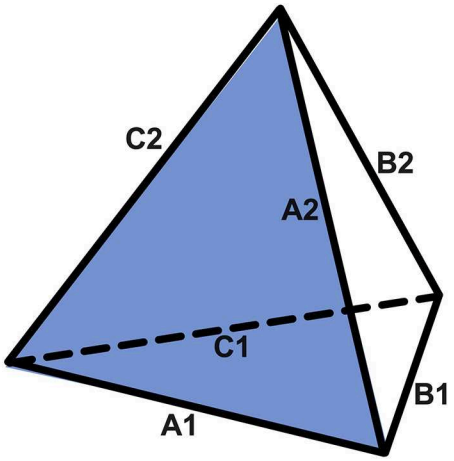

FIGURE 2
A regular tetrahedron as a geometric representation of the symmetry across domains of rPD, dyadic process, and Mahayana Buddhism. There are six sides of equal length in a regular tetrahedron, with three sides that form the bottom (A1, B1, and C1)—representing the theoretical aspects of rPD, dyadic processes, and Mahayana Buddhism, respectively—and three sides that point toward the apex of the regular tetrahedron (A2, B2, and C2)—representing the practical aspects of rPD, dyadic processes, and Mahayana Buddhism, respectively. The symmetry in the theoretical aspects is represented by the basal regular triangle that is formed by A1, B1, and C1: A1 refers to interactive payoff matrices and associated mathematical requirements in rPD; B1 refers to dyadic processes modeled as two strongly coupled active inference engines; and C1 refers to the wisdom that directly realizes the ultimate nature of reality according to Mahayana Buddhism. Likewise, the symmetry in the practical aspects is represented by those apex-oriented sides, A2, B2, and C2: A2 refers to the best winning TTF-like strategies in rPD; B2 refers to the methods to maintain a conflict-proof intersubjectivity in strongly coupled dyads; and C2 refers to a path that inseparably combines compassion and wisdom. The unity of the regular tetrahedron is made possible because all three domains are fundamentally based on the same ultimate nature of reality, i.e., effects are the interactive products of causes by conditions.

represented as the sides A1 and A2 of the regular tetrahedron in Figure 2, respectively.

The second domain is the theory and practice of dyadic processes. We re-introduce our dyadic active inference model and explain how invalid beliefs can hijack a person's active inference engine. In practice, we introduce key dyadic concepts underlying intersubjectivity and stress reduction that are highly analogous to TTF-like strategies in rPD. The theory and practice aspects of dyadic processes are represented as the sides B1 and B2 of the regular tetrahedron in Figure 2, respectively.

The third domain is the theory and practice of Mahayana Buddhism. We introduce classic texts by two co-founders of Mahayana Buddhism, i.e., Aryas Nagarjuna and Asanga, in the context of rPD and dyadic active inference. In practice, we introduce a genre of meditations, i.e., *lojong* mind training. Like a peacock that feeds on poisons to transform poisons into splendor, a well-versed *lojong* practitioner feeds on conflicts to transform conflicts into peace. We identify key premises underlying *lojong* practices. The theory and practice aspects of Mahayana Buddhism are represented as the sides C1 and C2 of the regular tetrahedron in Figure 2, respectively.

2. Theory and practice in reiterated prisoner's dilemma

The art of transforming conflicts starts from developing the discernment of zero-sum vs. non-zero-sum mindsets in which one perceives conflicts. We use a one-dimensional tug-of-war as the working metaphor for the former and a multidimensional dyadic dance for the latter. In a tug-of-war (and many sport games), the outcome of the game (winner and loser) is decided by the difference between two opposing teams' performances, so the best strategy is to *conquer* (out-perform) the opponent. In contrast, in a dyadic dance, the outcome of the game depends on the interaction between two players' games, as demonstrated in the prisoner's dilemma (Poundstone, 1992).

In prisoner's dilemma, two gang members, namely, Alice and Bob, are caught by the police, and the police do not have sufficient evidence to convict both of them on the principal charge, so they offer Alice and Bob a binary choice, either betraying their partner (Defect) or remain silent (Cooperate). The outcomes (payoffs) of Alice and Bob's plays consist of two scenarios that are fair to both Alice and Bob (a win–win and a lose–lose scenario) and two scenarios that are unfair to either Alice or Bob (a win–lose and a lose–win scenario) as follows.

(1) The win–win scenario: If both Alice and Bob remain silent (Cooperate), they will receive an equal amount of payoff, e.g., both serving 1 year in prison on a lesser charge. In this case, the Payoff for Alice and Bob is denoted as (R, R), respectively, where $R = -1$.
(2) The lose–lose scenario: If both of them betray the partner (Defect), Alice and Bob will receive an equal amount of payoff, e.g., both serving 2 years in prison, denoted as (P, P), where $P = -2$.
(3) The win–lose scenario (unfair to Bob): If Alice defects but Bob cooperates, Alice will receive a greedy payoff (G) (e.g., be set free, $G = 0$) and Bob will receive an unfairly punishing payoff (U) (e.g., serve 3 years in prison, $U = -3$). The payoff for Alice and Bob is denoted as (G, U), respectively, where $(G, U) = (0, -3)$.
(4) The lose–win scenario (unfair to Alice): If Alice cooperates but Bob defects, Alice will serve 3 years in prison (U) and Bob will be set free (G), denoted as (U, G), where $(U, G) = (-3, 0)$.

The generalized payoff matrix is listed in Table 1. The values in the payoff matrix follow the order:

$$G > R > P > U$$

Note that in the example given above, the payoff is measured as (-1) times the number of years to serve in prison, i.e., $(G, R, P, U) = (0, -1, -2, -3)$.

When the same two players play PD repeatedly over time and they can remember the opponent's immediately preceding play, as

TABLE 1 Generalized payoff matrix of prisoner's dilemma.

Payoff matrix [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$]		Bob's play	
		Cooperate	Defect
Alice's play	Cooperate	Win-win (R, R)	Lose-win (U, G)
	Defect	Win-lose (G, U)	Lose-lose (P, P)

in a Markov chain, rPD is at play. An additional requirement

$$2R > G + U$$

is needed to make rPD in favor of the win–win scenario relative to other scenarios. This additional requirement "makes the pie bigger" for the win–win scenario than that in the win–lose and lose–win scenarios, as the sum of the payoffs for Alice and Bob in the win–win scenario (2R) is greater than those in the win–lose and lose–win scenarios (G + U). For each player, this additional requirement can make the repetition of mutual cooperation (i.e., expected payoff = R) more preferable to alternating between win–lose and lose–win indefinitely [i.e., expected payoff = (G + U)/2]. *This additional requirement is the key that leads to enduring peace—meaning that there is no cyclic conflict between Alice and Bob—and prosperity— meaning that both Alice and Bob will gain more than otherwise—in rPD.*

In the prisoner's dilemma, the payoff is not solely determined by one's own play unilaterally, as Axelrod stated:

> *"...what is best depends in part on what the other player is likely to be doing. Further, what the other is likely to be doing may well depend on what the player expects you to do."* (Axelrod, 1984)

Essentially, a player's payoff in rPD is consistent with the notion in Madhyamaka Buddhist Philosophy that effect is an interactive product of cause by condition (Ho et al., 2022), denoted as follows.

$$\text{Effect} = \text{Cause} \times \text{Condition}$$

Here, the effect is one player's payoff, the cause is the player's own play (Cooperate or Defect), and the condition is the opponent's play (Cooperate or Defect). So, the payoff for Alice and Bob is denoted as

$$\begin{aligned} Payoff_{(Alice)} &= Play_{(Alice)} \times Play_{(Bob)} \\ Payoff_{(Bob)} &= Play_{(Bob)} \times Play_{(Alice)} \end{aligned}$$

In practice, there are several archetypical strategies in playing rPD, including Random, Cooperator, Defector, Alternator, Nice-unless-Grumpy, and Tit-for-Tat. In Random, the play of Cooperate or Defect is chosen randomly. In Cooperator, the player always cooperates. In Defector, the player always defects. In Alternator, the player alternates between cooperating and defecting. In Nice-unless-Grumpy, the player defects only after a certain level of grumpiness that increases when the opponent defects and decreases when the opponent cooperates. In Tit-for-Tat, the player starts with a cooperative play and, starting the second trial, its current play ("tit") simply mimics what the opponent did the last time ("tat"). When different strategies are pitted against each other in tournaments repeatedly, Tit-for-Tat robustly emerges as the winning strategy over and over again, demonstrating the value of (1) not being the first to defect, (2) being somewhat forgiving, and (3) being provokable in the sense that the opponent's first defection will be surely retaliated by choosing the play of Defect (Axelrod, 1980a,b).

However, even if both players jointly adopt the Tit-for-Tat strategy, they are prone to a "death spiral" where a one-time, single-bit error in either player's play, e.g., when one agent defects and the opponent cooperates, will lead to a never-ending alternating scenario between cooperation and defection, yielding a lower expected payoff, (G + U)/2, than the expected payoff, R, of repeated mutual cooperation. To escape this "death spiral", a strategy called "Tit-for-Tat with Forgiveness" (TTF) can be employed. In this modified strategy, when the opponent defects, a player employing this TTF strategy will occasionally cooperate on the next play despite the opponent's play on the previous trial, and the exact probability that a player will forgive the opponent's defection depends on his or her opponent's behaviors. To maintain the reciprocity, the opponent's very first defection will not be forgiven in TTF.

TTF-like strategies in rPD appear to have the following features (Axelrod, 1984):

1. *Nice*: A successful player shall not be the first to defect. This feature prevents the player from getting into unnecessary trouble.
2. *Reciprocating*: A successful player must reciprocate both cooperation and defection, and therefore, it should be provoked by the very first defection by the opponent and consequently retaliate against the opponent's defection in the previous play, except occasional forgiveness. This feature discourages the opponent from persistently trying to defect.
3. *Forgiving*: A successful player must also be forgiving sometimes, despite the fact that the opponent just defected in the previous play. This feature helps restore mutual cooperation and reduce the likelihood that both parties will get into long runs of revenge and counter-revenge.
4. *Non-envious*: A successful player is not envious of the other player's success, i.e., not striving to score more payoff than the opponent.

Due to the clarity of the behaviors of a player employing TTF, other players in a tournament will come to adapt to TTF as well (Axelrod, 1984). The *contagiousness* of TTF has been corroborated in rPD tournaments that used machine-learning algorithms to simulate the evolution of rPD (Surma, 2019).

In summary, when conditions are suitable (i.e., G > R > P > U and 2R > G + U in the payoff matrix), TTF-like strategies are not only evolutionarily plausible but also robustly preferable for both players to earn as much payoff as possible in practicality, as noted in the book "the evolution of cooperation" (Axelrod, 1984):

> *"If a nice strategy, such as TIT FOR TAT, does eventually come to be adopted by virtually everyone, then individuals using this nice strategy can afford to be generous in dealing with any[sic] others. In fact, a population of nice rules can also protect*

> *itself from clusters of individuals using any other strategy just as well as they can protect themselves against single individuals... These results give a chronological picture for[sic] the evolution of cooperation. Cooperation can begin with small clusters. It can thrive with rules that are nice, provocable, and somewhat forgiving. And once established in a population, individuals using such discriminating strategies can protect themselves from invasion. The overall level of cooperation tends to go up and not down. In other words, the machinery for the evolution of cooperation contains a ratchet.*" (Axelrod, 1984)

Based on the analysis described earlier, we postulate the following hypothesis:

Hypothesis 1: *When two players are engaged in an rPD-like relationship, a player's commitment to following TTF-like strategies will ensure the possibility to transform conflicts (alternating between win–lose and lose–win scenarios) into enduring peace and prosperity (repeated win–win scenarios).*

3. Theory and practice in dyadic active inference

Symmetrically, the four properties of TTF-like strategies, namely, nice, reciprocate, forgiving, and non-envious, are highly consistent with the principles that we have identified in our active inference framework for dyadic interactions, i.e., maintaining symbiotic benevolence and mitigating problems of under-coupling and over-mentalizing to promote stress reduction, compassion, and intersubjectivity, and we have elucidated underlying neural and theoretical bases in a series of articles (Ho et al., 2020, 2021, 2022). For a very brief introduction of dyadic active inference, refer to Box 1. We hereby summarize the take-home messages from our previous work and then refute the validity of the meme of "us the good vs. them the evil" accordingly.

3.1. Summary of take-home messages from our previous work

3.1.1. A person is an active inference engine

An active inference model is a formal model postulating that a living entity, e.g., a person, is functionally an active inference engine that strives to adapt to the environment by minimizing variational free energy that arises through surprises during person–environment interactions. In its simplest form, the person–environment interactions can be modeled as interactions between external states and the person, and the person can be modeled as an active inference engine consisting of sensory states, active states, and internal states. The sensory and active states of an active inference engine serve as an interface with the environments, including another person in dyadic interaction. The internal state does not directly interact with the environment and contains prior beliefs, plans, policies, or strategies that are updated and optimized through a surprise minimization process (Ho et al., 2022). Refer to Figure 3A for an active inference model of a person and Figure 3B for a heuristic application of this model to a player in PD.

3.1.2. Dyadic coupling between active inference engines and emerging conditional independence between self and other

Parent–child interactions are essential for the development of a person, which means that dyadic processes (person–person interactions) are key to the development of an active inference engine. Although the duality of self and others emerges as a result of apparent conditional independence between two active inference engines, all persons and their environments are functionally connected interdependently when they are placed in a strongly coupled state. Thus, the apparent duality—a person who exists independently of the rest of the world—is just an illusion (Ho et al., 2022). As it is explained later, not realizing the illusory conditional independence between self and others in dyadic interactions is a mistake of *over-separation*.

3.1.3. Two states of an active inference engine

Active inference engines can appear to function in two distinct states, namely, a strongly coupled state and a weakly coupled state (Ho et al., 2022). When two persons' active inference engines are entangled in the strongly coupled state, the input to one person's sensory states is predominantly coming from the output from the other person's active states, and vice versa. When the surprise is minimized during this strongly coupled state, one person's internal states are approximating the other person's internal states, reaching a high level of intersubjectivity—subject–subject understanding of covert events of one's intentions or feelings (Ho et al., 2022). A high level of intersubjectivity enables two persons to understand one another's internal beliefs, plans, policies, or strategies underlying their overt behaviors. Notably, due to the strong coupling, the dyad will imitate one another's actions in a way that is the hallmark of TTF-like strategies in rPD. Refer to Figure 4 for a heuristic model of two active inference engines that are strongly coupled in the context of rPD. Conversely, when an active inference engine is not strongly coupled with another active inference engine, it will reside in a weakly coupled state. In the weakly coupled state, an active inference engine will perceive the world from a self-centered, egoistic perspective, as if the observer were independent of the observed objects that are not relationally interacting with the observer (Ho et al., 2022).

3.1.4. The active inference engine is hijacked by invalid beliefs in dyadic processes

While it is normal for an active inference engine to alternate between a strongly coupled state and a weakly coupled state, it would be a problem if a person fails to establish sufficient intersubjectivity during its strong coupling with another person. If an active inference engine fails to maintain the strong coupling in a dyadic interaction, the surprise, which is proportional to the stress perceived by an active inference engine (Peters et al., 2017), will become excessive and, therefore, harmful to the dyad (Ho et al., 2022). We have proposed that invalid beliefs play a key role

BOX 1 Dyadic active inference framework.

As described with more details previously (Ho et al., 2022), according to Free-Energy Principle (FEP), a living organism is a self-organizing system that maintains its characteristic phenotypic states and avoids surprising deviations from these expected states by generative processes that are self-organizing and self-evidencing (Friston, 2013; Ramstead et al., 2020; Friston et al., 2022). As the physical, biological processes of an organism embody its "best guess" about its environments, on average and over time, the organism tends be attracted to a limited number of attractor states in the space of all possible states, with low entropy or spread in the probability density over the space of possible states, i.e., low variational free energy. Variational free energy is a measure of the upper bound of surprise or prediction error—the difference between the organism's "best guess" beliefs about what caused its sensory states and what it observes. The FEP leverages the principle of surprise minimization to optimize the prior beliefs in the active inference engine by minimizing variational free energy—the upper bound of surprise. There are two ways to minimize variational free energy, namely, perceptual inference and active inference. In perceptual inference, agents strive to update their prior beliefs, while in active inference, agents change their environment (or their sampling of information from the environment) by selecting a plan or policy in a set of prior beliefs that would yield the least expected free energy (Peters et al., 2017). Notably, in FEP, the variational free energy is more of a function of beliefs and expectations in the internal states, rather than a function of the environments hidden from the internal states (Ramstead et al., 2020). In such processes, internal and active states' dynamics are a function of, and only of, a variational free energy bound on surprise, and the belief optimization is implicitly done in the minimization of variational and expected free energy (Friston et al., 2022).

The notion of active inference emphasizes that actions solicit a sensory outcome that informs approximate posterior beliefs about external states of the world. Such generative process in FEP renders a living organism to be participatory, or enactive in soliciting and, therefore, co-creating its perception of the external states, which is very different from a representationalist process by which external states generate sensory states exclusively (Friston et al., 2022). Heuristically, one may consider that an active inference engine is actively self-evidencing what the world should be (known as an enactive account), rather than passively learning to represent what the world seems to be (known as a representationalist account)—a distinction that has been elaborated in the literature (Ramstead et al., 2020).

Inspired by FEP (Friston, 2013), we suggest that a person can be formally modeled as an active inference engine in a multi-level network consisting of four nodes, namely, nodes of sensory states (S), active states (A), internal states (I), and external states or events (E). This network is partitioned into an external state (E) and an active inference engine that consists of the nodes (S) and (A) at a lower level and node (I) at a higher level (see Figure 3.

We need a dyadic active inference model of two agents that are strongly coupled to model dyadic interactions. Just like ice and water are two phases of the same H_2O molecules that behave distinctly (solid and liquid, respectively), the same active inference engine can behave very differently between the phases of weakly coupled and strongly coupled states—while an active inference engine maintains conditional independence between its internal and external states in a weakly coupled state, such conditional independence is diminished in a strongly coupled state, when its external states are no longer a unitary node (E), but rather another active inference engine, such that one engine's active states (A) serve as a primary source of input to the other engine's sensory states (S), and vice versa. In the most strongly coupled state, one person's active states will become total environmental inputs for the other person's sensory states, and vice versa (see Figure 4).

According to our previous work (Ho et al., 2020, 2022), we have identified three inter-related problems that that may impair dyadic interactions that, fortunately, can be mitigated by effective dyadic interventions: (1) *deficient relational benevolence due to invalid beliefs, (2) under-coupling, and (3) over-mentalizing,* as follows:

1) *Deficient relational benevolence:* invalid beliefs prevents the awareness of relational benevolence. As depicted in Figure 4, when two persons (e.g., Alice and Bob as Players 1 and 2 in rPD) are strongly coupled ($\mathbf{A_1 \approx S_2}$ and $\mathbf{A_2 \approx S_1}$), the variational free energy is minimized collectively *if*, and *only if*, the surprise (prediction errors) in one person is minimized without increasing the other's. Therefore, Player 1 can achieve intersubjectivity by minimizing his or her variational free energy through communicative interactions with Player 2, wherein Player 1's prior belief would approximate Player 2's prior beliefs ($\mathbf{I_1 \approx I_2}$). We have postulated that invalid beliefs (*Vikalpas*) will diminish the awareness of relational benevolence and of the prior beliefs of each person's active inference engine (Ho et al., 2021).

2) *Problem of under-coupling:* Under-coupling increases variational free energy. As depicted in Figure 5, when Player 1 engages Player 2's overt behaviors only, Player 1 may reduce Player 2, who serves as Player 1's external states, to a unitary object without its own inner states such as feelings and prior beliefs. Thus, Player 1 would fail to achieve intersubjectivity and find it difficult to reduce stress in either party. For example, when Alice neglects to see that her plays cause Bob to feel negatively and only focuses on how to out-perform Bob, Alice would fail to recognize Bob's attempts to reduce Bob's own variational free energy and therefore Alice's variational free energy during dyadic interactions would increase.

3) *Problem of over-mentalizing:* Over-mentalizing can perpetuate impairments of dyadic interactions. Over-mentalizing can happen when cyclic conflicts render players defensive against one another repeatedly and, therefore, misattributing the other player's defections to malice or character flaw rather than his or her ignorance of the best strategies that involve reciprocal benevolence. Conceptual thoughts (*Vikalpas*) are responsible for the problem of over-mentalizing.

when they hijack the active inference engine, causing problems of under-coupling and over-mentalizing during the time of dyadic interactions (Ho et al., 2022). We postulated that invalid beliefs are nothing but invalid conceptual thoughts (*vikalpas* in Sanskrit) that are enshrouded in our systems by the working of mental fabrication/proliferation (*prapañca* in Sanskrit) (Ho et al., 2021), described later.

3.1.5. A hijacked active inference engine is burdened with excessive stress and weariness

It has been established that chronic stress can accelerate mental and physical weariness and aging (McEwen, 2012). Furthermore, stress can be conceived as a result of excessive variational free energy in an active inference engine (Peters et al., 2017). Stress arising in dyadic interactions can become excessive if an active inference engine is hijacked by invalid beliefs (Ho et al., 2020). Although stress in dyadic interactions can interfere with decision-making (Ho et al., 2014) and caring behaviors (Kim et al., 2015), it can also be mitigated through dyadic interventions, as supported by our neuroimaging studies (Swain et al., 2017; Ho et al., 2020) and systematic review on the efficacy of parenting interventions on parenting stress (Ho et al., 2022).

3.1.6. The post-conflict bifurcation between two incompatible paths

Previously, we identified an entry point of bifurcation between two incompatible post-conflict responses for an individual: (a) attuning to the counterparts' perspectives and needs *despite* the conflicts and (b) blocking the attunement to the counterparts *due to* the conflicts. The post-conflict paths diverge depending on the presence or absence of the valid view of the ultimate nature of reality—that the conflict and its solution are effects of an interactive product of cause by condition. In our previous work, we described the potential neural basis underlying these two paths (Ho et al., 2021). We describe the post-conflict bifurcation in the context of rPD later.

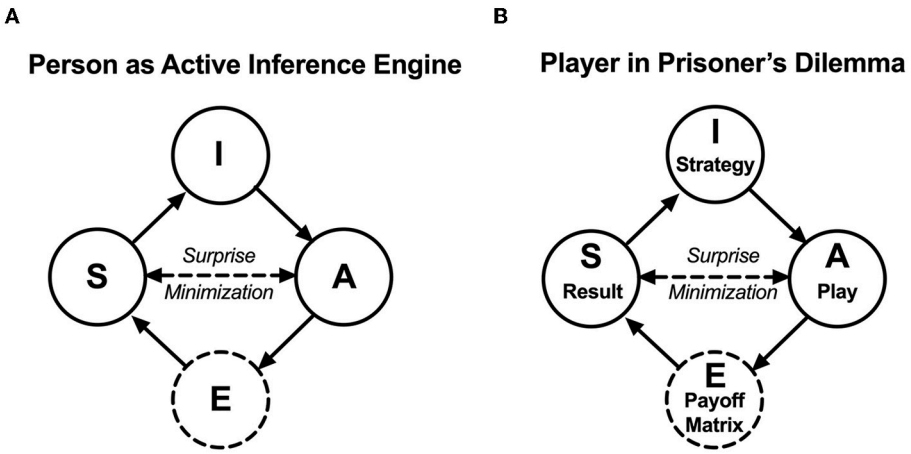

FIGURE 3
(A) An active inference model and its environments: in an active inference model, an adaptive person functions as an active inference engine—consisting of nodes Active State (A), Sensory State (S), and Internal State (I) (solid circles)—interacting with external events in the environments, node External State (E) (dashed circle). In a hierarchical network, (E) represents events from environments at an external level, (S) represents the person's afferent sensory state, and (A) represents the person's efferent active state, both at a lower level, and (I) represents the person's prior beliefs at a higher level. Nodes (E) and (I) do not have direct effects on one another, as they are separated by nodes (A) and (S). The double-arrowed line between (A) and (S) indicates the notion of active inference, that actions solicit a sensory outcome that informs approximate posterior beliefs in the internal states (I) about the external states (E). This is done by minimizing variational free energy—the upper bound of surprise of the active inference. **(B)** Applying the active inference model to reiterated prisoner's dilemma, the nodes (E), (S), (A), and (I) can be equivalent to (Payoff Matrix of rPD), (Result, i.e., the readout of payoff in a trial), (Play of "cooperate" or "defect"), and (Strategy, e.g., Tit-for-Tat), respectively.

3.2. Refuting "*life is a battle of us the good vs. them the evil*"

Here we conduct a logical analysis to refute the notion of "*life is a battle of us the good vs. them the evil*". According to the work by Arya Asanga (circa 380 CE), there are eight types of conceptual thoughts (*vikalpas* in Sanskrit) and three kinds of mental fabrication/proliferation processes (*prapañcas* in Sanskrit) that obscure the realization of ultimate reality (Asanga, 2016, p. 89–96), as follows.

The eight types of invalid conceptual thoughts (*vikalpas*) are as follows:

Type 1. The conceptual thought that conceives of an essential nature.
Type 2. The conceptual thought that conceives of a distinguishing characteristic.
Type 3. The conceptual thought that grasps a collection (of distinguishing characteristics) as a separate entity.
Type 4. The conceptual thought that conceives of an "I".
Type 5. The conceptual thought that conceives of entities as being "mine".
Type 6. The conceptual thought that conceives of entities as being agreeable.
Type 7. The conceptual thought that conceives of entities as being disagreeable.
Type 8. The conceptual thought that conceives of entities as being neither agreeable nor disagreeable, thus leading to an attitude of indifference toward it.

The three levels of mental fabrication/proliferation processes (*prapañca*) are as follows:

Level I. This level of substance provides a basis for the first three types of *vikalpas* (Types 1–3). These three types are beliefs that property exists deterministically in a specific form, identical to its observed appearance, independent of specific circumstances. This substance serves as the basis of *prapañca*, a proliferating process that superimposes ego onto an impersonal process, through which the next levels of substances, and the *vikalpas* supported by them, develop.
Level II. This level of substance is the basis of the next two types of *vikalpas* (Types 4–5). The view of ego is one that erringly grasps a self that is separate from a collection of perishable events, i.e., the "I" who affirms itself to exist, which is the root of all egoistic views. The egoistic views feed an egoistic conceit—a sense of entitlement to justify an event's value as "good" or "bad" according to one's own views, self-affirmingly, e.g., "It's good or bad (because I think so)".
Level III. This level of substance is the basis of the last three types of *vikalpas* (Types 6–8)—which evaluate entities as being agreeable, disagreeable, or neither and give rise to craving, hatred, or ignorance according to circumstances, respectively.

We postulate that the notion of "*us the good vs. them the evil*" may be caused by three major mistakes corresponding to the three levels of *prapañcas*, namely, *over-reduction, over-separation, and over-compression*, which obscure the direct realization of the ultimate nature of reality, described below.

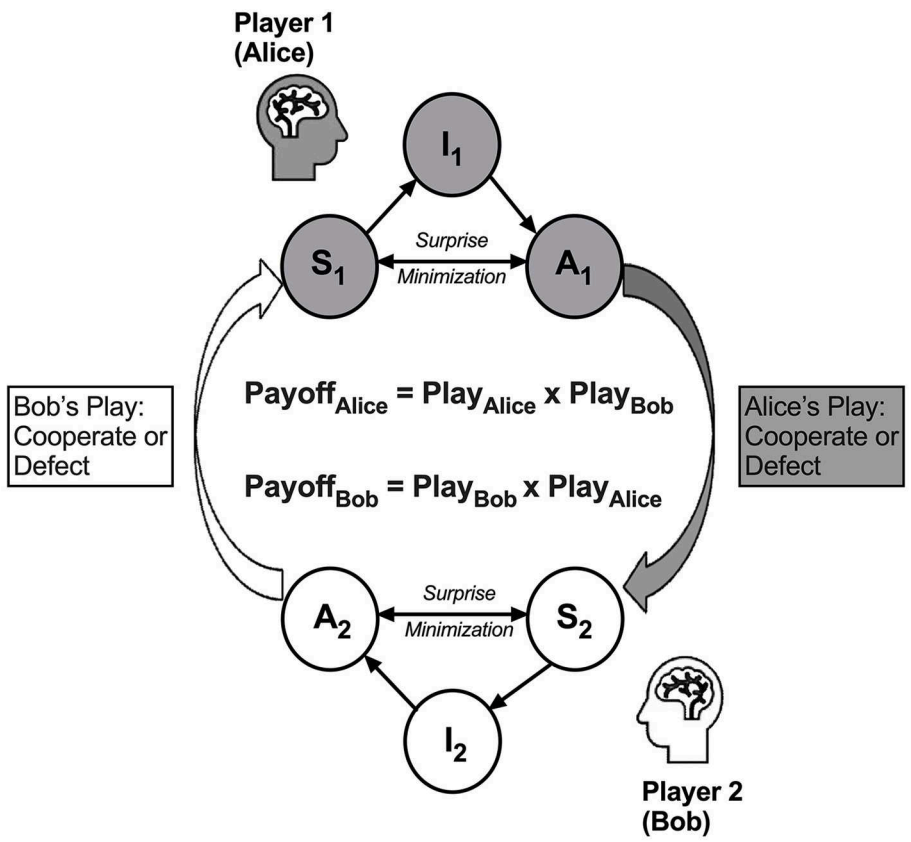

FIGURE 4
Dyadic active inference model in reiterated prisoner's dilemma: when two players (Alice as Player 1 and Bob as Player 2) are strongly coupled, one person's active states outputs become the total inputs of the other person's sensory states, and vice versa, i.e., (A_1) causes (S_2) and (A_2) causes (S_1), the surprise in Persons 1 and 2 are also coupled and thus the strategies in their internal states (I_1 and I_2) are optimized collectively. The results (S_1 and S_2), i.e., payoffs, are determined by the interaction between the players' plays (A_1 and A_2), i.e., $Payoff_{Alice} = Play_{Alice} \times Play_{Bob}$ and $Payoff_{Bob} = Play_{Bob} \times Play_{Alice}$, as if they are performing a multidimensional dyadic dance.

3.2.1. Over-reduction

In accordance with the first level of *prapañca* and the first three types (types 1–3) of *vikalpas*, over-reduction is the most subtle mistake among the three major mistakes discussed here. Over-reduction results from the failure to recognize as many variables as there are operating in dyadic interactions, which makes it impossible for a person to perceive the dependent origination nature of the dyadic interactions.

3.2.2. Over-separation

In accordance with the second level of *prapañca* and the middle two types (types 4–5) of *vikalpas*, over-separation dichotomizes all phenomena into categories of "I/mine" vs. "not I/not mine". The two categories are overly disjointed because the inter-dependent relationship between them is ignored. An over-separation will mislead a player in rPD to think that his or her own payoff will not be an effect of the interactive product of one's own play by the opponent's play.

3.2.3. Over-compression

In accordance with the last level of *prapañca* and the last three types (types 6–8) of *vikalpas*, over-compression confounds multiple dimensions of ownership, actions and feelings, and the outcomes (payoff) in rPD. Over-compression will mislead a player to erroneously think that his or her payoff is a function of a linear contrast between two competing players, pursuing the maximal difference. Obviously, this kind of zero-sum thinking is contrary to the "non-envious" quality in TTF-like strategies. As the differential payoff of own vs. opponent's is positive in the win–lose scenario and zero in the win–win scenario, the player would overestimate the expected payoff of the unfair win–lose scenarios (I win vs. opponent loses), thinking "*what if I can just exploit the opponent and then run away from it*", and, at the same time, the player would underestimate the expected payoff of the win–win scenario if he or she would choose to employ TTF-like strategies.

This logical refutation can be expressed formally based on the fact that, as described above, the payoffs in rPD are the effects of the *non-additive* interaction between two players' actions. If Alice and Bob are trapped by the misbelief of "*us the good vs. them the*

evil", they will misperceive their payoffs to be an additive function of their plays, denoted below:

$$\text{Payoff}_{(\text{Alice})} = \text{Play}_{(\text{Alice})} - \text{Play}_{(\text{Bob})}$$
$$\text{Payoff}_{(\text{Bob})} = \text{Play}_{(\text{Bob})} - \text{Play}_{(\text{Alice})}$$

If laden with such a misperception, Alice and Bob would compete to conquer one another in a zero-sum frame, that is,

$$\text{Payoff}_{(\text{Alice})} + \text{Payoff}_{(\text{Bob})} = 0$$

Such a "tug-of-war" mindset leads them to either cyclic conflicts or endless lose–lose scenarios in rPD. Refer to Figure 5 for a heuristic model of two active inference engines in the "tug-of-war" mindset. Being trapped in cyclic conflicts, worn-out players would not value the utility of being nice, reciprocating, forgiving, and non-envious of others' success and, therefore, forsaking any possibility of employing TTF-like strategies.

Taken together, we postulate the second hypothesis of the present study:

Hypothesis 2: *As a result of the mistakes of over-reduction, over-separation, and over-compression, a player in rPD may mistakenly believe that payoff is a linear function of the players' plays.*

3.3. Practical dyadic concepts in dyadic processes

Previously, we have applied our dyadic active inference framework to make sense of the efficacy of parenting interventions for reducing parenting stress (Ho et al., 2022), wherein we suggested that the strong coupling state between two active inference engines can parsimoniously explain nine dyadic concepts that have emerged in the practice of dyadic processes (Provenzi et al., 2018), as follows:

Mutuality:	Mutual contribution of the interactive partners.
Reciprocity:	Reciprocal influence between interactive partners.
Attunement:	Recognition of one another's intentions underlying actions.
Contingency:	Timely, reciprocal adjustment of affective and behavioral signals.
Coordination:	Bidirectional rhythmic exchanges characterized by specific timing and turn-taking, which facilitates the reciprocal prediction of future behavioral states.
Matching:	Simultaneous exhibition of the same affective and/or behavioral state.
Mirroring:	Exaggerated/marked imitation of trans-modal affective quality in a temporally contingent way.
Reparation:	Transforming unmatched dyadic states to matched dyadic states producing an opportunity to learn interactive strategies and to achieve better stress and emotion regulation.
Synchrony:	Degree of congruence between trans-modal behaviors of two partners that lagged in time.

All of these dyadic concepts are applicable to rPD. First and foremost, because the requirements of rPD's payoff matrix favor mutual cooperation, rPD is consistent with Mutuality and Reciprocity outright. Furthermore, the recognition of the opponent's strategy in rPD reflects Attunement (to one another's intentions). When both players in rPD adapt to employ TTF-like strategies, their "Tit for Tat" can be described as the dyadic concepts of Mirroring (imitation of the partner's last play), Contingency (between the opponent's last play and one's own current play), and Synchrony (as the coherence between plays on both sides over time). When their plays are identical in the win–win or lose–lose scenarios, it is consistent with Matching (the same play simultaneously). The retaliation of a player against the opponent's surprising defection and the return to cooperation if the opponent renews his or her cooperation are consistent with Reparation (by discouraging defections in the future), Reciprocity, and Contingency. The occasional forgiveness of the opponent's defections facilitates the reinstatement of mutual cooperation, which is key to Reparation.

3.4. Two examples of rPD in close relationships

Here we discuss two examples of rPD analysis in partner–partner relationships. We discuss the application of Mahayana Buddhist meditation to partner–partner relationships later.

For example, Alice and Bob are partners. They will be happy if their daily interactions yield win–win scenarios most of the time, with the sporadic win–lose or lose–win scenarios that may happen from time to time. In general, a happy partnership will be sustained by both partners if they will exhibit behaviors that are nice, reciprocating, forgiving, and non-envious (or non-dominating), all of which are consistent with TTF-like strategies. Conversely, they will be unhappy if they often find themselves trapped in lose–lose scenarios or constantly alternating win–lose and lose–win, but rarely experience win–win scenarios together due to the lack of forgiveness and reciprocity that are crucial to the reparation of an ongoing relationship.

We assume that Alice and Bob's relationship can be simplified to have a payoff matrix that meets the two requirements, $G > R > P > U$ and $2R > G + U$, to qualify their intimate relationship as rPD. Each of them has two binary plays, Conjoin and Dissociate, which are mutually incompatible, with the former defined as any actions that will strengthen their togetherness or shorten their distance and the latter defined as any actions that will weaken their togetherness or lengthen their distance.

There are two versions of rPD for Alice and Bob as partners, depending on how the payoff matrix is defined in their relationship. In the first version, Conjoin is functionally equivalent to Cooperate, and Dissociate is functionally equivalent to Defect, such that the

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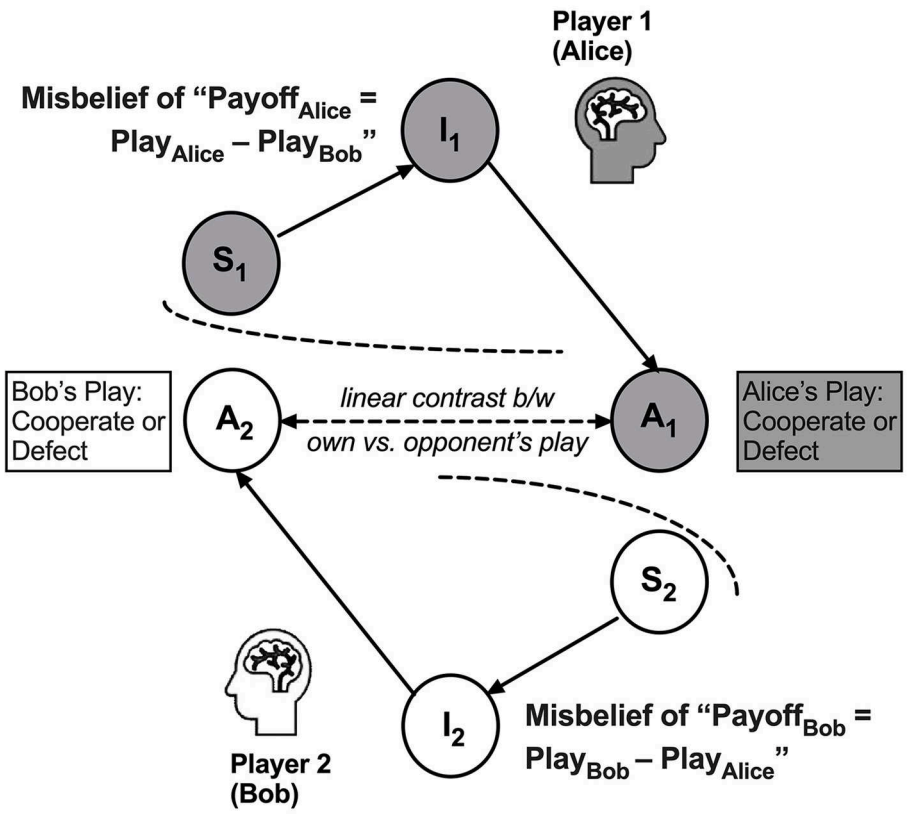

FIGURE 5
An under-coupling ensues in a dyadic system when the players become blind to one another's active inference engine, especially those covert, sensory, and internal states (S_2) and (I_2). Due to the under-coupling, the players tend to misattribute that the results are determined by the linear contrast between their plays, i.e., misbeliefs of $Payoff_{Alice} = Play_{Alice} - Play_{Bob}$ and $Payoff_{Bob} = Play_{Bob} - Play_{Alice}$, as if they are competing in a zero-sum one-dimensional tug-of-war.

TABLE 2 The payoff matrix of Alice and Bob's relationship in favor of union.

Payoff matrix [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$]		Bob's play	
		Conjoin	Dissociate
Alice's play	Conjoin	Win-win (R, R)	Lose-win (U, G)
	Dissociate	Win-lose (G, U)	Lose-lose (P, P)

TABLE 3 Payoff matrix of Alice and Bob's relationship in favor of divorce.

Payoff matrix [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$]		Bob's play	
		Dissociate	Conjoin
Alice's play	Dissociate	Win-win (R, R)	Lose-win (U, G)
	Conjoin	Win-lose (G, U)	Lose-lose (P, P)

payoff of win–win scenario [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$] = (R, R) is attained if both players Conjoin, and the payoff of lose–lose scenario [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$] = (P, P) is attained if both players Dissociate, as denoted in Table 2. If both players follow TTF-like strategies, then their union will be favored.

In the second version, Conjoin is functionally equivalent to Defect, and Dissociate is functionally equivalent to Conjoin, such that the payoff of win–win scenario [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$] = (R, R) is attained if both players Dissociate, and the payoff of lose–lose scenario [$Payoff_{(Alice)}$, $Payoff_{(Bob)}$] = (P, P) is attained if both players Conjoin, as denoted in Table 3. If both players follow TTF-like strategies, then their break-up will be favored.

Whether the win–win scenario means that both players do the same action of one kind (Conjoin) or the other (Dissociate) depends on whether both players agree to consider union or divorce to be their win–win scenario. Thus, although these two examples do not have the same outcome in terms of union or divorce, they are the same in terms of yielding robustly favorable win–win scenario's payoff (R, R) for the dyad.

4. Theory and practice of Mahayana Buddhism

Mahayana Buddhism (a.k.a. Great Vehicle Path to Enlightenment) represents a path to transform conflicts into enduring peace and prosperity, with a commitment to the fulfillment of self and others' aims *equally*. The combination of compassion and wisdom is a common quality throughout the base, path, and ultimate attainment of Mahayana Buddhism, as stated by one of the greatest Tibetan Buddhist teachers, Gelek Rimpoche (1939–2017):

> *"The essence of compassion is wisdom.*
> *The essence of wisdom is compassion."*

Accordingly, we hereby coin the term *intuitive compassion* to refer to wisdom that is not separate from compassion and compassion that is not separate from wisdom. Mahayana Buddhism cultivates intuitive compassion gradually in the following order:

1. Compassion (and benevolence),
2. Great compassion,
3. Conventional enlightenment-oriented mind, and
4. Ultimate enlightenment mind.

According to Buddhist definitions, compassion (*karuṇā* in Sanskrit) refers to the wish that others be free from suffering, and benevolence (*maitri* in Sanskrit) refers to the wish that others be happy (Buswell and Lopez, 2013). Compassion is a seed for great compassion (*mahākaruṇā* in Sanskrit), which is defined as the wish to free *all sentient beings* from suffering, which is distinguished from compassion by its scope (all sentient beings) and its agency (one personally seeks to alleviate the suffering of all other beings) (Buswell and Lopez, 2013). Great compassion is a seed for a conventional enlightenment-oriented aspiration (*bodhicitta* in Sanskrit) that propels those so-called enlightenment-oriented sentient beings (*bodhisattvas* in Sanskrit) to attain the wisdom that can enable them to fulfill self and others' aims *equally* (Buswell and Lopez, 2013). The combination of sufficient wisdom and *conventional bodhicitta* will enable the practitioner to attain the *ultimate bodhicitta* (*paramārthabodhicitta* in Sanskrit), which refers to the bodhisattva's direct realization of the ultimate truth (Buswell and Lopez, 2013). Ultimately, the practitioner who completes this path will attain the inseparable union of compassion and wisdom—intuitive compassion. We consider intuitive compassion a functional synonym to ultimate bodhicitta, for the reasons provided later.

One way to understand this developmental process is to note that the ever-broadening scope of compassion in this graded path parallels the ever-broadening scope of one's *identification—treating someone's conditions as if one's own without discrimination*. In the beginning, a practitioner can only identify with those near and dear to him or her, such as a parent's natural compassion and love for his or her child, which is supported by neurobiological factors (Swain and Ho, 2017; Swain et al., 2019; Eslinger et al., 2021). Then, progressively, he or she can identify with those "*friends*" who support his or her interest, then with those "strangers" who seem unrelated to his or her interest, then with those "enemies" who are in conflict with his or her interest. Thus, eventually, the practitioner identifies with all sentient beings *equally*. With each and every person that he or she identifies with additionally, the practitioner maintains a commitment to attaining self and other's aims through his or her own work of compassion (when the aim is to be free from suffering) and benevolence (when the aim is to be happy). As such commitment continuously calls for more know-how to solve more problems that are brought on by *identifying* with an ever-increasing number of people, the practitioner aspires the total enlightenment to ensure that he or she can complete the path. In this way, the ever-expanding identification with others will propel the practitioner to accumulate more merits conducive to intuitive compassion along the way.

From this perspective, it becomes clear that the practitioners who are committed to developing intuitive compassion will accept a premise that is not accepted otherwise, which is stated in the following hypothesis:

> **Hypothesis 3**: *A PIC practitioner will identify with every sentient being that he or she engages, seeing them as someone with whom he or she has been playing rPD indefinitely, together with an invariant commitment to transform conflicts into enduring peace and prosperity, regardless of their current relationship as friends, strangers, or enemies.*

This hypothesis can find support in a pithy summary of Mahayana Buddhism composed by Jetsün Drakpa Gyaltsen (1147–1216), entitled Parting from Four Attachments, as follows:

> "If you are attached to this life, you are not a true spiritual practitioner
> If you are attached to *saṃsāra*, you have no renunciation
> If you are attached to your own self-interest, you have no *bodhicitta*
> If there is grasping, you do not have the (proper) view."

The attachment here refers to the eighth or ninth of the twelve links of dependent origination (*pratityasamutpāda* in Sanskrit), namely, craving (*tṛṣṇā* in Sanskrit) or clinging/attachment (*upādāna* in Sanskrit), respectively, and it is followed by the tenth link, becoming (*bhava* in Sanskrit). Craving is defined as the desire to keep a feeling of pleasure or to separate from a feeling of pain, or as a non-diminution of a neutral feeling. Clinging/attachment is a stronger and more sustained type of attachment, which is said to be of four types: (1) clinging to sensuality (*rāga* in Sanskrit), which is a strong attachment to pleasing sensory objects; (2) clinging to false views and speculative theories (*dṛṣṭi* in Sanskrit); (3) clinging to faulty disciplinary codes and superstitious modes of conduct (*śīlavrataparāmarśa* in Sanskrit); and (4) clinging to mistaken beliefs in a permanent self (*ātmavāda* in Sanskrit), i.e., the attachment to the transitory mind and body as a real I and mine. In the context of dependent origination (PRATITYASAMUTPĀDA), craving (tṛṣṇā) leads to the clinging (upādāna) that nourishes the actions that will serve as the cause of "becoming/existence" (bhava), i.e., the next lifetime (Buswell and Lopez, 2013).

Here we interpret these four attachments in the context of rPD. With regard to the first attachment, if an rPD has an end, then

players anticipating the end may defect in the last trial to gain even more payoff, thinking that there would be no future trial for the opponent to retaliate. Likewise, the failure of thinking beyond the end of this lifetime will not value the basis of life, let alone a commitment to help one's enemy. Thus, thinking relationships beyond this lifetime is a necessary condition to uphold the TTF-like strategies in rPD for PIC practitioners; otherwise, he or she is not really on this path.

With regard to the second attachment, accepting that one is playing rPD with a number of others indefinitely, if a practitioner sees an rPD in an invalid frame of zero-sum tug-of-war, the practitioner will misattribute the optimal strategy to those who would not work in non-zero-sum dyadic dances, resulting in cyclic conflicts i.e., *saṃsāra*. Thus, the renunciation of *saṃsāra* requires the refutation of the tug-of-war mindset and conquering-oriented strategies in the endless continuation of the dyadic relationships.

With regard to the third attachment, if one ignores the aims of the other player in rPD, he or she will over-compress a multidimensional dyadic dance into a one-dimensional tug-of-war. If a PIC practitioner is not committed to self and others' aims equally (as in conventional *bodhicitta*), he or she will not try to reframe self and others' mindset to seek the possibility of win–win scenarios in their rPD-like relationships.

With regard to the fourth attachment, as described above based on the Princeton Dictionary of Buddhism (Buswell and Lopez, 2013), any clinging will entrap someone in cyclic conflicts, which are full of wrong conduct codes (e.g., conquering-oriented strategies) and wrong views (e.g., seeing rPD as tug-of-war, based on the misbeliefs of "*us the good vs. them the evil*" and an "I" that is permanent and impervious to the consequences of one's past actions in rPD).

4.1. Arya Asanga's classic summary of Mahayana Buddhism

To relate dyadic active inference to Mahayana Buddhism, we introduce a relatively more elaborated summary of Mahayana Buddhism, excerpted from Arya Asanga's classic text *Bodhisattvabhumi* (Asanga, 2016), as follows (with the bracketed numbering added, to be referred to later):

> "*A bodhisattva who abides in the Great Vehicle's spiritual lineage generates the thought to achieve [1] unsurpassed true and complete enlightenment. The bodhisattva who has generated that thought applies him- or herself to [2] the attainment of one's own aim and that of others. The person who is applying him- or herself to the attainment of one's own aim and that of others finds the means by which to [3] avoid becoming afflicted. The person who remains unafflicted finds the means by which to [4] remain free of weariness. The person who is unwearied finds the means by which to [5] increase his or her roots of virtue. The person who increases his or her roots of virtue ultimately achieves unsurpassed true and complete enlightenment. The person who is pursuing the practices that will accomplish one's own aim and that of others, pursuing the means by which one can avoid becoming afflicted, the means by which one will remain free of weariness, the means by which one will increase one's roots of virtue, and ultimately pursuing the attainment of enlightenment, at the very outset fixes his or her devotion upon the profound and extensive subjects. The person who has fixed his or her devotion upon those subjects will seek them. Having sought them, one will both teach them to others and strive to achieve them by[sic] one's own practice.*
>
> *As one strives to achieve them, one practices in whatever way, in relation to whatever object, and for the sake of whatever purpose one ought to practice. While proceeding in that way, in relation to that object, and for that purpose, one practices in whatever way will bring about [6] the accumulation of merit and the accumulation of wisdom. The person who has accumulated merit and wisdom practices the means by which to avoid abandoning samsara. While practicing in that way, one undertakes to [7] avoid developing the[sic] mental afflictions while remaining in samsara. While practicing in that way, one undertakes to avoid becoming attached to one's own happiness. While practicing in that way, one undertakes to avoid being made weary by the suffering of samsara. While avoiding being made weary by that suffering, a bodhisattva relies upon the inner and outer bodies of teachings and becomes one who is proficient in all the bodies of teachings.*
>
> *Having become a person who knows the various bodies of teachings, [8] one learns what should be taught to whom and how to go about doing so, thereby becoming one who knows the world. The person who knows the bodies of teachings and who knows the world in this way seeks the Dharma in a proper manner. The person who is seeking the Dharma in this way develops the ability to remove all doubts possessed by all sentient beings. As the person who possesses this ability increases his or her merit through[sic] removing the doubts of others, he or she will complete the accumulation of merit. By increasing one's knowledge, one will also complete the accumulation of wisdom. While completing the two accumulations, one will apply oneself in a genuine manner to the practice of meditating upon the spiritual qualities that are conducive to enlightenment.*
>
> *One will also know [9] the proper method of engaging in meditation. The person who has applied him- or herself in this manner will dedicate his or her meditation practice to the attainment of the Great Vehicle's form of complete nirvana, not to the attainment of the form of complete nirvana that is pursued in the vehicles of the listeners or the solitary realizers. The person who possesses this kind of skillful means will retain in his or her mind those teachings that were uttered by all the buddhas and bodhisattvas and that were previously heard. Through the power of meditation, every aspect of the Dharma teachings that one has not previously heard will also become clear. The person who possesses this power of retention and this clarity of understanding will practice the three doors to liberation with the aim of abandoning all the obscurations. The person who practices in this way will become one who is established in[sic] the aim of [10] abandoning one's own forms of erring belief and exaggerated*

> *pride as well as those of others. This constitutes a bodhisattva's form of practice that is excellent in every respect."* (Asanga, 2016, p. 665–667)

4.2. Interpreting the virtuous practices of Mahayana Buddhism in the contexts of rPD and dyadic active inference

Now we try to interpret Asanga's excellent summary of the path to enlightenment, focusing on the phrases that are underlined and numbered in the texts quoted above, to support the following hypothesis:

Hypothesis 4: *The virtuous practices in Mahayana Buddhism will cultivate a practitioner's commitment and capacity to steadfastly employ TTF-like strategies in rPD-like relationships.*

1) "unsurpassed[sic] true and complete enlightenment"

Arya Asanga used this term to refer to the direct realization of the reality of any observed object without obscurations (Asanga, 2016), which can be referred to as intuitive compassion or *ultimate bodhicitta*, as described later. The mind that allows the direct realization of reality is primordially unborn, formless, and knowing (Tenzin Gyatso the 14th Dalai Lama, 2020). Since the nature of the mind is no different between the unenlightened and the enlightened, the path to attain unsurpassed true and complete enlightenment is not a path to manufacture something that is not already present in the nature of the mind. Rather, it is a path to remove all kinds of obscurations, created by *vikalpas* and *prapañca*, which prevent the mind from seeing reality.

2) "attainment[sic] of one's own aim and that of others"

There are two modes of "knowing" (*jñāna in Sanskrit or yeshe in Tibetan*) that are relevant to how we interpret the attainment of one's own aim and that of others in Arya Asanga's work. The first mode of "knowing" is *intuition*, which is direct knowing unmediated by any form of light, sound, molecule, or other media. The primordial nature of the mind, which is clear and knowing, makes intuition possible. Similar to non-local information that is shared immediately and directly between the interacting events in quantum entanglement, intuitive knowledge (*vidyā in Sanskrit or rigpa in Tibetan*) is directly shared between one's own mind and that of others—for examples of a quantum approach to the brain and mind, refer to Atmanspacher (2017). Nevertheless, although intuition already affords the information necessary for someone who strives to attain his or her own aim and that of others, it is mostly obscured by mental afflictions. When a *bodhisattva* practices attaining one's own aim and that of others, he or she will need to perfect his or her intuition of self and other's aims in the process by removing all obscuring afflictions. This is one way to interpret Arya Asanga's notion that "*the bodhisattva who has generated that thought applies him- or herself to the attainment of one's own aim and that of others.*"

The second mode of "knowing" is mediated by physical forms that are imputed through *dependent designation* (*prajñaptisat*). According to the Madhyamaka school of Buddhist philosophy, the existence of a phenomenon is conceptually dependent on the designation, imputation, or convention relevant to the phenomenon under consideration. Madhyamaka Philosophy defines a person as a mere concept based on five aggregates, namely, aggregates of forms, feelings, discriminations, actions, and consciousness. The active inference framework is one of many possible approaches to model and make sense of the mediated, imputed knowledge possessed by a living organism. We speculate that there may be a functional correspondence between the notions of a person as five aggregates and that of a person as an active inference engine. In our dyadic active inference framework, when two persons (as active inference engines) are strongly coupled in dyadic interactions, the driving force of each active inference engine is to minimize its variational free energy, which can only be minimized collectively in the strongly coupled state (Ho et al., 2022). The distinction between self and other is effectively diminished in the strongly coupled state as well. As presented previously, organized life forms emerge in symbiotic ecology in which all entities are symbionts in a "community" (Ho et al., 2021, 2022). In this perspective, the application of oneself to the attainment of one's own aim and that of others is already occurring naturally during the strongly coupled dyadic interaction between any symbionts in symbiotic ecology. Besides, the strong coupling between symbionts enables the plays of cooperation and defection in a myriad of rPD-like situations to be occurring naturally in symbiotic ecology.

3) "avoid[sic] becoming afflicted"

For an active inference engine, to avoid becoming afflicted during dyadic interactions is to avoid being obscured by invalid beliefs in a strongly coupled state. According to Arya Asanga, erring beliefs and exaggerated pride are generated by mental fabrication or proliferation (*prapañca*) of conceptual thoughts (*vikalpas*). We have discussed the types of conceptual thoughts and levels of mental fabrication or proliferation above. Before one can actually help others attain their aims, one should first liberate him- or herself from afflictions by putting a stop to the mental fabrication of conceptual thoughts. Refer to Ch. 18 V. 5 (Nagarjuna, 1995) as quoted below.

Therefore, if one wishes to avoid afflictions, he or she ought to put a stop to actions driven by the fabrication of conceptual thoughts supported by an active inference engine, and the cessation of afflictions is accomplished by (1) preventing these conceptual thoughts from obscuring the realization of the ultimate nature of reality and (2) properly understanding that effects are an interactive product of causes by conditions.

In facing someone on the other side of a conflict, if one can stop his or her own fabrication of conceptual thoughts that conceive the self vs. other antagonisms in the death spiral of a zero-sum conflict, then one has a chance to transform conflicts into enduring peace and prosperity by choosing to employ altruistic TTF-like strategies to meet conflicts in rPD-like interactions.

4) "remain[sic] free of weariness"

When one wants to avoid becoming afflicted during dyadic interactions, even if he or she is strongly coupled with someone from the other side of a conflict, this person's active inference engine can maintain the strong coupling and minimize the stress that is proportional to the variational free energy generated in the dyadic interactions. This will definitely protect the person from chronic stress and weariness without

disconnecting from others during dyadic interactions. Besides, when more and more conflicts are transformed into a series of interactions following altruistic TTF-like strategies, the rewards resulting from win–win scenarios will also diminish the sense of weariness.

5) "increase[sic] his or her roots of virtue"

By minimizing stress and weariness, one can strive to attain an understanding of others, including someone from the other side, and thus come to understand that one can increase the chance to find a win–win scenario as part of post-conflict reparation. By strengthening the skill and capacity to repair the relationship with someone from the other side of a conflict, one increases his or her roots of virtue. Here virtue refers to the potential to realize an outcome desirable for one and others alike.

6) "the[sic] accumulation of merit and the accumulation of wisdom"

The accumulation of merit can be interpreted as the accumulation of capacity and potential to attain win–win scenarios in social interactions. The accumulation of wisdom can be interpreted as a successive eradication of (a) the conceptual thoughts and (b) mental fabrication/proliferation that obscure the ultimate nature of reality.

7) "avoid[sic] developing the[sic] mental afflictions while remaining in samsara"

We interpreted this phrase as meaning that one can prevent invalid beliefs (*vikalpas*) from hijacking one's active inference engine while remaining strongly coupled with other active inference engines that are laden with invalid beliefs. Here, samsara (*saṃsāra* in Sanskrit) refers to cyclic rebirth, which is interpreted as the continuity of invalid beliefs and mental fabrication/proliferation in cyclic conflicts.

8) "one[sic] learns what should be taught to whom and how to go about doing so, thereby becoming one who knows the world"

At this stage, the PIC practitioner on the path to enlightenment learns how to transform conflicts into altruistic peace in numerous kinds of rPD-like situations in the "real" world. She or he will become one who knows the world because she or he cannot accomplish the transformation of the conflicts without knowing what his or her counterpart's intents and plays are.

9) "proper[sic] method of engaging in meditation"

According to Arya Asanga:

> *"It is a virtuous one-pointedness of mind that is possessed by bodhisattvas and is preceded by listening to and reflecting upon the collection of bodhisattva scriptures. It can be either 'mundane' or 'transcendent' in nature. [Moreover] it is a state of mental stability that pertains to quiescence or insight, or both of them in that it constitutes a path in which the two [forms of meditation] are practiced in combination. This should be understood as the essence of the 'meditative absorption' that is practiced by bodhisattvas."* (Asanga, 2016, p. 343)

Here, "meditative absorption" refers to a state in which the practitioner meditates correctly on an object and steadfastly holds the recollection of the object single-pointedly; "mundane" meditation refers to a form of insight meditation that refines the level of consciousness from being coarser to being more tranquil and it results in "freedom from attachment" to any form of illusory egoistic existence (as if one only existed in a weakly coupled state independent of others and the world); "transcendental" meditation refers to a non-conceptual state of mind that is free of both conceptual thoughts (*vikalpas*) and mental fabrication/proliferation (*prapañca*); thus, such transcendental meditation is an antidote for all forms of the illusory egoistic notion of existence (Asanga, 2016, p. 343).

A seminal example of proper meditation for a bodhisattva's practice is known as *lojong* (or *blo sbyong* in Tibetan). According to the Princeton Dictionary of Buddhism, *lojong* is a form of intuitive compassion meditation that specifically trains (*sbyong*) a practitioner to comprehend (*blo*) the ultimate nature of the mind and all phenomena. *Lojong* emphasizes how to see conflicts (and other circumstances that are ordinarily upsetting or depressing) as occasions for happiness in the perspective of dependent origination, e.g., thinking that adversities or difficulties are exhausting negative karmic results of one's own non-virtuous actions in the past. Specific practices include how to transform self-cherishing attitudes into cherishing others, by contemplating the illusory nature of the self, the faults in self-cherishing, and the benefits that flow from cherishing others (Buswell and Lopez, 2013).

Lojong training is based primarily on the techniques for (1) equalizing the attunement to self and others and (2) exchanging self and others by taking other's suffering and giving them self's happiness (Buswell and Lopez, 2013). The first meditative technique refers to three levels of equality that a *lojong* practitioner has to cultivate first as prerequisites (Rimpoche, 2007), as follows:

1. First, dwelling on equality in wishing all beings to be happy and free from suffering
2. Second, dwelling on equality in developing equanimity to friends and enemies in one's own responses, i.e., inhibiting one's attraction to friends and repulsion from enemies
3. Third, dwelling on equality in *identifying with* friends and enemies *equally* as if their sufferings are one's own

The second meditative technique refers to the give-and-take (*tonglen, or gtong len* in Tibetan) to take others' suffering and give one's own happiness. It aims to transform how one relates to the suffering that he or she experiences, from seeing adversities as unwanted stressors to welcoming them as treasury, because these sufferings can (a) exhaust negative consequences of past non-virtuous deeds, (b) enhance one's renunciation of such non-virtues, (c) open one's mind to change, (d) cultivate compassion for others who shared the same experiences, and (e) strengthen the aspiration for realizing the ultimate nature of mind and all phenomena for the benefits of all—as stated in Arya Shantideva's Guide to a Bodhisattva's Way of Life (*Bodhisattvacharyavatara* in Sanskrit), Ch. 6, V.21:

> *Furthermore, suffering has good qualities: through being disheartened with it (cyclic existence is renounced), arrogance is dispelled, compassion arises for those in cyclic existence, evil (non-virtue) is shunned, and joy is found in virtue.* (Shantideva, c. 700/1979)

The single-pointed "mundane" and "transcendental" meditations can be described according to Geshe Chekawa's Mind Training in Seven Points (Tulku, 1998), as follows (original texts in *italics*, with some interpretive notes added in parentheses):

Training in relative bodhicitta

Put all the blame on the one (eradicate ego-grasping *vikalpas*).
Meditate on everyone as kind (as in symbiotic relationships).
Train alternately in the two, taking and giving (*tonglen*).
Begin taking with yourself (taking one's own suffering as a valuable steppingstone on the path).
Mount the two upon the breath (this would need to be taught by a qualified teacher).
There are three objects (friend, enemy, and stranger), three *poisons* (greed, hatred, and wrong view), *and three roots of virtue* (virtuous practices that can transform the poisons).
The following are brief instructions for the post-meditation period (during everyday activities):
Be mindful in order to admonish yourself (the tug-of-war mindset in perceiving conflicts).
Train yourself with the verses during all activities (especially when arriving at a conflict).

Training in ultimate bodhicitta

Having attained stability, be shown the secret (of the ultimate nature of reality).
Consider phenomena to be like a dream (dependent origination).
Analyze the nature of unborn awareness (the nature of mind as clear and knowing).
Even the antidote itself is naturally free (of *vikalpas*).
Focus on the nature of the basis of all, the entity of the path (the basis of all refers to emptiness, i.e., Effect = Cause × Condition, as we postulated here)
Between sessions, be an illusionist (all phenomena are effects of interactive products of cause-by-condition interactions).

We further discuss the symmetry between *lojong* meditation and rPD later.

10) "abandoning[sic] all the obscurations... abandoning one's own forms of erring belief and exaggerated pride as well as those of others"

Arya Asanga suggested that erring beliefs and exaggerated pride effectively obscure the ultimate nature of reality. Thus, to achieve unsurpassed enlightenment, one has to completely abandon any forms of erring belief and exaggerated pride. The erring beliefs are interpreted here as those invalid beliefs that hijack one's active inference engine. The exaggerated pride is interpreted here as the self-centered beliefs about oneself that are impervious to the updating of the prior beliefs despite being strongly coupled with another person's active inference engine, resulting in zero-sum conflicts with others and the attitude of *conquering* others, rather than transforming conflicts into enduring peace and prosperity.

4.3. Symmetry across the domains of rPD, dyadic active inference, and Mahayana Buddhism

We postulate that intuitive compassion is an inherent function—therefore a functional synonym—of *ultimate bodhicitta*, for the following two reasons. First, in Madhyamaka Philosophy, *ultimate bodhicitta* refers to the direct realization of emptiness (*śunyatā* in Sanskrit) as the ultimate truth (Buswell and Lopez, 2013). A direct realization is, by definition, intuitive, i.e., direct perception unmediated by any form of media. According to Arya Nagarjuna (circa 150–250 CE), the emptiness that *ultimate bodhicitta* directly realizes is the dependent origination in all phenomena:

> "Neither from itself,
> Nor from another,
> Nor from both,
> Nor without a cause,
> Does anything whatever, anywhere arise." (Nagarjuna, 1995) Ch. 1 V. 1

Previously, we explained how Arya Nagarjuna's reasoning on emptiness is equivalent to a formal expression of the notion that "effect is an interactive product of cause by condition" (Ho et al., 2022):

$$\text{Effect} = \text{Cause} \times \text{Condition}$$

Notably, this expression is also compatible with the *interactive* payoff matrix in rPD, supporting the conjecture that realizing the ultimate nature of reality will help a player to play optimally in rPD.

Second, the direct realization of the ultimate truth is compassionate in nature because it automatically eradicates *vikalpas* and *prapañcas* that cause all afflictions, according to Arya Nagarjuna:

> "Action and misery having ceased, there is nirvana.
> Action and misery come from conceptual thought (*vikalpas*).
> This comes from mental fabrication (*prapañca*).
> Fabrication ceases through emptiness (*śunyatā*)." (Nagarjuna, 1995) Ch. 18, V. 5

To highlight intuitive compassion as a functional synonym of ultimate *bodhicitta*, we refer to the preamble and Verses 59–70, in *italics*, of Arya Nagarjuna's Commentary on the *Bodhicitta* (*Bodhicittavivāraṇa* in Sanskrit) (Nagarjuna, 2006), with our own interpretive notes added in brackets, as follows:

> "*Devoid of all real entities; Utterly discarding all objects and subjects, such as aggregates, elements, and sense-fields; due to sameness of selflessness of all phenomena, one's mind is primordially unborn; it is in the nature of emptiness. Just as the blessed Buddhas and the great bodhisattvas have generated the mind of great awakening, I too shall, from now until I*

> *arrive at the heart of awakening, generate the awakening mind in order that I may save those who are not saved, free those who are not free, relieve those who are not relieved, and help thoroughly transcend sorrow [in] those who have not thoroughly transcended sorrow. Those bodhisattvas who practice by means of the secret mantra, after having generated awakening[sic] mind in terms of its conventional aspect in the form of an[sic] aspiration, must [then] produce the ultimate awakening mind through the force of meditative practice.*" (Nagarjuna, 2006)

Verse 59.

> *Starting with ignorance and ending with aging*
> *All processes that arise from*
> *The twelve links of dependent origination*
> *We accept them to be like a dream and an illusion.*

[The ignorance here refers to the obscuration of the ultimate nature of reality; the twelve links of dependent origination, therefore, can be understood as the working of *vikalpas* and *prapañcas* that hijack an active inference engine to cause malfunctioning in dyadic interactions.]

Verse 60.

> *This wheel with twelve links*
> *Rolls along the road of cyclic existence*
> *Outside this, there cannot be sentient beings*
> *Experiencing the fruits of their deeds.*

[A person whose *vikalpas* and *prapañcas* obscure the nature of rPD-like dyadic interactions will be trapped in cyclic conflicts due to the misbelief of "*us the good vs. them the evil.*"]

Verse 61.

> *Just as in dependence upon a mirror*
> *A full image of one's face appears*
> *The face did not move onto the mirror*
> *Yet without it, there is no image [of the face].*

[Here, the relationships among (a) a person, (b) one's face, (c) the mirror, and (d) the image of the face serve as a metaphor for the relationships among (a') an observer (subject), (b') an object to be observed, (c') an interaction between the observer and the object being observed, and (d') what the observer perceives the observed object to be *like* (*qualia*), respectively. This verse is a metaphoric expression of the notion that Effect = Cause × Condition, wherein Effect refers to "the image of a face," i.e., the qualia that the observer perceives the face to be like ("face-ness"), Cause refers to the person in "one's face," i.e., the observer, Condition refers to the "face" to be observed, and the operation "X" refers to "the mirror," i.e., the interaction. This metaphoric expression describes the nature of the mind, as further discussed later. The metaphor also implicates the meaning of intuition in intuitive compassion, as the observer's perception of the observed ("the image of face") is directly caused by the interaction ("mirror") between the observer and the object to be observed ("the face"), unmediated by any third-party media.]

Verse 62.

> *Likewise, aggregates recompose in a new existence*
> *Yet the wise always understand*
> *That no one is born in another existence*
> *Nor does someone transfer to such existence.*

[In the context of conventional phenomena, such as dyadic interactions between two active inference engines in rPD, this verse may be understood in the following way: the re-composition of aggregates in a new existence refers to a new state of a player, i.e., an active inference engine after a dyadic interaction is neither causeless nor the same as the original state before the interaction. Thus, in the context of rPD, this particular verse is consistent with the expression of $\text{Payoff}_{(\text{Alice})} = \text{Play}_{(\text{Alice})} \times \text{Play}_{(\text{Bob})}$, wherein the new state of Alice is an interactive product, not a linear transformation, of Alice's or Bob's original state.]

Verse 63.

> *In brief, from empty phenomena*
> *Empty phenomena arise*
> *Agent, karma, fruits, and their enjoyer –*
> *The conqueror taught these to be [only] conventional.*

[One may interpret this verse as suggesting that from one dyadic interaction, the next arises, with all parts of the interactions following the expression of emptiness, i.e., Effect = Cause × Condition. In the context of rPD, agent, karma, fruits, and their enjoyer in this particular verse refer to the active inference engine of a player Alice (agent), her action $\text{Play}_{(\text{Alice})}$ (karma), her $\text{Payoff}_{(\text{Alice})}$ (fruits), and the operation "X" (enjoyer) in the expression of $\text{Payoff}_{(\text{Alice})} = \text{Play}_{(\text{Alice})} \times \text{Play}_{(\text{Bob})}$, respectively. Each element in this expression exists conventionally according to its name and form from the perspective of dependent designation, without having any non-relational, intrinsically independent essence.]

Verse 64.

> *Just as the sound of a drum as well as a shoot*
> *Are produced from a collection [of factors]*
> *We accept the external world of dependent origination*
> *To be like a dream and an illusion.*

Verse 65.

> *That[sic] phenomena are born from causes*
> *Can never be inconsistent [with facts]*
> *Since the cause is empty of cause*
> *We understand it to be empty of origination.*

[These two verses point out that in the expression of Effect = Cause × Condition, any Cause and Condition themselves are the interactive products of the previous Cause and Condition, and therefore, none of them are born without interactions between their own cause and condition, and "empty of origination" refers to the fact that they do not exist intrinsically.]

Verse 66.

> *The non-origination of all phenomena*
> *Is clearly taught to be emptiness*
> *In brief, the five aggregates are denoted*
> *By [the expression] "all phenomena."*

[Five aggregates of a person [forms, feelings, discriminations, actions, and consciousness] may refer to the active inference

processes that constitute person–environment interactions. When an active inference engine (the observer) interacts with an object in a strongly coupled state, both the observer and the observed (the object) become the interactive products of causes by conditions involved in their interaction. The same principle is applied to those interactions among the sensory, active, and internal states within the active inference engine. In this sense, all information processed in person–environment interactions is *relational* in nature. Using the metaphor described above in Verse 61, the appearance (qualia) of the observed object (i.e., "the image of the face in the mirror") is the information extracted from the object (i.e., "one's face in front of the mirror") by the observer (i.e., "the person seeing the image") after the interaction (e.g., "the mirror" between the observer and the observed object) occurs. For detailed discussion based on Physics, Biology, and Psychology on this notion, refer to our previous work (Ho et al., 2022).]

Verse 67.

> *When the [ultimate] truth is explained as it is*
> *The conventional is not obstructed*
> *Independent of the conventional*
> *No [ultimate] truth can be found.*

[One way to interpret this verse is that due to the unity of conventional truth and ultimate truth based on Effect = Cause × Condition, the wisdom realizing the ultimate truth and compassion traversing the conventional truth are inseparably united in the *ultimate bodhicitta*—intuitive compassion—that directly realizes such unity, as described in the following three verses 68–70.]

Verse 68.

> *The conventional is taught to be emptiness*
> *The emptiness itself is the conventional*
> *One does not occur without the other*
> *Just as [being] produced and impermanent.*

Verse 69.

> *The conventional arises from afflictions and karma*
> *And karma arises from the mind*
> *The mind is accumulated by the propensities*
> *When free from propensities it's happiness.*

Verse 70.

> *A happy mind is tranquil indeed*
> *A tranquil mind is not confused*
> *To have no confusion is to understand the truth*
> *By understanding the truth, one attains freedom.*

4.4. Summarizing the symmetry in Eight Verses

The symmetry across the three domains of Mahayana Buddhism, dyadic active inference, and rPD can be summarized in terms of Eight Verses of *lojong* Mind Training (*lojong tsikgyema* in Tibetan) composed by Geshe Langri Thangpa (1054–1123), as follows (with our own interpretive notes added in brackets following each verse):

1. *By thinking of all sentient beings*
   As more precious than a wish-fulfilling jewel
   For accomplishing the highest aim,
   I will always hold them dear.
   [Generating the conventional bodhicitta to fulfill the aims of self and others equally.]

2. *Whenever I'm in the company of others,*
   I will regard myself as the lowest among all,
   And from the depths of my heart
   Cherish others as supreme.
   [Whenever in dyadic relationships, give up any self-centered unidimensional view to make it possible to frame all dyadic interactions in an rPD-compatible multidimensional frame. This is the basis of the first level of equality.]

3. *In my every action, I will watch my mind,*
   And the moment destructive emotions arise,
   I will confront them strongly and avert them,
   Since they will hurt both me and others.
   [Refrain from being influenced by any conceptual thoughts that misperceive conflicts in terms of the tug-of-war metaphor. Prepare to identify with others without being carried away by self or others' conceptual thoughts and negative emotions. This is the basis of the second level of equality.]

4. *Whenever I see ill-natured beings,*
   Or those overwhelmed by heavy misdeeds or suffering,
   I will cherish them as something rare,
   As though I'd found a priceless treasure.
   [Prepare to perform TTF-like strategies when facing conflicts with a stranger with equality in fulfilling the aims of self and others. This is the first one-third of the basis of the third level of equality.]

5. *Whenever someone out of envy*
   Does me wrong by attacking or belittling me,
   I will take defeat upon myself,
   And give the victory to others.
   [Prepare to perform TTF-like strategies when facing conflicts with an enemy with equality in fulfilling the aims of self and others. This is the second one-third of the basis of the third level of equality.]

6. *Even when someone I have helped,*
   Or in whom I have placed great hopes
   Mistreats me very unjustly,
   I will view that person as a true spiritual teacher.
   [Prepare to perform TTF-like strategies when facing conflicts with a friend with equality in fulfilling the aims of self and others. This is the last one-third of the basis of the third level of equality.]

7. *In brief, directly or indirectly,*
   I will offer help and happiness to all my mothers,
   And secretly take upon myself
   All their hurt and suffering.
   [Without announcing in any way what would undermine the deployment of TTF-like strategies in rPD, practice a single-pointed meditation to identify with others' sufferings arising in the conflicts and use the conflicts to eradicate conceptual thoughts and suspend mental fabrication with a steadfast commitment to benefitting self and others equally.]

8. *I will learn to keep all these practices*
   Untainted by thoughts of the eight worldly concerns.
   May I recognize all things as like illusions,
   And, without attachment, gain freedom from bondage.
   [Keep the practice of conventional bodhicitta free of the tug-of-war metaphor in which zero-sum conflicts are bound to happen on a single dimension with positive and negative payoffs measured in the forms of experiencing pleasant/unpleasant feelings, getting gain/loss of resources, being liked/disliked in relationships, and having good/bad reputations, due to the misperception of the payoff matrix based on the difference between the players' plays, e.g., $\text{Payoff}_{\text{Self}} = \text{Play}_{\text{Self}} - \text{Play}_{\text{Other}}$. Instead, focusing on the ultimate nature of the dyadic relationships in rPD-like dances, one can rest with the understanding of the payoff being the effect of the interactive product of cause by condition, e.g., $\text{Payoff}_{\text{Self}} = \text{Play}_{\text{Self}} \times \text{Play}_{\text{Other}}$.]

4.5. A summary of the path of intuitive compassion

We summarize the opposite directions on PIC as two incompatible paths in Table 4. The gist of these opposing directions can be captured in the two sets of verses as follows, either

Love first.
Inquire later.
Inquire to love,
Not to conquer.

Or

Exploit first.
Manipulate later.
Manipulate to exploit,
Not to love one another.

There is no doubt that conflicts are unpleasant and that no one would enjoy any aversive experiences in suffering. Whenever a conflict happens in a dyadic relationship, a person guided by PIC would realize that the conflict serves as a stepping stone on a bidirectional path and he or she will decide which direction to go on the path. The foundation for treating conflicts as stepping stones to enduring peace lies in the recognition of the nature of suffering and the values thereof. When a conflict occurs, a practitioner of PIC will see suffering in the conflict as a blessing in disguise. Of course, many inquiries would need to be conducted and they will have to be answered pointedly and properly, if one wants to figure out how to transform conflicts into enduring peace by properly engaging one's counterparts in conflicts in a series of interactions, realizing that we are all playing non-zero-sum rPD, rather than zero-sum games.

For partners in rPD-like relationships, such as close relationships, practicing PIC can help repair the relationships by (1) transforming win–lose or lose–win conflicts into win–win scenarios and (2) reducing their resentment toward each other after encountering defections. For example, *lojong* meditation can strengthen the commitment to employing TTF-like strategies to strive for win–win scenarios, such that the partners will be nice (start the rPD with cooperation and never defect first) and learn how to suspend his or her conceptual thoughts so that they can recognize that the best practice in their relationship is to follow TTF-like strategies. By practicing *tonglen* (self-other exchange by

TABLE 4 Summary for two incompatible directions that bifurcate at each conflict as a stepping stone on the path of a dyadic relationship.

Basis of the path	Path of intuitive compassion Valid views of the nature of reality	Path of cyclic conflicts Wrong views of the nature of reality
View on life	Four noble truths: 1. Life with cyclic conflicts is suffering 2. Causes of suffering 3. Cessation of suffering is nirvana (enduring peace) 4. Path to nirvana	Four non-virtuous misbeliefs 1. Life is winner-takes-it-all 2. Cause of winner-takes-it-all 3. Never being caught is the best 4. Path to never being caught
Weighing of one's own and opponent's aims	Equality in wishing to fulfill self and other's aims	One's own aim overweighs the opponent's
State of social relationship	Strongly coupled state (see Figure 3)	Weakly coupled state (see Figure 4)
View of one's own and opponent's payoff in social interactions	$\text{Payoff}_{(\text{self})} = \text{Play}_{(\text{self})} \times \text{Play}_{(\text{opponent})}$ $\text{Payoff}_{(\text{opponent})} = \text{Play}_{(\text{opponent})} \times \text{Play}_{(\text{self})}$	$\text{Payoff}_{(\text{self})} = \text{Play}_{(\text{self})} - \text{Play}_{(\text{opponent})}$ $\text{Payoff}_{(\text{opponent})} = \text{Play}_{(\text{opponent})} - \text{Play}_{(\text{self})}$
Perception of social relationships	Endless rPD-like multidimensional dances	Opportunity to exploit others and run away in one-dimensional tug-of-wars
Perception of the purpose of one's own actions	To reciprocate what the opponent did or to repair damages in social relationships	To conquer or exploit social relationships for one's selfish gains
Perception of future	Future is a relational consequence of current dyadic interactions	Future is a chance to escape from obligations or consequences of one's past actions
Summary verse	Love first Inquire later Inquire to love Not to conquer	Exploit first Manipulate later Manipulate to exploit Not to love one another

taking other's suffering to oneself and giving one's own happiness to others), one will take in his or her partner's defection by reciprocating with either retaliation (to defect without generating any resentment or blame) or forgiveness (to cooperate without acting out of ignorance or greed) in the following trial.

5. Conclusion

Conflicts are ubiquitous, and they entail sufferings for all parties involved. Compassion, i.e., a wish to relieve others from suffering, is a commitment to face conflicts and sufferings in a mindset that makes it possible to transform them into enduring peace and prosperity. We introduced PIC to highlight the symmetry across the domains of (a) rPD, (b) dyadic active inference, and (c) Mahayana Buddhism, in their theoretical and practice aspects alike, as geometrically represented in Figure 2.

In the theoretical aspect, the symmetry lies in the recognition that the elements of interest operating in these domains are the effects of the interactive product of cause by condition: in rPD, the elements—the players' payoffs—are the effects of an interactive product of their actions; in dyadic active inference, the elements—intersubjectivity and stress-reduction—are the effect of an interactive product of two strongly coupled active inference engines; in Mahayana Buddhism, the elements—all phenomena including the actor, the receiver, and the object/energy being exchanged between them—are the effects of an interactive product of causes and conditions.

In the practice aspects, the symmetry lies in those strategic techniques that are commonly shared in the proven strategies that can yield optimal outcomes in each of these domains: in rPD, the technical features are being nice, reciprocating, forgiving, and non-envious in TTF-like strategies; in a dyadic active inference, the strategic techniques are dyadic concepts, e.g., mutuality, reciprocity, attunement, contingency, reparation, matching, mirroring, coordination, and synchrony in dyadic interactions, which can be boosted to become conflict-proof by dyadic interventions targeting problems that may allow conflicts to impair dyadic interactions (*deficient relational benevolence, under-coupling, and over-mentalizing*); in Mahayana Buddhism, the strategic techniques are often described as virtuous practices of generosity, ethics, patience, non-weariness, and meditations, with wisdom being the inseparable companion of these practices.

Conflict as a point of bifurcation, like a stepping stone, is also embedded in the symmetry across these domains. In rPD, conflicts are those win–lose or lose–win scenarios to be transformed into an enduring win–win or lose–lose scenarios depending on the strategies. In dyadic active inference, conflicts are collective surprises between two strongly coupled active inference engines that would need to be minimized. In Mahayana Buddhism, conflicts and sufferings of one's own or others' are equally valuable for the practitioners to transform, like the poisons that can make a peacock even more splendorous. Likewise, compassion in the face of conflicts is also part of the symmetry. We postulated that compassion reflects the conflict-proof commitment to choosing a non-zero-sum frame, as opposed to a zero-sum one, to fulfill self and others' aims equally in all these domains.

A caveat is that this commitment to compassion is not the same as unconditional cooperation with the opponent. The reciprocity, as one of the strategic techniques in these domains, cannot be overly diminished by always cooperating unconditionally even after the opponent's defection in the last move. Most of the time, the opponent's defection should be retaliated by defections, except for occasional forgiveness that comes at an auspicious timing (to be discerned and determined by someone with intuitive compassion). While such reciprocity means that retaliation is part of the optimal TTF-like strategies, it does not mean that the retaliation must be violent in nature. For example, Mahatma Gandhi led the successful campaign for India's independence from British rule by holding a steadfast non-violence principle in retaliating against the opponent's oppression with a non-violent movement of non-cooperation. In a way, the UK–India interactions at that time may serve as a good case for demonstrating that two players in conflicts can find an enduring win–win solutions in the real world. When all things considered, both parties saw that the "pie" of mutual cooperation, in the form of India's independence, is bigger than what it was otherwise at the time of post-World War II.

Thus, though violence is common in the time of conflict, especially when one side wants to exterminate the other side for good, this only calls for more intuitive compassion to creatively make the pie of mutual cooperation bigger than cyclic conflicts (i.e., $2R > G + U$) and to persistently take the time for conflicts to be transformed into enduring peace eventually. In doing so, the retaliation part of TTF-like strategies, seemingly violent or not, should be done with a steadfast commitment to eventual mutual cooperation and enduring peace.

> "*Non-violence takes a long time,*" said the 14th Dalai Lama.
> "*Do we have the time, Holiness?*" his bodyguard asked.
> "*I've never known,*" said the 14th Dalai Lama.
> ∼ *Kundun, the film* (Scorsese, 1997)

Indeed, no one would know whether humanity has enough time to dissolve all the conflicts that we face today. Nevertheless, Bodhisattvas seem not concerned about time because their great compassion enables them to be willing to spend three infinite eons or longer to complete the path to enlightenment (Buswell and Lopez, 2013). Perhaps in their intuitive compassion, they can see the transient nature of conflicts and the destined peace and prosperity all along, just like playing rPD games with a proven winning strategy steadfastly. In dedicating their virtuous practices, Bodhisattvas would pray as what Arya Shantideva did in *Bodhisattvacharyavatara* (Shantideva, c. 700/1979), Ch. 10, V.55,

> *For as long as space endures*
> *And for as long as living beings remain,*
> *Until then may I too abide*
> *To dispel the misery of the world.*

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

SH is the principal developer of the theoretical framework and hypotheses, the writer of the manuscript, and created the figures in the study. YN has collaborated with SH in developing and refining the theoretical framework presented in this article. He also co-wrote the manuscript. JS co-wrote the manuscript and supported the research involved in the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The relationship of trait-like compassion with epigenetic aging: The population-based prospective Young Finns Study

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Introduction: Helping others within and beyond the family has been related to living a healthy and long life. Compassion is a prosocial personality trait characterized by concern for another person who is suffering and the motivation to help. The current study examines whether epigenetic aging is a potential biological mechanism that explains the link between prosociality and longevity.

Methods: We used data from the Young Finns Study that follows six birth-cohorts from age 3–18 to 19–49. Trait-like compassion for others was measured with the Temperament and Character Inventory in the years 1997 and 2001. Epigenetic age acceleration and telomere length were measured with five DNA methylation (DNAm) indicators (DNAmAgeHorvath, IEAA_Hannum, EEAA_Hannum, DNAmPhenoAge, and DNAmTL) based on blood drawn in 2011. We controlled for sex, socioeconomic status in childhood and adulthood, and body-mass index.

Results and discussion: An association between higher compassion in 1997 and a less accelerated DNAmPhenoAge, which builds on previous work on phenotypic aging, approached statistical significance in a sex-adjusted model (n=1,030; b=−0.34; p=0.050). Compassion in 1997 predicted less accelerated epigenetic aging over and above the control variables (n=843; b=−0.47; p=0.016). There was no relationship between compassion in 2001 (n=1108/910) and any of the other four studied epigenetic aging indicators. High compassion for others might indeed influence whether an individual's biological age is lower than their chronological age. The conducted robustness checks partially support this conclusion, yet cannot rule out that there might be a broader prosocial trait behind the findings. The observed associations are interesting but should be interpreted as weak requiring replication.

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KEYWORDS

compassion, temperament and character inventory, DNA methylation, epigenetic aging, DNAmPhenoAge, prosocial personality, longevity

1. Introduction

1.1. Compassion as a personality trait and its association with longevity

There is accumulating evidence that prosocial behavior, such as helping others, providing social support, and caregiving within and beyond the family, is associated with better health, wellbeing, and longevity (1–4). It has been shown that the motive behind prosocial behavior is important. Only individuals who help for other-oriented, non-egoistic reasons have a mortality advantage (5). Consequently, individuals' relatively stable personality traits have been recognized as predictors of longevity (6–9). Knowledge about the underlying biological mechanisms is growing (4, 10–13), although less is known about whether individual differences in prosociality predict the pace of epigenetic aging.

The current study focuses on trait-like compassion, which can be characterized by concern for another person who is suffering and the motivation to help (14, 15). Compassion for others has developed from a caring motivation that, over the course of evolution, was extended beyond the family (14, 16) as it has health benefits and survival value (16). Garcia et al. (17) describe compassionate individuals as forgiving, charitable, and benevolent. They try to be constructive in a relationship and when dealing with interpersonal conflicts, rather than seeking revenge and reacting in a hostile manner (17, 18). An individual's authentic desire to alleviate undeserved human suffering can lead to prosocial behavior (19, 20) if accompanied by commitment and the competencies needed in a given situation (16, 21). Compassion is a subscale belonging to the broader character trait Cooperativeness in Cloninger's biopsychological model of personality, which measures how well an individual gets along with others (17). Cooperativeness has clear links to the five-factor model of personality which has, like compassion, well-studied influences on health and well-being (8, 12, 22, 23). Moreover, more agreeable individuals were found to have lower mortality risk (6, 7, 9), whereas a more hostile and vulnerable personality is inversely associated with longevity (7, 24). Epigenetic aging is a potential biological mechanism that might explain the link between prosociality and longevity, investigated in this work by the example of compassion for others.

1.2. Epigenetic aging

The biological age of an individual can be different than the date on his or her birth certificate (25, 26). The variance in biological age left unexplained by chronological age is thus a potential mechanism for the hypothesized effect of compassion on longevity. Biomarkers of aging have been defined as individual lifespan differences in time to the onset of disease, decline in functional capacity, and death (27). One of the first indicators of epigenetic aging was found in telomere biology (28). Telomeres are the protective ends of chromosomes that shorten at each cell division. Telomere length is consequently strongly associated with chronological age (29). More recently, epigenetic clocks were developed as biomarkers of aging by building on the finding that DNA methylation (DNAm) patterns change across the genome as an individual grows older (30, 31). If the biological age is higher than the chronological age, this refers to an accelerated epigenetic age (26, 31, 32). DNAm age acceleration has been found to have detrimental effects on aging-related health conditions, cognitive and physical functioning, and cause-specific and all-cause mortality (25–27, 33, 34). It should however be noted that telomere biology and methylation-based age acceleration share only little variance (26), and thus appear to be linked through independent pathways to aging-related health conditions and mortality risk (34).

Since DNAm biomarkers capture epigenetic changes that are probably reversible (25), a better understanding of the causes and consequences of epigenetic aging might make it possible to prevent aging-related chronic diseases and thus to prolong the human lifespan (35, 36). However, relatively little is known about the association between motivational prosocial personality traits and epigenetic aging. It is therefore important to examine whether compassion for others triggers biological mechanisms that lead to longevity.

Although there is no previous research on trait-like compassion for others and epigenetic aging, we can draw on previous evidence for practicing compassion, even though self-compassion and other-compassion are distinct constructs (22, 37). With regard to loving-kindness training, which cultivates warm and friendly feelings toward oneself, close others, and more distant persons, it was found that it had a buffering effect on telomere shortening which was stronger than for mindfulness training, which is less related to compassion (38). Meditators, practicing either mindfulness or compassion-related meditation, were also found to have slower running epigenetic clocks in old age (35). Further, the effect of meditation including compassion practices on telomerase activity was found to be partially transmitted through changes in personality traits (39).

1.3. The current study

The current study examines whether the motivational personality trait compassion for others predicts DNAm-based epigenetic age acceleration. Previous studies in the compassion domain relied mostly on cross-sectional data or relatively short and not very intense interventions, whereas we assessed compassion as a trait longitudinally with a personality measure covering developmental changes from the age of 20 to 39 years (40).

Over the past three decades, several types of biological age indicators have been proposed, and DNA methylation-based epigenetic clocks outperform other potential biomarkers of aging in terms of validity and predictive power (25, 26). We include five

TABLE 1 Summary statistics of main study variables.

Variable	*n*	Mean	*SD*	Min	Max
Epigenetic age acceleration Horvath	1273	−0.04	4.21	−22.69	19.49
Intrinsic epigenetic age acceleration Hannum	1273	−0.02	4.09	−19.56	18.93
Extrinsic epigenetic age acceleration Hannum	1273	−0.09	5.15	−18.71	17.28
Phenotypic epigenetic age acceleration	1273	−0.04	5.33	−17.47	20.11
DNAm indicator of telomere length	1273	0.01	0.18	−0.62	0.60
Compassion 1997	1,030	0.04	0.97	−3.26	2.16
Compassion 2001	1,108	0.03	0.97	−4.10	2.02
Gender (male)	1273	0.42	0.49	0.00	1.00
Socioeconomic status adulthood	1130	−0.01	0.97	−2.55	1.91
Socioeconomic status childhood	1197	0.03	1.01	−1.51	2.28
Body-mass index	1218	0.01	1.00	−1.95	6.11

indicators of biological aging (DNAmAgeHorvath, IEAA_Hannum, EEAA_Hannum, DNAmPhenoAge, and DNAmTL) to reflect the different aspects of the human aging process (26, 27, 31, 33, 41). They were assessed in a large and representative sample, whereas previous studies on practicing compassion (not compassion as a trait) included only a single measure of epigenetic age acceleration and had the limitation of small sample sizes (e.g., Ref. (35)). We also attempted to investigate whether the association found between practicing compassion and telomere length holds for compassion as a trait (38, 39).

The multi-generational, genetically informed nature of our data supports testing whether compassion predicts a less accelerated epigenetic age over and above childhood, and adulthood risk factors, such as socioeconomic status and body-mass index.

2. Methods

2.1. Participants

The Young Finns Study (YFS) is an ongoing prospective multidisciplinary study that follows six birth cohorts from childhood through adulthood (42). Participants living in an area with a university hospital were selected from the Finnish population registry. The original sample consisted of 3,596 individuals. The participants were 3, 6, 9, 12, 15, and 18 years old at baseline (1980, T0) and they answered the compassion scale in 1997 (T1, youngest participant 20 years old) and 2001 (T2, oldest participant 39 years old). Blood samples were drawn from the participants in the year 2011 (ages 19–49 years).

The YFS was approved by all participating universities' ethics committees at the beginning of the study in 1980, and the follow-ups were approved by the ethics committee of the University of Turku [vernacular institution name: Varsinais-Suomen sairaanhoitopiirin kuntayhtymä, Eettinen toimikunta, Meeting Number 9/2010; study name, "Lasten sepelvaltimotaudin riskitekijät projekti (Laseri) 30-vuotis seurantatutkimus, 25.8.2010"]. The YFS was conducted according to the guidelines of the Helsinki declaration. Written informed consent to participate in the YFS was obtained. Summary statistics for all the main study variables can be found in Table 1.

2.2. Compassion measure

Trait-like compassion for others was measured with the Temperament and Character Inventory (TCI), developed and validated by Cloninger and colleagues (18, 43). The compassion (versus revengefulness) scale has 10 items (e.g., "I like to imagine my enemies suffering" [reverse scored]; "It gives me pleasure to help others, even if they have treated me badly" [positively scored]; "It gives me pleasure to see my enemies suffer" [reverse scored]; and "I hate to see anyone suffer" [positively scored]). Compassion for others belongs to the broader cooperativeness scale consisting of 42 items in total, the other subscales being helpfulness (versus unhelpfulness), empathy (versus social disinterest), social acceptance (versus social intolerance), and pure-hearted conscience (versus self-serving advantage) (17). We used the revised TCI answered on a Likert-scale with five response options (44). We rescored the reverse-scored items before the mean for each measurement occasion was calculated. We excluded participants if they had responded to less than 50% of the compassion items. The compassion scale has a high internal consistency (Cronbach's $\alpha T1\text{-}T2 \geq 0.86$) and is relatively stable over time ($rT1->T2 = 0.71$; $p < 0.001$). It has a good model fit when accounting for the common variance between the reverse-scored items (10, 23). Due to the age-dependency of compassion (40), we standardized the mean scores within the six birth cohorts.

2.3. Epigenetic clocks

DNA methylation (DNAm) age was calculated successfully for 1,529 participants based on whole blood data measured by utilizing the Illumina Infinium platform from 2011 EPIC/850 K array. The sample size of the main analyses is smaller ($n = 843$–$1,108$) because not all participants filled in the psychological questionnaires. We report results for five DNAm age indicators that were estimated with an online calculator[1]. The underlying method and R function are described in Horvath (31). The produced indicators were normalized,

1 http://dnamage.genetics.ucla.edu/home

as this improves the predictive accuracy and makes the data more comparable to the training data (32). The average correlation between the samples and the gold standard was good ($r \sim 0.97$). In 60.6% of the samples the predicted tissue was correct and sex was always correctly predicted. This information indicates a high precision of the DNAm age predictions.

These DNAm based biomarkers can be broadly categorized into (cell-)intrinsic and extrinsic measures of epigenetic aging (25, 26, 33).

2.3.1. Intrinsic DNAm age measures

We included two intrinsic DNAm age indicators. Intrinsic indicators are largely unperturbed by and independent of cell-type composition accompanied by aging ((25); for some contrary evidence see (45)), and are thought to represent an epigenetic maintenance system (26, 31). The DNAmAge indicator of Horvath (31) is estimated based on 353 CpGs and can predict age across multiple tissues and cell types. The indicator has high accuracy already in childhood and adolescence (46). The difference between DNAmAgeHorvath and chronological age was associated with a higher all-cause mortality risk assessed 5 years later, even after accounting for sociodemographic background, childhood IQ, and other risk factors (47). The validity of DNAmAgeHorvath was further demonstrated by associations with physical and cognitive fitness (48) and cancer and cardiovascular mortality (49). Another epigenetic clock has been developed by Hannum et al. (30). This blood-based indicator of aging-related methylation levels uses 71 CpGs. Based on Hannum's clock the intrinsic epigenetic age acceleration (IEAA_Hannum) indicator has been developed, which is by design not confounded by differences in blood cell counts (33). IEAA_Hannum has also shown many robust associations with diverse aging-related conditions (25, 33). As intrinsic DNAm age measures have been around for longer than their extrinsic complements, they are probably the most researched epigenetic clocks in the literature.

2.3.2. Extrinsic DNAm age measures

We also included two extrinsic DNAm indicators of epigenetic aging. Extrinsic DNAm age indicators are more dependent on aging-related changes in blood cell counts and appear to be associated with immune senescence (27, 33, 50).

The extrinsic epigenetic age acceleration (EEAA_Hannum) is the second enhanced indicator based on Hannum's clock (33). EEAA_Hannum is a strong predictor of time to death across ethnic groups (33), assessing the aging-related functional decline of the immune system. A recently identified epigenetic biomarker is the phenotypic age estimator (DNAmPhenoAge), which was proposed by Levine et al. (27) building on previous work on phenotypic aging. It taps into physiological dysregulation in aging individuals and has been developed by predicting a composite indicator of nine morbidity-and mortality-risk factors (e.g., albumin levels and white blood cell count) and chronological age, and was estimated based on 513 CpGs. DNAmPhenoAge was classified by Horvath and Raj (25) as belonging to the group of extrinsic DNAm age indicators. DNAmPhenoAge has been found in recent reviews and meta-analyses to predict future aging-related diseases and mortality better than the above epigenetic clocks (25, 27).

There is some evidence that extrinsic measures are under weaker genetic control and are thus more influenced by the environment than intrinsic measures (47, 51). Finally, extrinsic measures of epigenetic aging were found to be more strongly associated, compared to intrinsic measures, with demographic variables and external factors that are under behavioral control (25).

For all four epigenetic age acceleration indicators, the residuals were used that resulted from regressing the calculated DNAm age on chronological age.

2.3.3. DNAm age measure of telomere length

We included a DNA methylation-based indicator of telomere length (DNAmTL) estimated with 140 CpGs (41). DNAmTL correlates with measured leukocyte telomere length ($r \sim -0.35$) and outperforms the latter in predicting time to death and coronary heart disease or heart failure (41). It is thought to provide additional insights into mechanisms linking exposure to environmental factors, cell replication, and aging-related health conditions and mortality risk. We used the age-adjusted version of DNAmTL.

2.4. Control variables

Following previous studies, we included standard control variables (see Ref. (52)). We adjusted for sex, socioeconomic status in childhood (SESC in 1980) and adulthood (SESA in 2007) (i.e., composite scores of high educational level, upper white-collar occupation, currently having a job, and highest income quartile) (53), and body-mass index (BMI) (54). The control variables were standardized within the six birth cohorts before filling the missing values with measurements of the same variables from a later YFS wave (SESC in 1983, SESA 2012, BMI 2012) in order to increase the sample size in the adjusted analyses.

2.5. Analytical strategy

All analyses were run with Stata version 15.1.

First, we tested the degree to which selective attrition might have affected our results by means of chi-square tests and independent samples *t*-test. Included participants donated blood samples and responded to the compassion scale at least once.

Then, we computed the correlations between the main study variables.

The main analyses of the effect of compassion on DNAm age acceleration and DNAmTL were conducted with multivariate multiple regression. The analyses were conducted separately for compassion for others in 1997 and 2001. In the first step, we controlled the association only for sex (N1997/2001 = 1,030 / 1,108). In the second step, we included childhood and adulthood SES as well as BMI (N1997/2001 = 843 / 910). For each methylation-based indicator of biological aging, we ran separate linear regression analyses.

To assess the robustness of our findings, we further tested whether broader prosocial tendencies in cooperativeness or one of the other subscales are driving them, whether they are dependent on the balanced wording of the compassion scale, whether they hold when controlling baseline levels of the outcome, and whether they are robust to variation in sample size.

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3. Results

3.1. Preliminary analyses

Attrition analysis indicated that excluded participants had lower DNAmTL (mean = −0.03 vs. 0.01; $p = 0.004$) and were more likely to be male (53% vs. 42%, $p < 0.001$) than included participants who were required to respond to the TCI at least once and donated a blood sample. Other study variables were not affected by selective attrition.

The epigenetic clocks were moderately to strongly correlated with one another but not with compassion in the unadjusted analyses (Table 2). Men had higher methylation-based biological age measured with DNAmAgeHorvath, IEAA_Hannum, and EEAA_Hannum than women. Their DNAmPhenoAge acceleration, however, was lower and they had shorter DNAmTL. Of the five indicators, only younger DNAmPhenoAge was associated with higher socioeconomic status both in childhood and adulthood, whereas all five DNAm age indicators were associated with the body-mass index.

3.2. Main analyses

The main results are presented in Table 3. The prediction of a less accelerated DNAmPhenoAge by higher compassion for others in 1997 approached statistical significance when controlling for sex alone ($p = 0.050$; Model 1; $n = 1{,}030$). Compassion in 1997 predicted epigenetic age acceleration even more strongly when further accounting for SESC, SESA, and BMI ($b = -0.47$; $p = 0.016$; Model 2, $n = 843$).

There were no associations between compassion in 1997 and the other four DNAm age indicators. Compassion in 2001 did not predict epigenetic aging ($p > 0.09$; $n = 1{,}108$ / 910).

Compassion and sex alone accounted for 0.9–2.9% of the variance in the part of epigenetic age left unexplained by chronological age. All the included predictors together explained 2.6–4.9% of the variance in the five DNAm age indicators.

3.3. Robustness checks

We found mixed empirical support for the interpretation that higher compassion predicts whether individuals have slower-running epigenetic clocks. We therefore conducted a series of robustness checks.

First, the reviewed literature makes it plausible that broader prosocial tendencies contribute at least partially to the observed findings. To test this possibility, we repeated the analyses for the full cooperativeness scale of the TCI. In 1997, this broader character trait capturing an individual's prosociality predicted DNAmPhenoAge even more strongly than compassion (sex-adjusted, $b = -0.48$; $p = 0.034$ and fully-adjusted, $b = -0.64$; $p = 0.012$; Supplementary Table S1).

Second, we showed that it was compassion and not one of the other subscales that drove the reported findings. Associations for the other subscales were non-significant except for pure-hearted conscience in the sex-adjusted model, $b = -0.38$; $p = 0.030$, and empathy in the fully-adjusted model, $b = -0.41$; $p = 0.044$ (Supplementary Table S2).

Third, due to the balanced wording of our measure of compassion (versus revengefulness), it is possible that it reflects other concepts such as anger and hostility. We thus repeated the main analyses after excluding all negatively worded items belonging to the revengefulness pole (Supplementary Table S3). The balanced wording of the compassion scale did not affect the interpretation of the results considerably. A scale using only the positively worded items of the compassion pole showed the same pattern of association with

TABLE 2 Pearson correlations between the main study variables.

	1	2	3	4	5	6	7	8	9	10	11
1) Epigenetic age acceleration Horvath	1										
2) Intrinsic epigenetic age acceleration Hannum	**0.97**	1									
3) Extrinsic epigenetic age acceleration Hannum	**0.31**	**0.28**	1								
4) Phenotypic epigenetic age acceleration	**0.32**	**0.32**	**0.47**	1							
5) DNAm indicator of telomere length	**−0.14**	**−0.06**	**−0.36**	**−0.32**	1						
6) Compassion 1997	−0.05	−0.05	−0.03	−0.05	0.01	1					
7) Compassion 2001	−0.02	−0.02	0.02	0.01	0.01	**0.68**	1				
8) Sex (male)	**0.17**	**0.13**	**0.19**	**−0.07**	**−0.20**	**−0.14**	**−0.14**	1			
9) Socioeconomic status adulthood	−0.01	−0.01	−0.04	**−0.10**	0.05	**0.08**	**0.08**	**0.04**	1		
10) Socioeconomic status childhood	−0.01	−0.01	−0.03	**−0.06**	0.05	0.03	**0.04**	0.00	**0.27**	1	
11) Body-mass index	**0.09**	**0.10**	**0.09**	**0.12**	**−0.06**	**−0.08**	−0.03	**0.14**	**−0.07**	**−0.09**	1

Associations marked in bold are statistically significant at $p < 0.05$ level.

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TABLE 3 Linear regressions of compassion in (a) 1997 and (b) 2001 Predicting five DNAm epigenetic aging indicators in 2011.

(a) Compassion in 1997	Model 1				Model 2			
	Beta	*p* value	R^2	*n*	Beta	*p* value	R^2	*n*
Epigenetic age acceleration Horvath			3%	1,030			4%	843
Compassion	−0.13	0.336			−0.10	0.529		
Intrinsic epigenetic age acceleration Hannum			2%				3%	
Compassion	−0.16	0.229			−0.14	0.352		
Extrinsic epigenetic age acceleration Hannum			2%				3%	
Compassion	−0.04	0.810			−0.05	0.787		
Phenotypic epigenetic age acceleration			2%				4%	
Compassion	−0.34	0.050			−0.47	0.016		
DNA methylation-based indicator of telomere length			2%				3%	
Compassion	0.00	0.784			0.00	0.851		
(b) Compassion in 2001								
Epigenetic age acceleration Horvath			2%	1,108			4%	910
Compassion	−0.01	0.939			0.02	0.882		
Intrinsic epigenetic age acceleration Hannum			1%				3%	
Compassion	0.00	0.996			0.03	0.830		
Extrinsic epigenetic age acceleration Hannum			3%				4%	
Compassion	0.27	0.095			0.24	0.180		
Phenotypic epigenetic age acceleration			1%				5%	
Compassion	−0.03	0.850			−0.06	0.755		
DNA methylation-based indicator of telomere length			3%				4%	
Compassion	0.00	0.699			0.00	0.880		

Model 1 controls for sex and Model 2 includes controls for childhood socioeconomic status 1980, adulthood socioeconomic status 2007, and body-mass index 2007.

DNAmPhenoAge as in the main analysis (sex-adjusted, $b = -0.29$; $p = 0.092$; fully adjusted, $b = -0.44$; $p = 0.023$).

Forth, to make it less likely that epigenetic age predicts compassion than vice versa and to make the presence of spurious effects less likely, we controlled for baseline levels in the outcome measured 25 years earlier in a smaller subsample ($n = 66$–81). We were able to confirm that DNAmPhenoAge was predicted by compassion in 1997 when accounting for epigenetic age in 1986 and sex ($b = -1.50$; $p = 0.007$), but when including all control variables, the effect only approached statistical significance ($p = 0.052$; Supplementary Table S4).

Fifth, we conducted a full case analysis to determine whether the reduction of sample size accounted for some of the findings. Now, the sex-adjusted marginally significant effect of compassion in 1997 on DNAmPhenoAge became statistically significant ($b = -0.54$; $p = 0.006$, $n = 843$). When imputing the missing values for all predictors with chained equations (MICE), however, the fully-adjusted effect became non-significant ($p > 0.11$; $n = 1{,}030$).

4. Discussion

The main finding of the current study was that the prediction of higher trait-like compassion of epigenetic age acceleration assessed with DNAmPhenoAge approached statistical significance in a gender-adjusted model. The phenotypic age estimator is a DNA methylation-based indicator that builds on extensive previous work on phenotypic aging. The prediction became stronger when controlling for socioeconomic status in childhood as well as adulthood, and BMI. To our best knowledge, this is however the first time that a potential biological aging mechanism has been found that links trait-like compassion for others to longevity. One explanation behind our finding is that practicing compassion helps to adapt to stress (55, 56) by directly improving emotion regulation skills and behavioral responses (56, 57). The better innate immune responses to stress of individuals high in compassion (56) might further be explained by the association between DNAm age acceleration and immune senescence (27, 50). An alternative explanation is that the emotion-regulation and calming aspects of trait-like compassion are some of the psychological mechanisms explaining how meditation training affects epigenetic aging (58). Compassion for others, for instance, reduces stress by increasing the ability to receive social support (59), and protects against vital exhaustion (a marker of susceptibility to stress), negative emotionality (a marker of chronic stress responses) (60), and elevated levels of cytokines (a marker of immune response) (12). Our main finding is also in line with the association observed between meditation training and telomere biology (38, 39). In summary, the current study examined the relationship between the motivational personality trait compassion and epigenetic aging, and found some first important and interesting evidence that the concern for another person who is suffering and the motivation to help might indeed lead to longevity.

We established the association with compassion when first measured, but were unable to replicate it with our later compassion measurement. Thus, results were dependent on the age of the

participants (20–35 years vs. 24–39 years) when compassion was assessed. The role of compassion for others in epigenetic aging must thus be interpreted tentatively. It is well documented that trait-like compassion increases with age (40). One potential explanation for this is that there might not have been enough variance in compassion left in the second measurement to find statistically significant differences. Our study results require replication in an independent sample before more certain conclusions can be drawn.

We also tested whether the observed associations are specific for compassion or whether they apply to broader motivational, prosocial personality traits. A less accelerated epigenetic age was also predicted by Cloninger's broader character trait cooperativeness, that captures an individual's prosociality (17, 18). The association became even stronger. Thus, these further analyses showed that we cannot rule out that a broader prosociality trait accounted for at least part of the observed relationship between compassion and epigenetic aging.

We showed that the association was driven by the items capturing compassion and not revengefulness. The balanced wording of our measure of compassion did not account for the observed findings, given that personality concepts such as anger and hostility were previously found to be inversely associated with longevity (7, 24).

Our study also contributes to the accumulating evidence that prosocial behavior, such as helping others, providing social support, and caregiving within and beyond the family, is associated with better health, well-being, and longevity (1–4). It emphasizes that the motive behind prosocial behavior is important (5–7, 9).

Compassion as a personality trait did not have an effect on DNAmAgeHorvath, IEAA_Hannum, or EEAA_Hannum. Our null finding for most included DNAm-based indicators has implications for the development of anti-aging interventions. Both intrinsic and extrinsic epigenetic age acceleration estimators have previously been found to be associated with practicing compassion (35) and diverse lifestyle factors (61). On the basis of the review of previous literature (25, 51), it was expected that trait-like compassion would be more strongly related to (cell-) extrinsic DNAm indicators of epigenetic aging that appear more malleable, such as DNAmPhenoAge, than intrinsic indicators. There is some evidence that extrinsic measures are under weaker genetic control (47, 51) and show associations with external factors that are under behavioral control (25). DNAmPhenoAge is also special in the sense that it has been created to model biological age by building on a set of phenotypic morbidity-and mortality-risk factors (27). DNAmPhenoAge therefore captures the social gradient in health better than the other indicators, as shown by the associations with both childhood and adulthood socioeconomic status and BMI (e.g., (62)). This might in part explain why compassion was especially predictive when including the full set of social and health control variables. The other DNAm age indicators, by contrast, have been created with the aim of modeling chronological age, while assuming that the variation from chronological age represents biological age (i.e., DNAm age acceleration) (26, 31, 32). Because in the case of DNAmPhenoAge biological age is generated first and then methylation is used to model it, the logic behind this indicator is more robust and requires fewer assumptions than the other DNAm age indicators.

Previous research on practicing compassion reported inverse associations with telomere shortening (38, 39). To our best knowledge, this study pioneers the use of a DNA methylation-based indicator to assess telomere length and compassion as a trait. We did not find an effect of compassion on DNAmTL in the YFS data. Although DNAmTL outperforms leukocyte telomere length in predicting aging-related health conditions and mortality risk, the two are only moderately correlated (41). The fact that practicing compassion is obviously not the same thing as trait-like compassion might further explain the difference compared to previous studies.

There is a growing consensus that a p value close to 0.05 is too liberal for new discoveries to declare an association significant (63). At the same time, there is disagreement on the level of adjustment that is required when different tests of the same hypothesis are conducted or when highly correlated indicators are compared (64). When applying the most conservative Bonferroni correction for five comparisons, the null hypothesis of each DNA methylation-based epigenetic aging indicator would only be rejected if it has a value of $p<0.01$. The observed effect of compassion on DNAmPhenoAge should be interpreted as weak and would not survive testing for multiple correction. Further, not all of the analyses of the different aspects of the human aging process yield a significant result. The findings were also to some degree modified by variation in sample size due to non-response. Given that the single finding for one of the outcomes holds up depending on which control variables are regressed out and otherwise becomes marginally significant, the overall picture could also be interpreted as a null finding. The fact that changes in DNAm biomarkers are generally reversible (25) nonetheless indicates some practical significance of our findings.

In a smaller subsample the effect of compassion on DNAmPhenoAge was still visible when adjusting for epigenetic age assessed more than a decade earlier. This allows us to rule out to some degree the interpretation that epigenetic age predicts compassion, and makes the presence of spurious effects less likely.

4.1. Limitations and strengths

The unequal timing of the compassion measurements and the assessments of DNAm age in the study design of the YFS, and the difference in sample size, made it impractical to estimate whether the change in compassion over time has an effect on (change in) epigenetic aging. Another limitation is that compassion was measured only with a self-report methodology, even though with a validated and well-known personality instrument, the TCI (18, 43). The used compassion scale was not validated against other measures of compassion. However, there does not exist a golden standard for assessing dispositional compassion nor a measure exclusively developed for its assessment corresponding to our definition of compassion (14–16). Despite having a relatively stable disposition, compassion has an episodical emotional component (14), and people are not always committed enough to act compassionately (21). The current paper only measured compassion as a motivational personality trait, and thus the results for epigenetic aging might not be generalizable to the emotion of compassion and compassion-induced prosocial behavior.

Even though the analyses were based on a relatively large and representative sample, this does not permit to rule out the possibility of committing a Type II error, which is not finding a relationship that actually exist. More studies are needed to add more evidence on the potential link between prosocial behavior and the pace of epigenetic aging.

We presented data for compassion measurements spanning 4 years of aging and for a subsample with 25 years difference in DNAm age measurements. This allowed us to draw some causal inferences of the relationship between trait-like compassion and epigenetic aging and to shed new light on biological mechanisms that may lead to longevity. Five DNAm age indicators (DNAmAgeHorvath, IEAA_Hannum, EEAA_Hannum, DNAmPhenoAge, and DNAmTL) were used that had demonstrated high validity and predictive power in previous work (25, 26). We were further able to control for a wide range of potential confounders, including childhood and adulthood factors.

4.2. Conclusion

The motivational personality trait compassion for others predicted a less accelerated epigenetic age as assessed with DNAmPhenoAge when controlling for sex, socioeconomic status, BMI, and baseline epigenetic age. The current study is the first to demonstrate a biological aging pathway for how compassion for others might lead to longevity. It remains possible that a broader prosocial personality, in part, drives this association, as cooperativeness also predicted DNAmPhenoAge. The results of the role of compassion for others in epigenetic aging must however be interpreted with caution. The prediction was only marginally statistically significant in the sex-adjusted model. The second measurement of compassion for others was not related to a younger epigenetic age and none of the other four biomarkers of aging were predicted by compassion. The support of our data for an association of trait-like compassion with DNA methylation-based epigenetic aging was overall weak and thus requires replication. The presented findings are nonetheless interesting, and suggest that DNAmPhenoAge is more likely to be malleable by behavioral choices such as prosocial behavior than other tested DNA methylation-based indicators.

Data availability statement

The Cardiovascular Risk In Young Finns study (YFS) dataset presented in this article is not readily available because it comprises health related participant data and their use is therefore restricted under the regulations on professional secrecy (Act on the Openness of Government Activities, 612/1999) and on sensitive personal data (Personal Data Act, 523/1999, implementing the EU data protection directive 95/46/EC). Due to these legal restrictions, the data from this study can not be stored in public repositories or otherwise made publicly available. Requests to access the datasets should be directed to the chairman of the publication committee (Prof Mika Kähönen, Tampere University, Finland).

Ethics statement

The 30 year follow-up of the YFS was approved by the ethics committee of the University of Turku [vernacular institution name: Varsinais-Suomen sairaanhoitopiirin kuntayhtymä, Eettinen toimikunta, Meeting Number 9/2010; study name, "Lasten sepelvaltimotaudin riskitekijät projekti (Laseri) 30-vuotis seurantatutkimus, 25.8.2010"]. The YFS was conducted according to the guidelines of the Helsinki declaration. Written informed consent to participate in the YFS was obtained.

Author contributions

HD, LK-J, SM, PM, AS, CC, IZ, MK, MHu, OR, TL, and MHi have made a substantial contribution to designing or carrying out the research, writing or revising the manuscript, or providing guidance on the execution of the research. The analyses have been conducted by HD, SM, and PM. All authors contributed to the article and approved the submitted version.

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Conflict of interest

PM and TL are employed by the company Fimlab Laboratories Oy.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1018797/full#supplementary-material

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A phenomenological study of compassion satisfaction among social work educators in higher education

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Background: Compassion satisfaction (CS) is a phenomenon that has been studied among the helping professions, such as nursing and social work and has been linked to stress, burnout, compassion fatigue, and vicarious trauma. Social work educators may also experience these same issues, yet more research is needed on how they might counter the negative impacts associated with this type of work by utilizing their experiences of CS.

Objectives: A phenomenological study was carried out to explore and describe how social work educators in higher education experiences CS.

Methods: Eleven in-depth interviews with social work educators were conducted, and constructivist grounded theory techniques were utilized to analyze the data.

Results: Social work educators experienced CS within the education and personal realms, which encompassed four different elements: achievement, support, balance, and empathy.

Discussion: The four elements of CS were utilized by social work educators in this study as coping strategies to enhance their experience of CS, thus encountering threats to CS, such as institutional barriers, interaction with administrators and colleagues, and work overload.

Conclusion: Interventions fostering compassion satisfaction and reducing compassion fatigue, burnout, and stress should be considered, including interventions that increase the sense of accomplishment, promote holistic self-care, encourage administrative and collegial support, and improve work-life balance.

KEYWORDS

compassion satisfaction, self-care, social support, education, higher education

Introduction

The work demands associated with being an educator in higher education institutions could produce adverse negative outcomes on this population's professional quality of life. For instance, high levels of time pressure from needing to develop curricula and course materials, teaching, training, and mentoring students, conducting and publishing research, attending conferences, and participating in committee, departmental, and faculty meetings with a lack of administrative and collegial support have been linked to an increased the likelihood of stress and burnout among this population (Hoffman et al., 2007; Kim and Stoner, 2008; Watts and Robertson, 2011;

Chen, 2022). The stressors associated with working in higher education environment have also been shown to diminish worker productivity, contribute to high resignation rate, and increase emotional and physical problems, such as anxiety, depression, emotional exhaustion, burnout, and depersonalization, which may lead to poor job satisfaction and compassion fatigue (Watts and Robertson, 2011; Sangganjanavanich and Balkin, 2013; Sabagh et al., 2018; Raimondi, 2019).

The literature has also shown that educators in higher education invest a great amount of their time and effort in caring about their students, particularly distressed ones (Hoffman et al., 2007Raimondi, 2019). Deeply caring for distressed students over time and exercising and empathy, which has been described as the ability to cognitively understand another person's emotions, express and show concern, feel those emotions, and be prepared to respond properly to the person's needs (Hatfield et al., 2011; Levett-Jones et al., 2019) have been associated with experiencing stress and becoming more vulnerable to secondary traumatic disorder, neglectful self-care, and compassion fatigue (Stoves, 2014Cordaro, 2020). However, other studies have associated empathy with lower levels of burnout and secondary stress trauma (Wagaman et al., 2015).

Numerous protective variables have been identified in recent literature related to counseling and traumatology that could be utilized as proactive coping strategies or as intervention coping strategies to lower the risk of stress, burnout, secondary traumatic disorder, neglectful self-care, compassion fatigue, and emotional and physical problems associated with the work environment. Active engagement in strategic self-care interventions, work-life balance, high level of social support, increased sense of accomplishment, and mitigating stress-related outcomes are examples of factors identified as protective factors against stressors come from work (Conrad and Kellar-Guenther, 2006; Alkema et al., 2008; Bourassa, 2009; Diaconescu, 2015; Salloum et al., 2015). The literature on the field of traumatology has also shown that the experience of compassion satisfaction is exceptionally significant as a protective factor to be used to better deal with work stressors and redirect them toward positive outcomes, such as enhancement in work performance, engagement, and competency (Radey and Figley, 2007; Snyder and Cistulli, 2009; Sacco and Copel, 2018; Raimondi, 2019).

Compassion satisfaction refers to the joy and positive emotions experienced by helping professionals from having the ability to complete their work effectively. For instance, they might consider it rewarding to have the capability to assist others through their work. They may have optimistic feelings about their coworkers, their ability to improve the working environment, or even the whole society (Stamm, 2010). Compassion satisfaction and its role in reducing compassion fatigue and other work-related stressors are well-researched in other helping and caregiving professions (Kraus, 2005; Carmel and Friedlander, 2009; Harr and Moore, 2011; Ray et al., 2013; Thomas, 2013: Wagaman et al., 2015; Pelon, 2017). However, research on compassion satisfaction among educators in higher education in general and among social work educators, in particular, is still rare, specifically research that focuses on strategies to encounter stress, compassion fatigue, burnout, and other adverse psychical and psychological outcomes associated with working as social work educators in higher education (Raimondi, 2019; Velez-Cruz and Holstun, 2022).

Although social work educators differ in job responsibilities from helping and caregiving professionals, social work educators in higher education could arguably experience compassion satisfaction. Increased knowledge about the experience of compassion satisfaction among this population may yield valuable information to inform interventions intended to counter the negative impacts on the professional quality of life associated with social work academia.

Thus, this study was conducted using qualitative research methodology to explore the phenomenon of compassion satisfaction among social work educators in higher education. Aims for this study included: (1) Identifying and describing the psychological essence of compassion satisfaction among social work educators working in higher education. (2) Investigating how social work educators engage in compassion satisfaction. (3) Understanding threats to compassion satisfaction among this population.

Materials and methodology

The researchers used the method of phenomenology to explore, describe, understand, and interpret the lived experiences of social work educators. The subjective understanding of phenomena experienced by individuals becomes an integral and central part of the study findings (Moustakas, 1994). Thus, phenomenology allowed researchers to gain deep insight into the meaning-making processes (Qutoshi, 2018) associated with CS among this population. In addition, using the phenomenological approach afforded researchers opportunities to mine rich and descriptive narratives from the social work educators in the study (Moustakas, 1994). Throughout the research process and subsequent analysis, the researchers also used constructivist grounded theory analytic techniques (Charmaz, 2014) to aid in the meaning-making process of social work educators and discover strategies related to how they engaged in the phenomena of CS. Hence, there is an interplay in the phenomenological data collection with grounded theory analysis for this study (Lincoln and Guba, 1985; Spinelli, 1989; Moustakas, 1994; Charmaz, 2014).

Recruitment of participants included a convenience sample of social work educators in higher education from three different states. The final sample included 11 participants ($N = 11$). 100% of the individuals who agreed to participate in the study met the inclusion criteria and completed the study. The participants were not compensated for their participation. The study included only those who were actively teaching social work courses in higher education when the interviews were conducted. Participants' employment status ranged from teaching one class to full-time. Sampling continued until data saturation was reached. For example, the research team discontinued recruitment when there was enough information to replicate the study, there was no ability to obtain new information, and further coding was no longer feasible (Guest et al., 2006). The researchers reached a repetition point, completed the codebook with no further codes needed, and enough data was collected for study replication.

This study was approved by the Institutional Review Board at [blinded for review]. Participants signed informed consent documents before participation and were allowed to ask clarifying questions to ensure their complete understanding of the consent process. To protect the confidentiality, the researchers asked all participants to provide a codename/pseudonym to be used throughout the analysis and reporting of the study's findings. Respondents completed a demographic survey and *The Professional Quality of Life (ProQOL) Version 5 measurement instrument* (Stamm, 2010). In addition, the researchers used a

semi-structured interview guide when conducting in-depth interviews. The researchers developed an interview guide based on the theoretical sensitizing concepts of CS, symbolic interactionism, and pragmatism. Thus, the researchers focused on the meaning participants provided CS as they had experienced it in their own lives.

The researchers conducted in-depth interviews in various locations, such as office spaces and public coffee shops, ranging from 20 to 45 min. The researchers engaged in careful listening, critical thinking, and asking additional probing questions, which are significant for gaining in-depth insight into the lived experience of compassion satisfaction among social work educators. Participant interviews were recorded and transcribed. Based on the constant comparative technique, each line of every transcript was assessed line by line via open coding (Boyatzis, 1998; Strauss and Corbin, 1998). The line-by-line coding was then used to create focused codes. Using the most significant and frequent codes, a codebook was developed. The thematic codes were then entered into Dedoose software. To reinforce the trustworthiness of study findings, the researchers used triangulation, with peer-debriefing and member checking of emergent themes as well as the use of multiple sources of data, such as field notes and participant scores from the Professional Quality of Life (ProQOL) Version 5 measurement instrument (Creswell and Miller, 2000; MacMillan and Koenig, 2004; Padgett, 2008; Stamm, 2010).

Furthermore, a situational analysis was utilized as an extension of grounded theory analysis techniques (Charmaz, 2014). Thus, messy, ordered, and positional maps were used in the data analysis (Clarke et al., 2018). To further the analysis, field notes, and analytical memos were utilized (Charmaz, 2014). Using Dedoose software, the researchers calculated intercoder agreement with a Kappa score of 0.92, considered an excellent agreement (Cohen, 1968). In addition, the researchers completed an adjudication process to look at test results to identify places where there were code disagreements. This iterative process helped to identify and edit segments in which codes disagreed, resulting in more accurately coded materials (Guest and MacQueen, 2008).

The experiences of the researchers as social work students and educators in higher education assisted them to acknowledge similar experiences and connect with the participants emotionally. This connection allowed them for deep and reflective responses during the research process. To reduce their subjectivity and minimize bias, the researchers engaged in bracketing, used field notes, sought consultation, and maintained inter-related and personal thoughts separately from that of participants through data collection and analysis (Moustakas, 1994; Maxwell, 2012; Tufford and Newman, 2012).

Results

The sample for this study was comprised of participants who were mostly Caucasian females, with only two who self-identified as male. Only one participant self-identified as an African American. The mean age for the participants was 51 years old. The participants came from several different, mid-sized cities in the United States. Most participants (60%) held a master's degree level of education, whereas 40% were PhDs. Five served as tenure track faculty, three in term positions, and three as adjunct faculty. The number of years participants worked as social work educators in higher education ranged from one to 30, with a mean time of 11 years. In addition, 64% of participants were not practicing social workers. The number of years that participants had practiced social work also varied, with a range of one to 60. The mean time participants had worked in social work practice social was 18 years (See Table 1).

All participants who completed the Professional Quality of Life (ProQOL) Version 5 measurement instrument (Stamm, 2010) scored high on the Compassion Satisfaction scale. 77% of participants scored low on the Burnout scale, with only two having average scores. 88% scored low on the Secondary Traumatic Stress Scale, with only one participant scoring average. Within the context of social work education, participants described the experience of CS and threats to CS which encompassed four different elements: achievement, support, balance, and empathy. CS was experienced in two different realms: one's educational setting, and one's personal life. The researchers also identified several strategies utilized by social work educators to preserve CS and counter burnout and CF (See Table 2).

While the phenomenon of CS has mainly been studied among practitioners working with clients, the participants in this study were able to apply it to the educational realm and described how they experience CS. Two themes emerged: the impact on students and the students' impact on clients. For example, Theresa described how she experienced CS by recognizing her ability to have an impact on students,

> So as an educator, I think compassion satisfaction would be knowing you can help your students, motivate your students, and help your students get through some of the issues that might lead to compassion fatigue, to help them, to create awareness for them, and maybe some building blocks or tools to help themselves.

Additionally, Samantha explicated how she experienced CS thru recognizing the size of the students' impact on clients, "I think of the thousands and thousands of clients they are going to interact with and how much of a difference I'm making through that and that's huge."

Threats

Threats to CS identified by social work educators included bureaucracy, work overload, online teaching, and organizational culture. Participants named bureaucracy as the most frequent threat interfering with their experiences of CS. For example, Mariah explained the negative impact of institutional barriers on her experience as a social work educator, "Well, I have moments when I'm really ticked off and I've struggled with resentment over institutional barriers more than anything. It's not the student." Moreover, Mary explicated how the interaction with administrators and colleagues interfered with her experience of CS, "It's interacting with administration and colleagues that gives me fatigue. It's the system." Participants also noted that the type of work done, as well as being overloaded posed threats to their experiences of CS. For example, Chris noted, "The work as a social work educator, I swear, you could just do nothing but work all the time, you really could, around the clock, um, there's always something to do." However, Cal addressed the difficulty in sustaining compassion satisfaction while teaching online courses, "Those are much harder for me to maintain that compassion satisfaction, because it's really hard to develop relationships online. I struggle with that." Finally, Leigh talked about

TABLE 1 Participant demographics.

Codename	Highest Education	Current Position	Years as an educator	Currently Practicing	Years as a practitioner
Leigh	Doctoral	Professor	11–20	No	1–20
Cal	Master's	Adjunct	11–20	No	21–40
Emily	Master's	Instructor	1–10	Yes	1–20
Theresa	Doctoral	Professor	21–30	No	1–20
Chris	Doctoral	Assistant Professor	1–10	No	21–40
Samantha	Master's	Instructor	1–10	No	21–40
Michael	Master's	Instructor	11–20	No	41–60
Mary	Doctoral	Associate Professor	21–30	No	21–40
Mariah	Doctoral	Professor	21–30	Yes	21–40
Janet	Master's	Adjunct	1–10	Yes	1–20
Bradford	Master's	Adjunct	1–10	Yes	21–40

TABLE 2 Elements, realms, and strategies of compassion satisfaction for social work educators working in higher education.

Elements of CS	Realm	Strategies
1. Achievement	Educational	- Perceiving student success - Participating in energizing engagement
	Personal	Awareness of doing one's best
2. Support	Educational	Giving and receiving collegial encouragement
	Personal	Fellowshipping with family and friends
3. Balance	Educational	Boundaries with Students
	Personal	Self-care
4. Empathy	Educational	Considering context of students' personal lives
	Personal	Empathy for self

the potentially negative impact the organizational culture of research-based institutions of higher learning might have on their educators when she voiced, "They're really living and dying by that publish or perish, then I think it takes the educator sometimes away from what that primary purpose of being an educator is, and I think when you get pulled away from the primary purpose, whether you realize it or not, there is a, uh, a frustration, there's a friction."

Coping strategies

The strategies participants most frequently mentioned related to experiencing CS concerned the element of achievement. These took place in both the educational realm and the personal realm. Within the personal realm, participants noted the strategies of perceiving student success and participating in energizing engagement. Student success was an important part of CS for many participants. For example, Mariah shared how an experience of CS was facilitated for her by recognizing the achievement of her students, as practitioners,

> "I've just seen people that I've taught become outstanding clinicians, so that's just wonderful. I did not cause that, but I had something to do with that, and that feels good.

Other participants saw achievements such as high-quality classroom engagement, which energized their work roles and lead to maintaining CS. Leigh noted, "I experience it when we get in a classroom discussion that just goes off the chain, and its, you know, phenomenally more than you could have hoped for…. there's just something so satisfying and energizing when you come out of that experience."

Within the personal realm, achievement was focused on self-awareness, such as realizing that one did the best job they possibly could have done. For example, Mary noted,

> You cannot be dependent on some outside factor or some person constantly giving you, 'Good job,' 'Thank you,' all the time, because it's not going to come. It needs to come from inside yourself, and that's why it makes sense. You're the compassion satisfaction or the … meaning you get from being able to help somebody else.

Likewise, Mariah echoed these sentiments when she said, "I do the best I can. I work on that; I try to work on integrity. I try to be who I am when nobody's looking." Self-awareness and self-reflection were related to a lack of support. Participants reported needing to develop these attributes within the personal realm if they were not receiving support from others in the work environment.

Many participants put forth narratives about collegial support as a strategy for experiencing CS within the educational realm. For instance, when she first began working in higher education, Theresa recalled a professor who, "…took me under their wing and really helped me, so I was glad that that person was there." Likewise, Cal expanded on Theresa's insights when she said, she had a full-time faculty lead that acted as "…kind of my liaison. She's been very positive, you know, very full of compliments when I'm doing something well." Participants also detailed that support also arose out of the personal realm and involved family and friends. For example, Mariah noted, "I have a strong network of friends and family and colleagues. All those things help."

Most participants noted to achieve balance, setting boundaries was an important aspect of bolstering experiences with CS. The boundaries were described by participants as keeping appropriate lines between themselves as faculty and the students. This definition encompassed ideas of their roles as helpers, classroom work, and internal boundaries. Emily discussed the importance of having clear boundaries when she stated, "I will mentor them, talk to them kind of thing but if they full on need therapy, I will refer them out." And, related to Emily's sentiments on the topic, Theresa offered, "… my job is to help coach them, teach them, and have them learn. I see myself as being responsible to identify the barriers to their learning and get them the resources to help them with that."

The participants also discussed balance as it related to feedback, grading, and fairness. Cal explained, "I get that students get frustrated, but I'm always very careful to phrase my feedback in a way that lets students own their behaviors and their mistakes." Adding to that, Bradford put forth "…when helping a student, I try to regulate my ability to answer that and make sure I can do that for everybody. So, I make sure there is fairness and equity."

Participants also noted that keeping good boundaries also meant internal boundaries. For example, Samantha explained that she does not take students' challenging behavior personally when she elaborated, "I do not look at their performance that I'm responsible for, because there are too many other things going on in their life that I cannot intervene with." Adding to that, Michael detailed: "One of the saddest days for me in social work, way long time ago, was learning that I could do the best job I could possibly do, and have a bad outcome, because I'm not in charge of the outcome." Within the personal realm, self-care was a strategy that participants utilized to maintain balance and experience CS. Emily noted, "So, I guess if I take care of myself then I will be in a better mindset of things, and so, it'd be easier to deal with something that comes up." Similarly, Michael noted, "We need to take more responsibility for our own outcomes, our own satisfaction index. I think we should pay more attention to how we are doing mentally, physically."

Speaking to keeping boundaries as a form of self-care, Chris noted a strategy of being 'done" when 'the keys go in the basket" This shows a personal boundary between work and home. Adding to that, Chris vocalized: "It took me a while to, you know, work through, this profession…does not define you. And, once I worked my way through that, man, my compassion satisfaction rose… I just really engage in, you know, good self-care habits."

Empathy came up when speaking about students, as well as empathy for themselves. Within the educational realm, the participants noted having extra compassion for students because of their personal challenges outside of the classroom. Mariah voiced.

> It's hard and grueling when you are a student. And I think part of compassion is understanding there is this whole range of what people bring to the room, and you often do not know what that is.

Empathy for self was noted in the personal realm. This appeared to not only allow a route to self-care, but also allow an honesty from students. As Bradford one day in her class she said to her students, "we are going to end class early, and we'll pick it up next week, I only got three hours of sleep, I know I'll be in a better place, and I'll be able to convey these things to you in a much better way than I am right now, so I'm honest with them about my own life struggles, so they kind of know it's okay to be honest about theirs."

Discussion

Current research in the field of traumatology identified CS as an essential protective factor against work-related stressors, such as burnout, compassion fatigue, and secondary traumatic disorder, emphasizing how CS leads to experiencing positive outcomes from work like improving work performance, increasing the level of engagement with clients, and enhancing competency (Radey and Figley, 2007; Snyder and Cistulli, 2009; Sacco and Copel, 2018; Raimondi, 2019). While stress, compassion fatigue, burnout, and other adverse psychical and psychological outcomes have been associated with working as social work educators in higher education (Stoves, 2014; Cordaro, 2020), research on CS among this population is still rare (Raimondi, 2019; Velez-Cruz and Holstun, 2022). In this study, we have acquired qualitative data from 11 social work educators in higher education to help elucidate the significance of CS from an emic perspective. This study addressed how the psychological essence of CS is identified and described among social work educators in higher education, explored how social work educators engage in compassion satisfaction, and unearthed a deeper understanding of threats to CS among this population.

A substantial number of participants were able to apply CS to the educational realm, indicating it can be experienced thru recognizing their abilities to have a positive impact on students and realizing the great size of the influence that students will have on clients in the future. This finding is consistent with how Stamm (2010) defined the experience of CS among helping professionals, the pleasure, positive emotions, and optimistic feelings experienced by those working in helping professions thru having the ability to complete their work effectively and assist others through their work.

A number of the participants in this study identified bureaucracy, overload, online teaching, and organizational culture as threats to CS. This is clearly seen in the challenges and struggles they experienced from institutional barriers, interaction with administrators and colleagues, work overload, online teaching, and involvement with the organizational culture of research-based institutions of higher learning, which interfered with their experiences of CS. These threats to CS demonstrate how work demands with a lack of administrative and collegial support in higher education institutions could produce adverse negative outcomes on this population's professional quality of life and increase the likelihood of stress and burnout among this population (Hoffman et al., 2007; Kim and Stoner, 2008; Watts and Robertson, 2011; Chen, 2022).

Many of our participants focused on achievement, support, balance, and empathy as elements within the educational and personal realms encompassed their lived experience of compassion satisfaction. These four elements were used by participants in this study as practical tools for everyday life to cope with stressors that come from working as social work educators and to facilitate the experience of CS. Participants in this study spoke of a sense of achievement from perceiving students' success, participating in energizing engagement, being a part of a high-quality classroom, and realizing that they did the best job they possibly could have done, which they used as an important coping strategy to deal with stress and experience CS. Numerous studies point to the significance of a sense of

achievement as a protective factor against stress and compassion fatigue, which negatively influence the experience of CS (Bourassa, 2009; Harr and Moore, 2011; Kawar et al., 2019).

Participants in this study called upon support as a strategy for dealing with work stressors and experiencing CS. This is clearly seen in the collegial support they experienced within the educational realm and the family and friend support experienced within the personal realm, which contributed positively to their experience of CS as educators. As Drury et al. (2014) have shown, the capacity for coping with stress, burnout, and compassion fatigue can be enhanced through strong social and collegial support, which facilitates the experience of CS (Drury et al., 2014). In a recent study Yu and Gui (2022) point to the importance of perceived social support to improve CS and protect self against compassion fatigue (Way and Tracy, 2012; Yu and Gui, 2022).

The importance of achieving balance for the social work educators in higher education in this study was a significant tool to alleviate stress and experience CS. Setting and keeping good boundaries, balance as it related to feedback and personal boundary between work and home were some of the examples that participants in this study discussed as an important strategy for bolstering their experiences with CS. This finding reinforces Bae et al. (2020) when they indicated that work-life balance is associated with an increase in compassion satisfaction. The importance of self-care, which was discussed by participants in this study as a coping strategy to encounter compassion fatigue and experience CS is in line with past research (Conrad and Kellar-Guenther, 2006; Alkema et al., 2008; Harr et al., 2014; Salloum et al., 2015).

Our participants in this study also point to empathy as an important strategy to maintain CS, which is in line with the research showing that higher levels of empathy are associated with lower levels of burnout and secondary stress trauma (Wagaman et al., 2015). However, other studies have shown the possibility for a faculty member who exercises empathy and deeply cares for distressed students to become psychologically overwhelmed and develop compassion fatigue (Stoves, 2014; Cordaro, 2020).

Future research recommendations

Stamm's (2010) explications on CS among the helping professions and her concepts were helpful for analysis purposes. They appear to align well with the idea of CS as extended to social work educators. However, more research may help connect other aspects of CS to higher education. Implications for educators would be to attempt to use the strategies found to foster their own CS. Strategies that emerged could be beneficial for others to replicate, such as keeping good boundaries or finding a supportive person within their colleagues. Administrators in higher education should look carefully at the organizational culture of their institution, which may affect the CS of those in their educational departments. Thus, developing policies and procedures that assist social work educators in increasing self-care levels to sustain CS and encounter compassion fatigue and burnout.

Limitations

Most of the participants in the study sample had taught for over 10 years, and this provided less data on those who were newer to the profession. Therefore, the results may not be as representative as those who are new educators. There were also more females (81%) than males (18%) represented in the participant sample. These percentages differed from the national average of 72.5% for females and 27% for males, as reported in the Council on Social Work Education's (CSWE) 2017 annual report (CSWE, 2017). Thus, the sample may not be gender-representative of the overall social work educator population.

Conclusion

This study provided a platform for participants to voice their lived experiences of CS within the educator domain. Based on the study's findings, further research would be beneficial to further investigate each strategy found and the barriers within education to engaging in the strategy. Further, it would be interesting to investigate how CS differs for those teaching full-time versus those still practicing while working in higher education. Additional research could also focus on comparing CS within higher education across different disciplines to see if there are challenges or strategies unique to the social work education realm. Overall, the lived experiences of CS are a topic ripe for investigation in this field and essential for the well-being of educators. The experience of higher education professionals in social work education is an essential function of personal and educational professional well-being for both those in academia and the future social workers they shape.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Institutional Review Board (IRB) at the University of Louisville. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SS performed the qualitative analysis, participated in the design, and edited both the first and final drafts of the manuscript. BM helped with the data's design and analysis. JZ carried out the qualitative analysis and contributed to the study's design. All authors contributed to the article, read, edited, and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Energizing compassion: using music and community focus to stimulate compassion drive and sense of connectedness

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Objectives: The last 20 years have seen considerable research on the nature and biopsychosocial impacts of compassion training on self and others. This training is usually focused on calming and slowing the mind and body and on individual imagery practices and mantras. This study explored the effects of three variations: 1. The impact of using energizing music to generate activation and "drive" for compassion; 2. To focus on imagining "breathing in and breathing out a white light or mist of compassion" to bring compassion to the world; and 3. While listening to energizing music, participants were guided to imagining connecting to the compassion (Sangha) community, imagining oneself as linking with others as part of communities seeking to help the world.

Methods: From approximately 1,600 members of the Compassionate Mind discussion list, participants were invited to take part in a new energizing focused self-practice study. The study involved listening to recorded guidance on the evolutionary model of compassion and the need to address the potentially harmful side of our nature. This was followed by a 4 1/2-min tonglen-informed guided practice of breathing in and breathing out compassion accompanied by energizing music. Forty-three participants completed several self-report scales measuring compassion orientation, wellbeing, social safeness, and positive affect before and following 2 weeks of practice. Participant experiences were recorded from 6 open explorative questions.

Results: Self-report measures taken before and following 2 weeks of practice revealed significant increases in self-compassion, compassion to others, openness to compassion from others, activated positive affect, safe positive affect, social safeness, and wellbeing, with the largest effect size relating to compassion for the self ($d = -0.76$). In addition, qualitative data revealed that the participants had experienced the practice as energizing, inspiring, and felt socially connected and that it had significant impacts on other aspects of their lives. Some participants noted that engaging with suffering also stimulated sadness.

Conclusion: This study found that pairing energizing music with breathing practices and specific compassion visualizations, focusing on the desire to bring compassion to the world and be part of a compassionate community, was well-accepted and had a range of significant positive impacts. This study indicates the potential value of exploring energizing in comparison to the more standard soothing and settling practices as ways of stimulating the biopsychosocial processes of compassion.

KEYWORDS

compassion, meditation, energizing, connectedness, music, tonglen

Introduction

The biopsychosocial benefits of cultivating compassion have been promoted for thousands of years (Dalai Lama, 1995; Lampert, 2005; Ricard, 2015). More recently, the nature and beneficial impact of compassion has come under scientific exploration (for reviews see Gilbert, 2017; Kirby, 2017; Seppälä et al., 2017; Roca et al., 2021). Although there remain controversies and variations in how compassion is defined and measured (Mascaro et al., 2020), rooting compassion in its evolved algorithm (Gilbert, 2009, 2014, 2017, 2020a,b; Gilbert and Choden, 2013) offers a fairly standard motive-based definition that compassion constitutes *a sensitivity to suffering in self and others with a commitment to try to alleviate and prevent it* (Dalai Lama, 1995; Goetz et al., 2010; Gilbert, 2017; Mascaro et al., 2020). The advantage of seeing compassion as a stimulus–response algorithm (i.e., "*if* A *then* do B") is that it enables the identification of two different elements. These are first to explore the processes that facilitate people's detection and preparedness to move toward and engage with suffering, and second, the processes that influence people's efforts to work out what to do and actually do them (Gilbert, 2009; Poulin, 2017; Di Bello et al., 2020). This means that the first movements to compassion can be stressful because we are moving toward pain or threat (Gilbert, 2009; Di Bello et al., 2020). Studies have shown that when only distress is focused on (e.g., through images or stories), compassion can be stressful (Gilbert et al., 2017; Condon and Makransky, 2020; Di Bello et al., 2020). Condon and Makransky (2020) have drawn attention to this issue and developed what they call *sustainable compassion training*. Like Compassion Focused Therapy (CFT), they suggested that training in compassion needs to teach abilities to be sensitive and have the courage and wisdom for skilful engagement but also ways to be helpful. Hence, the second element of the compassion algorithm is the action and response function. When guiding people in compassion, it is important how and what people learn about compassion (Mascaro et al., 2022).

Planning and taking action requires a different set of skills and a different type of empathy to work out what will be helpful and to act on it compared to being sensitive, moving into and empathizing with suffering. Planning and taking action are also related to different physiological processes (Di Bello et al., 2020). Poulin (2017) notes that people can be motivated and knowledgeable of what to do but still not take compassionate action. The skills of compassion can also differ with context. For example, a skilled firefighter, social advocate, or therapist counseling a dying client require different types of empathic skill, tolerance, and other compassion competencies, but are united in *the motive* to try to address suffering in their context. This means individuals can train in specific competencies for specific contexts. Individuals who can behave compassionately in one context, for example, risking their lives to save others, may not be that empathic or compassionate in another context, such as having empathic sensitivity to mental distress. We should also note that our use of competencies to be sensitive to suffering and its causes are related *to motives*. For example, the motives for vengeance, cruelty, or sadistic enjoyment can also involve sensitivity to suffering, but how to cause it rather than relieve it.

The fact that the algorithm of compassion has two very distinct processes complicates how we investigate its social and psychophysiological processes, particularly when we are exploring people's reactions to distress or their planned actions which are context-dependent. Di Bello et al. (2020) studied subjective and physiological responses to two videos. Video 1 invited participants to look at individuals in distress and explored empathic sensitivity. Video 2 invited participants to look at people engaging in helpful actions. Following the first video, participants experienced an increase in sadness and a decrease in positive affect, as well as a decrease in vagally-mediated heart rate variability (vmHRV). This shows that the first aspect of compassion (engagement with and sensitivity to suffering) involves empathic resonance and a decrease in one's own positive emotions. After participants watched the second video, which tapped into the "action" component of compassion, a decrease in sadness and an increase in vmHRV was found. The results, therefore, indicate how the two processes of compassion are linked to different psychophysiologies.

Loving-kindness meditations mitigate against the problems of only being sensitive to distress because they focus on distress but then quickly shift the participant to the response component of wishing for a positive outcome for the person. For example, Weng et al. (2018) offered instructions:

> *For each person, they imagined a time when the person had suffered, brought non-judgmental and balanced attention to reactions to suffering, and then practiced wishing the person relief from suffering. They repeated compassion-generating phrases such as, "May you be free from suffering. May you have joy and happiness." They were also instructed to pay attention to bodily sensations (particularly around the heart) and to envision a golden light extending from their heart to the heart of the other person* (p. 4).

The rapid movement from awareness of suffering to positive responses with the wish to be free of suffering stimulates different physiological systems (Petrocchi et al., 2022).

Many of these forms of meditative practices also focus on mindfulness and processes of *slowing, soothing, and grounding* in the body (Weng et al., 2013, 2018). These guided practices seek to stimulate the vagus nerve and other physiological infrastructures that support compassion (Keltner et al., 2014; Porges, 2017; Kirschner et al., 2019).

Energizing and music

Soothing effects may be a result of the way that training is conducted because compassion can also increase arousal (Di Bello et al., 2020). Indeed, compassionate action often requires invigorating behavior, for example, in saving others or struggling for social justice and taking heroic action (Zimbardo, 2019). We wanted to explore the impact of a different type of compassion practice that deliberately seeks to activate rather than calm. There are spiritual practices, such as the use of Sufi whirling and other forms of dance, that seek to create an experience of self-transcendence, and stimulate compassion with activation and

arousal (Winton-Henry, 2009). Linked to a more "invigorated" approach to compassion, there is increasing evidence that certain kinds of energized movements, such as yoga and dance, can create a sense of interconnectedness that supports compassion motivation. They can invigorate feelings of encouragement, enthusiasm, and joy for wanting to spread compassion and take action (Gard et al., 2012; Karkou et al., 2019; Yilmazer et al., 2020).

We did not use dance in our study but we did use music that can energize and give people the desire to want to move or dance. We accompanied visualizations with energizing music taken from Thomas Bergersen called the Final Frontier, available on the internet (and used in this study with permission). There is good evidence that music can have a variety of impacts on emotional states as exemplified by how it is used in film scenes. There is also good evidence that music can have major therapeutic benefits (De Witte et al., 2020). For many years, one of the authors (PG) has introduced these practices to colleagues and participants during retreats and in training. It was based on their feedback and experience that the current practice was developed for research.

Tonglen

One of the authors (PG) was introduced to several different practices of tonglen by a Buddhist monk called Choden and his colleagues during training in Samye Ling (Gilbert and Choden, 2013). It is seen mainly as a Tibetan Buddhist practice believed to be around 1,000 years old. It evolved to help promote compassion and the courage to engage with suffering and reduce ego-focusing. It invites a more visceral approach to take in the suffering of others and breathe out compassion, allied with a strong wish for suffering to be relieved, and forms part of Bodhicitta practice. A simple overview is given by Chödrön (2023), a more detailed description of the process by Berzin (2005), and some research studies by Mah et al. (2020). As noted, the standard method is to imagine breathing in suffering (sometimes in the form of dark smoke), imagine it being transformed in one's heart, and then breathing out a white light of compassion, with a focus on one's heartfelt wish for that to be healing. It heightens the issue of taking on the pain of others and transforming it. It also stimulates a sense of responsibility to address the suffering around us.

In this study, we changed the focus because imagining taking on or taking in the suffering of others is an advanced practice and we were more interested in focusing on the energizing process of bringing compassion into the world. So, instead of breathing in suffering, we invited participants to imagine breathing in a white light or mist of compassion, which fills one's body and invigorates compassion (in a more advanced practice, participants can imagine breathing in a bright white light that has emanated from an imagined Buddha sitting at the center of the universe who is emanating compassion and energy) (Rinpoche and Mullen, 2005). Then, participants were invited to imagine breathing out compassion in the form of white light or mist to address the suffering in the world. So, basically, participants imagined breathing in and breathing out compassionate light.

The focus of compassion is to address suffering and the causes of suffering. One of the causes of suffering is, of course, ourselves. One of the reasons we can be so harmful is because we are all evolved beings that did not choose to be here and have an evolved and socially shaped brain that can be tricky and harmful according to what gets activated. Looking back over the last few thousand years, it is clear that humans have a terrible dark side, with their history of wars, holocausts, torture, slavery, and everyday callousness (Gilbert, 2019b). While loving-kindness tends to focus on the wish for others to be free of suffering and happiness, another focus can be to bring the power of compassion to the dark side in symbolic processes or visualizations. One of the authors (PG) adapted the practice such that when we breathe out compassionate light, we imagine breathing out light to address the darkness, to light up the darkness as a way of focusing on addressing the dark side of humanity. Hence, participants ground themselves, using a standard soothing rhythm breathing practice, then imagine breathing in compassionate light and breathing out compassionate light. What they breathe out represents the light that brings enlightenment and compassion to the world because we are all born with tricky brains and can do harmful things.

Part of a community

One of the most important evolutionary adaptations for humans is our extraordinary capacity to do things together and to want to feel part of a community and have a sense of belonging (Baumeister and Leary, 1995; Mikulincer and Shaver, 2014; Camilleri et al., 2023). In many Buddhist traditions, learning and practicing meditation began in communities and monasteries (the Sangha) and only later, when individuals practiced, would they spend more time meditating alone. We believe that visualizing oneself as part of a community that shares the collaborative wish to bring compassion into the world, also stimulates courage for compassion via a sense of belonging and joint action. Hence, the second part of this visualization invited participants to consider that they were amongst others doing the same practice. Additionally, towards the end of the practice, participants were asked to imagine that the compassionate light they were breathing out would coalesce with that of others to become an expanse of compassionate light spreading into the darkness.

Compassion has been studied in different ways including through physiology, behavior, and self-report measures (see Seppälä et al., 2017). As this was an internet proof of concept early study, we used the compassion engagement and action self-report scales (Gilbert et al., 2017) because they tap into the two aspects of compassion: "sensitivity" and "action", in relationship to the flows of compassion: to self, to others, and from others. We were also interested in whether the energizing process impacts positive emotion in different ways. The "types of positive affect" scale enables the distinction among energizing positive emotion, relaxed, and also safeness-content positive emotion (Gilbert et al., 2009; Armstrong et al., 2021). One of the aspects of this type of compassion exercise was designed to help people experience being part of a compassionate community. To assess this aspect, we utilized the "social safeness and pleasure" scale which explores people's sense of being part of and secure within their social relational networks (Gilbert et al., 2009). Finally, we explored the

impact on general wellbeing. Hence, in this early study, we were exploring the impact of energizing compassion on self-reported compassion, types of positive emotion, the degree to which it stimulated social connectedness and was associated with wellbeing. Subsequent studies will explore other potential effects.

Aims

In this proof of principle research, we sought to explore if the research ideas of bringing energizing music to an adaptation of a tonglen practice are understandable and the methodology acceptable to participants. While objective-standardized matches can be used in such studies, what is especially important is qualitative research, which can also provide insight into the unique experiences, helpfulness or possible detrimental effect of the practices. In particular, we wanted to explore *how* people experienced energizing compassion that uses music and stimulates a sense of being part of a collective compassionate, motivated group. Hence, we incorporated a set of specifically designed single-item measures.

Methods

Design

The study employed a repeated measures within-subjects design using self-report measures and qualitative feedback before and after 2 weeks of practice.

Participants

Initially, a study invitation was sent via email to the Compassionate Mind Foundation Google discussion list of ~1,600 members (mainly consisting of professionals interested in the evolutionary and biopsychosocial approach to compassion), inviting them to take part in the study. The only exclusion criterion was the inability to understand spoken and written English. Although many participants ($n = 115$) showed interest, only 43 participants completed measures both before and after using the practice for 2 weeks. The final group consisted of 35 female and 8 male participants aged 25–68 years ($M = 49.35$; $SD = 11.06$).

Guided meditation

To some extent, the origins of this study were serendipitous. One of the authors (PG), a musician interested in the role of music to create emotional textures, had been practicing compassion exercises (such as the flow of life and tonglen practices), using different types of music. He identified one piece of music by Thomas Bergersen that, for him, generates energy for compassion. Out of curiosity, he offered to share his experience with participants at an online workshop to explore their experience. Participants were very enthusiastic and fed back that combining the music with this guided meditation generated feelings of being energized, connected, and joyful. With this anecdotal evidence, the authors decided to explore these experiences in a more standard scientific way.

The authors contacted Thomas Bergersen, composer of the music called *Final Frontier* from the album *Sun* (https://www.youtube.com/watch?v=BAzCf0ascW8), for permission to use the music with a guided meditation and it was granted for a small fee.

One of the authors (PG) then developed a video that provided a brief overview of the CFT evolutionary approach to compassion which was followed by guided meditation. This included the following information: 1. We, like all living things, have bodies, brains, and minds *that have been built for us, not by us,* to pursue survival and reproductive biopsychosocial goals (Gilbert, 1989). A lion did not choose to be a lion, and no zebra chose to be its prey. No human chose to be born human, nor did they choose their ethnicity, gender, birth, or cultural embeddedness. 2. Consequently, we inherit *tricky* brains that have the potential for love and compassion, but also hatred, callousness, and cruelty; we can act harmfully or helpfully. 3. Human history shows that we have a terrible dark side that has acted very harmfully through wars, slavery, exploitation, and oppression. 4. It is important to become mindfully aware of what our evolved and socially constructed brain can do through no fault of our own. 5. With awareness, comes the option to cultivate the most important motives that can help us stand against the motives behind the dark side of our mind (fear, rage, and greed)—this is the cultivation of compassion. Although given an evolutionary orientation (Gilbert, 1989, 2009, 2019a), this awareness of the challenges of the human mind has been articulated in Buddhist writings and others for many centuries (Dalai Lama, 1995; Austin, 2011). Hence, CFT focuses on addressing the dark side of the human mind.

Following this brief psychoeducation outline, participants were guided into the CFT grounding and body preparation for compassion meditation (see Gilbert and Simos, 2022). This involved attention to posture and brief soothing-rhythm breathing of around four breaths per minute. This led into the music and newly developed guided meditation based on tonglen practice, modified in the following ways:

- Rather than breathing in suffering and breathing out compassion, participants were guided to imagine breathing in a compassion-based white light or a mist that fills the body, then breathing out white light and mist, whilst imagining it reaching out into the world to address the suffering of others. Additionally, participants were guided to focus on feeling that this was something they really wanted to do, and how wonderful that would be if they could do it and help the world move toward a more compassionate orientation. This is linked to what is called a Bodhicitta wish (Rinpoche, 1999).
- The third component invited participants to imagine their social connectedness, to see themselves as part of a community of individuals working to address suffering in the world; to imagine all the white light they were sending out joining with

others to fill the world with compassionate light. In Buddhist traditions, this can be thought of as connecting to a sense of being a member of a community sharing the same aspirations: a Sangha. Again, the focus is on the joyous and energizing experience of being part of such a community.

The full recording and transcript can be found at https://www.compassionatemind.co.uk/resource/audio.

Procedure

Participants from the Compassionate Mind Foundation Google discussion group were recruited via email and directed to the study information sheet on Qualtrics (Qualtrics, Provo, UT). They provided written consent in accordance with the Declaration of Helsinki's ethical principles for medical research involving human subjects (World Medical Association, 2013).

Participants were then asked to complete two demographic questions regarding their age and gender, and two questions which explored their previous experiences of using compassion and mindfulness meditations. The latter two questions were rated on a 5-point Likert scale from 0 "not very much" to 4 "very much". They were also asked to complete self-report questionnaires measuring compassion orientation, positive affect, wellbeing, and social safeness. Participants were subsequently emailed and given access to the video containing the overview of compassion and guided meditation, and invited to practice this over 2 weeks. They were invited to practice this as often as possible, with or without the recording and music.

After 2 weeks, the participants were invited via email to complete the same self-report measures completed initially, alongside some questions on usage and experience of the practice. These included several statements asking participants to rate the extent to which the meditation helped them feel more, for example, energized (measured from 1 "not at all" to 10 "very much"). Participants were also invited to complete a number of open-ended questions about their experience and how the meditation made them feel.

Measures

Participants were asked to complete the following self-report measures both before and after 2 weeks of practice:

Three types of positive affect scale

Gilbert et al. (2008) developed this scale to measure the degree to which people experience different positive emotions. Participants are asked to rate 18 "feeling" words on a 5-point scale to indicate how characteristic it is of them (0 = "not characteristic of me" to 4 = "very characteristic of me"). Each item belongs to one of three subscales, which are Activated Positive Affect (e.g. "excited"), Relaxed Positive Affect (e.g. "peaceful"), and Safeness/Contentment Positive Affect (e.g. "secure"). The scale has good psychometric properties with Cronbach's alpha of 0.83 for Activating Positive Affect and Relaxed Positive Affect, and 0.73 for Safeness/Contentment Positive Affect (Gilbert et al., 2008).

Compassionate Engagement and Action Scales

The Compassionate Engagement and Action Scales (CEAS; Gilbert et al., 2017) are three scales that measure self-compassion ("I am motivated to engage and work with my distress when it arises"), the ability to be compassionate to distressed others ("I am motivated to engage and work with other peoples' distress when it arises"), and the ability to receive compassion ("Other people are actively motivated to engage and work with my distress when it arises"). In the first section of each scale, six items are formulated to reflect the six compassion attributes in the CFT model: sensitivity to suffering, sympathy, non-judgement, empathy, distress tolerance, and care for wellbeing. The second section of the scale has four more items that reflect specific compassionate actions to deal with distress. Participants are asked to rate each statement according to how frequently it occurs on a Likert scale from 1 to 10 (1 = "Never"; 10 = "Always"). The CEAS showed good to excellent internal consistencies of self-compassion engagement $\alpha = 0.74$/action $\alpha = 0.89$; for others engagement $\alpha = 0.81$/action $\alpha = 0.88$ and from others engagement $\alpha = 0.91$/action $\alpha = 0.93$ (Matos et al., 2021).

Social Safeness and Pleasure Scale

The Social Safeness and Pleasure Scale (SSPS; Gilbert et al., 2009) was developed to assess the extent to which individuals feel a sense of warmth, acceptance, and connectedness in their social world. Items include "I feel secure and wanted" and "I feel a sense of warmth in my relationships with people." Participants rate their agreement with 11 statements using a Likert scale from 1 ("almost never") to 5 ("almost all the time"). Previous research has found that this scale demonstrates good internal consistency ($\alpha = 0.96$) (Kelly and Dupasquier, 2016).

Warwick and Edinburgh Well Being Scale

The Warwick and Edinburgh Well Being Scale (WEWBS; Tennant et al., 2007) is a 14-item scale assessing eudemonic and hedonic wellbeing. Items include cognitive processes (thinking clearly and solving problems), feelings (optimism, confidence, and feeling useful), and the quality of relationships with others (feeling loved and feeling close to other people). These are expressed as 14 statements which people can answer on a 5-point Likert scale (from 1 "none of the time" to 5 "all of the time"). Statements include "I've been feeling relaxed", "I've been thinking clearly" and "I've been feeling loved". The scale has good internal consistency (Cronbach's alpha score of 0.89 in a student sample and 0.91 in a sample representative of the population; Tennant et al., 2007).

Process

Following 2 weeks of practice, the participants were asked to reflect on the frequency of their usage of the meditation during the first and second week, with and without music, on a 5-point Likert scale (none, 1–2, 3–4, 5–6, or 7 or more times). The participants were asked to complete several single-item questions derived from common reflections people had made using the meditation. They

were not derived in any specific order but simply developed to understand how the meditation was experienced. Participants were asked to rate the extent to which the practice made them feel more, for example, energized, joyful, and socially connected, on a 10-point Likert scale (from "not at all" to "very much").

Participants were asked the following six open-ended questions exploring their experiences following 2 weeks of practice:

1. What were your standout experiences?
2. Can you describe how the practice made you feel?
3. Could you describe any impact the practice may have had on you?
4. Did you notice any change in your experience and understanding of compassion?
5. How do you think the practice might change the way you act in the future?
6. Any other feedback?

In addition, participants were invited to reflect on their experiences and share their observations from weeks 1 and 2. We analyzed this data separately from the six open-ended questions.

Data analyses

Quantitative analysis

Data were analyzed using SPSS version 27. Item-level missing data were inputted using the mode for scales with fewer than 20% of items missing. In the case where missing data were higher, scale/item data were removed from the dataset; 62.6% of participants (n = 72/115) only completed the pre-measures. This left 37.4% (n = 43) of participants who completed all of the measures. This formed the basis of the analysis. Data were checked for normality and outliers; skewness and kurtosis values ranged within acceptable levels and no statistically significant violations were found (Kline, 2005). Means, standard deviations, and reliability statistics (Cronbach's alpha) were calculated for each study variable. Correlations were generated to explore relationships among the single-item measures. In addition, paired-samples t-tests explored the changes in questionnaire responses before and after the 2-week intervention. For the two questions pertaining to practice usage and engagement with the exercises, frequency analysis was conducted.

Qualitative analysis

Qualitative analysis of open-ended questions sought to explore the impact and experience of using energizing music and a guided variation of tonglen practice.

In consideration of the responses given in open-ended questions and the nature of this pilot study, qualitative content analysis (QCA) was used to explore the data. This provided an opportunity to explore theoretical issues, enhance understanding of the data (Elo and Kyngäs, 2008), provide inferences and insights from the data in this context, and highlight categories for further exploration (Krippendorff, 1980). The analysis, therefore, focused on the experience of energizing compassion as a new form of practice.

Qualitative content analysis process:

1. Preparation of the data and analysis of word frequency was carried out using MAXQDA 2022 (VERBI Software, 2021).
2. Inductive analysis of categories (open-ended question responses) was based initially on word frequency. Responses containing words with the highest frequency were then coded and grouped into categories. We then returned to all responses for each question to ensure themes had not been missed. The responses for each category were extracted and compiled into documents that covered each of the open-ended questions separately. This analysis sought to explore and identify critical processes (Lederman, 1991), with a qualitative focus on meanings, intentions, consequences, and context (Downe-Wamboldt, 1992).
3. Personal observations from weeks 1 and 2 were also analysed.
4. Analyses were reported using a combination of MAXQDA word cloud graphics (see Supplementary material) and categories highlighted in the inductive analysis. Some words were removed from the word cloud graphics to improve readability (e.g. "and", "of", "with" and "the"). A table of the process of analysis and the themes highlighted is also available in Supplementary material.

Results

Quantitative analysis

The majority of participants had some degree of experience with compassion (37/43 participants) and mindfulness practices (33/43 participants) as shown in Table 1.

Participants were able to practice the meditation without music if they wished. The majority of participants reported that they practiced with the music three or more times in week 1 (30/41) and week 2 (23/41), (see Table 2).

Table 3 reveals that all the single item questions were highly correlated. Of interest, the experiences of feeling energised, joyful, socially connected and confident were highly correlated with the

TABLE 1 Participants' previous mindfulness and compassion meditation practice usage (n = 43).

	0 Not very much	1	2	3	4 Very much
To what extent do you use… Compassion based practices?	2/43	4/43	10/43	15/43	12/43
Mindfulness and/or other meditations?	4/43	6/43	9/43	14/43	10/43

TABLE 2 Participant engagement with the energizing compassion exercise with music during week 1 and 2 (n = 41; n = 2 missing).

	None	1–2	3–4	5–6	7 or more
Week 1	2/41	9/41	12/41	14/41	4/41
Week 2	7/41	11/41	8/41	12/41	3/41

TABLE 3 Descriptives (means and standard deviations) and correlations for single-item questions exploring the extent to which participants felt, for example energized, following two weeks' practice.

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Energized	7.48	2.10	–									
2. Joyful	7.43	2.23	0.89**	–								
3. Socially connected	7.02	2.17	0.53**	0.56**	–							
4. Confident	7.12	2.20	0.79**	0.86**	0.68**	–						
5. Hopeful	7.43	2.20	0.86**	0.88**	0.64**	0.89**	–					
6. Compassionate to others	7.52	1.98	0.58**	0.58**	0.72**	0.67**	0.64**	–				
7. Compassionate to self	7.43	2.15	0.60**	0.57**	0.62**	0.65**	0.66**	0.92**	–			
8. Open to compassion from others	7.19	2.25	0.57**	0.60**	0.61**	0.74**	0.70**	0.79**	0.80**	–		
9. Courageous	7.10	2.36	0.81**	0.86**	0.53**	0.84**	0.89**	0.50**	0.56**	0.69**	–	
10. Wise	6.60	2.45	0.65**	0.72**	0.54**	0.81**	0.79**	0.40**	0.43**	0.66**	0.90**	–

**Correlation is significant at the 0.001 level (2-tailed).
(1) energized; (2) joyful; (3) socially connected; (4) confident; (5) hopeful; (6) compassionate to others; (7) compassionate to self; (8) open to compassion from others; (9) courageous; (10) wise.

TABLE 4 Descriptives (means and standard deviations) and paired sample *t*-test scores for questionnaire measure at pre- and post-2 weeks practice.

				T-test			
	α	Baseline	Post	*t*	*df*	*p*	*d*
Compassion for self	0.86	70.44 (10.55)	79.44 (9.14)	−5.01	42	<0.001	−0.76
Compassion to others	0.86	81.65 (8.75)	85.30 (7.02)	−3.18	42	<0.005	−0.49
Compassion from others	0.96	66.77 (16.99)	72.42(15.06)	−2.41	42	<0.05	−0.37
Social safeness	0.90	42.88 (7.02)	45.00 (7.29)	−1.99	42	≤0.05	−0.30
Activated positive affect	0.89	16.95 (6.44)	20.30 (6.24)	−4.14	42	<0.001	−0.63
Relaxed positive affect	0.87	11.49 (4.63)	13.05 (4.75)	−1.97	42	0.055	
Safe positive affect	0.69	10.74 (2.60)	11.93 (2.63)	−2.82	42	<0.01	−0.43
Wellbeing	0.92	50.30 (7.42)	54.14 (7.30)	−3.52	42	≤0.001	−0.54

three flows of compassion. Interestingly too, courage had one of the highest correlation values, with wiseness and courageousness being very highly correlated. As single item measures, these are only indicative requiring more detailed analysis in the future.

Table 4 provides the data on paired samples *t*-tests (two-tailed) which were conducted to compare the pre- and post- questionnaire responses. After 2 weeks, there were significant increases in self-compassion, compassion to others, openness to compassion from others, activated positive affect, safe positive affect, social safeness, and wellbeing, with small to medium effect sizes. Differences in relaxed positive affect approached significance ($p = 0.55$).

Interestingly, those who practiced without the music three or more times had a change in self-compassion score of 6.64 in the first week whereas those who always practiced with the music had a change in score of 9.48.

Qualitative content analysis

Results of the qualitative data analysis are reported here under the headings of each open-ended question with the following themes. All names are pseudonyms.

1. **What were your standout experiences?**

Energy, energizing, exhilarating: Participants reported an increase in energy and how this increase influenced their thinking after the experience.

> *I noticed that on a couple of occasions I was surprised at the energy that I had which usually I wouldn't have. I even noticed that I had become more flexible and more aware of and not wanting to set into routines from which I would be reluctant to change. I realized I was more encouraging of myself to try different things.* Hetty

> *Listening the first time - exhilarating, emotional, uplifting. Feeling energised after each practice and that I have more to offer than I give myself credit for*. Hilary

Connection to self: The experience encouraged participants to connect with themselves and find the motivation to "re-experience" positive and negative events. It also encouraged more appreciation of what they had to offer.

> *This was a moving experience. I connect with my life and trying to re-experience the positive and negative events connected. I feel with more energy and I started planning workshops. I would like to learn more and to use these exercises with myself and others.* Veronika

Connection to others: Feeling a connection to others was reported in relation to "nameless/faceless" others, other participants in the study, colleagues, and "a sense of goodness in the world."

> *The emotional power of actually visualising others in the world doing this exercise and expending compassion to a nameless/faceless other. Because of the study, I felt a connection with the other participants of the study and was able to visualise others doing the same exercise as I and that helped me to accept compassion from others. There was one occasion where I had a difficult interaction with a colleague and utilised the exercise to extend compassion to them and the emotional connectedness and universal human experience I felt with them was very powerful to the point I became tearful. It helped me to see an alternative view of the disagreement and fix the situation.* Cleo

> *A rousing sense of connectedness, a stirring of energy in my chest, feeling of being powerful with compassionate connection (rather than power in regards to others). A sense of goodness in the world.* Pat

A global compassionate community: Feeling connected to a global movement of compassionate others was described as "amazing," "emotional", and "beautiful." Some participants reported feeling a transhistorical connection to "generations of human beings" with a sense of their contributions to "making life a little better for all of us".

> *Imagining being joined in a global circle of empowering and compassionate white light at various times throughout the day was an amazing experience*. Danielle

> *I really enjoyed imagining being part of a whole movement of people all breathing out compassion into the world.* Lisa

> *The meditation made me appreciate the effort and the contribution that humans have made, over the years. The music made me see generations of human beings, swarming like bees, all busy trying to make life a little better for all of us. And this is beautiful.* Kirsty

2. **Can you describe how the practice made you feel?**

Part of a compassionate community: The experience of feeling "united" and "belonging" was reported as powerful for many participants. Furthermore, participants emphasised how this made them feel more connected and hopeful.

> *A sense of belonging, strong, and the unity of my whole light joining others'*. Kelly

> *Like I am part of a compassionate world, I mostly felt that in my chest. I noticed my chest would actually expand and take up more space. It made me feel more hopeful for a compassionate world and positive about the world. It made me feel safer.* Pat

> *Connected to compassionate motivation and part of a compassionate community*. Rita

> *United, like a compassionate power ranger or another team of superheroes.* Sara

> *It made me feel connected with others, both those doing the study and those others in the world who work daily to spread compassion. It made me feel more prepared for the rest of the day and able to take on anything that came my way.* Cleo

> *Uplifted, joyful, hopeful, inspired by others, a strong sense of belonging.* Hilary

Physical experiences: Physical experiences as a result of, and during, the practice included "calm," "warm," "powerful," "strengthened," and "ALIVE." One participant described how their experiences ranged from feeling "anxious and activated" to "calm and soothed."

> *Calm but energised, optimistic, ready*. Danielle

> *It made me feel warm, as though my heart were expanding*. Grace

> *Powerful, connected, courageous*. Ingrid

> *It made me feel ALIVE and invigorated*. Lisa

> *Sense of being physically and emotionally strengthened, grounded, nourished, determined*. Tina

> *Energized. Connected with my body and centred. I enjoyed the music...* Veronika

> *A range from anxious and activated to calm and soothed*. Wilma

> *I felt that the music and energy can linger in the body especially when [I] think about it, certain rhythm and image comes up from the body, interconnected within self and the outside world*. Maria

Changes in emotional experience over time: Some participants reported feeling "overstimulated", "overwhelmed" and "overloaded" with one participant describing a range of difficult emotions that they worked through (Carl). However, participants also noted over time that these challenges were reduced and became easier with practice.

> *A whole range of emotions came up, fear, sadness, the feelings got better over the two weeks.* Carl

> *A bit euphoric, on the edge of overstimulated. I have a pretty good acquired positive affect tolerance but I found it not quite but almost demanding to take in the intensity of the musical track.* Freire

> *At first a little distressed and overwhelmed even when I adjusted the volume. After the first week I started enjoying the music.* Una

3. **Could you describe any impact the practice may have had on you?**

Reminders and re-connection: Perhaps unsurprisingly, given the global environment that participants found themselves in, many reported feelings of re-connection and being reminded that there are compassionate others in the world and they are not alone.

> *I think that I've been struggling for the past 2 years with the pandemic, restrictions, isolation, war, callousness in the world, etc, and this practice helped me re-connect to a feeling that there are other things to be aware of – joy, collaboration, overcoming dark forces… we all have a dark side (or sides) but we can work together to make the world better.* Danielle

> *A consolidated reminder that I am not alone!* Kelly

> *I feel more connected to the world as a whole and the people within it. More hopeful.* Carl

> *I liked the visualisation of white coming in and out as I was breathing, it made the practice more tangible for me. I live with the impact of trauma and it helped me to feel safer in that there are a lot of compassionate people in the world when I can be quite threat focused.* Pat

> *I feel motivated to plan and practice this exercise. This exercise made me think about what is happening in other countries and the war and how other peoples are suffering right now. I feel the necessity of help and support and do something to make a better life.* Veronika

> *It has lifted my energy levels and confidence to engage with others. I also have more space and energy to be compassionate to others again, not being debilitated by my own stress, anxiety and depression.* Elizabeth

> *A lovely reminder that I am not alone - something to call upon and use to connect.* Hilary

4. **Did you notice any change in your experience and understanding of compassion?**

Expanded understanding and appreciation for the dimensions of compassion: Participants reported how the experience had expanded their understanding of, and appreciation for, experiencing a different dimension of compassion. Some participants noted the significance of experiencing compassion as a drive, and as activating, as opposed to previous experiences of soothing.

> *Yes, compassion is being connected. It is also transcending the immediate reality.* Andrew

> *A lot of the time I practice calming and soothing compassionate skills and this helped me to activate compassion focused drive rather than soothing. This is really very useful.* Pat

> *Compassion is action... I want to do.. I would like to help.* Veronika

> *I think the music directed me toward specific aspects of compassion that are not usually at the core of my awareness and practice; rather than empathy, connecting with suffering, loving kindness and being with the difficulty, trauma and suffering of humanity that is normally where my practice rests, I felt a much larger, expansive, joyful, fierce, transpersonal and cosmic level of compassion. I'm certain that reflects Gilbert's take on compassion and was refreshing and uplifting for me.* Anna

> *It made me think that compassionate practice doesn't have to be slow. Excitement and enthusiasm within the music can still have compassionate qualities. I have used the white smoke visualisation while running for example. So the practice could contribute to exercise routines to calm anxiety and breathing.* Greta

Embodied experience of compassion: The embodied experience of compassion and its impact was highlighted by participants. Participants spoke of how the theoretical concepts of compassion became felt, and in turn, this aided in motivation and commitment to being compassionate.

> *Yes, I have come to have a more energised, joyful, lighter sense of compassion - something I had been working on for a long time. The music paired with the CS practice helped me feel these things (as opposed to thinking about or wanting them).* Danielle

> *Grounding and a 'felt' or embodied sense of compassion.* Rita

> *Yes. We are always telling our clients it's not their fault. For the first time, this did not just come across as a conceptual idea. I actually felt this for the first time this past week. I was able to be far more observant of my own process with an interested and curious attitude. I was able to provide myself with reassurance in a difficult client situation and....I ACTUALLY FELT REASSURED. I have had that happen before, but not like this. The reassurance felt....believable.* Eddie

> *It helps to strengthen my understanding and embodiment of compassion, inhaling the sensitivity as awareness is also based on energy and exhaling to help the others which in return helps self too.* Maria

5. **How do you think the practice might change the way you act in the future?**

Use exercise to develop own compassion practices: Participants described how they hoped the exercise would help them to develop their own personal practices with others.

> *Be more energetic with compassionate endeavours, not just calm and soothing.* Tina

> *I would be well served to integrate these components into how I experience and practice compassion. it makes it much bigger than what I am able to generate and give, but tapping into a larger stream.* Anna

> *Well, if things progress as they have, I suspect that doing this practice each day (I really look forward to it) can only strengthen my own sense of compassion, and my compassionate self, and motivate me to continue working to bring compassion to others. It has helped me slow down when I needed to address my own suffering. I think the biggest change is really feeling from the inside out reassured.* Eddie

> *If the impact would remain each time, i believe with time would make me more calm, attentive, compassionate.* Jude

> *Hopefully making me to do small compassionate things with more care and beauty.* Kirsty

> *This is a practice of building a compassion mind and its neurological pathway. It will be reactivated whenever and where ever is needed.* Maria

Call upon exercise for personal use: The exercise was highlighted as something participants would return to when they were distressed.

> *I think when I'm feeling stuck, afraid, beaten down, or just crappy, I can listen to it and re-connect to my inner compassionate warrior, or even imagine it lifting me.* Danielle

> *I think it will protect me from feeling so low when distressed - less isolated.* Kelly

> *I'll use these techniques to help myself cope with stressful situations and to moderate my responses to difficulty in future.* Elizabeth

> *I think it will enhance my stamina, my sense of myself against challenges.* Hilary

Use exercise to engage with others more: Connecting with compassion being expressed by others was an area that participants thought the exercise would help them with.

> *I would hope that it would help me grown in kindness and empathy toward others and myself. It would nice to release myself from the distress of being judgmental of myself and others and more loving.* Hetty

> *Reminding me to draw on the compassion of others, even though I might not know, are putting compassion out into the world.* Ingrid

> *Possibly connecting more easily, authentically and openly with others who are showing compassionate motivation and behaviours.* Rita

6. **Any other feedback?**

Positive feedback: Positive feedback reported changing views about compassionate motivation in participants themselves and others around the world.

> *I am 100% glad that I had the opportunity to take part in this study. It has really changed how I feel about myself and the world around me. I am full of energy and enthusiasm which is a very welcome experience for me. I haven't felt like this for a number of years.* Olivia

Helped with own and others' fears, blocks, and resistances (FBRs)

> *This practice has made me realize my struggle with myself where I couldn't imagine breathing out compassion towards others, because I couldn't accept that I could be a storehouse of compassion. And then I realized that even as I thought this about myself, I could feel compassion towards myself for feeling so badly about myself and that was a wonderful feeling!* Hetty

> *Really helpful practice for strengthening determination and ability to keep bringing compassion into the world, especially when this is very challenging. The musical component in particular felt as if it helped me to replenish my energy and the sense of belonging to compassionate community strengthened my commitment and determination to keep going when compassion and connection feels very hard (is being unconsciously rejected/resisted).* Tina

Observations

The following section reports the participants' reflections and observations from weeks 1 and 2.

Observations from week 1

Participants engaged with the practice and communicated openly about their experiences. Some reported feeling energized by the music whilst others felt the music was too intense.

> *The music felt inspirational. I imagined breathing compassion (in and out). I imagined others around the world being compassionate and imagined being connected to them. The music, however, didn't match my sense of compassion which is more tranquil.* Harry

> *The music was music therapy - very powerful and evocative and made me imagine how your research team/Paul Gilbert imagines the properties of compassion - if I had to choose a piece of music to evoke compassion, it would not have chosen that one. very interesting to lean toward the dramatic, energizing, dynamic, expansive qualities within compassion as evoked in the music. my compassion mode is much more quiet, soft and tender, so it was an interesting stretch to enter the practice with the music. I appreciated what was evoked in me.* Freire

> *I like the music better, the more I do it, and it is never the same meditation, there were always new images every time I do the meditation.* Kirsty

Observations from week 2

Participants continued to practice the exercise, with many reporting that they had engaged more with the music, were feeling more energetic, confident, and connected, and were adapting the exercise where they felt it was needed. There were also powerful reports of the influence of the practice on FBRs. Some participants described how they had used the practice over time, adjusted to the practice, or adjusted their thinking and understanding of the experiences they were having (see observation 2, below).

> *I made more sense of the imagery this week! I think if I can't imagine it then it won't happen, that's the energising for me. I got an image of white light and could use it, that felt incredible. I enjoyed the music practise a lot more in the second week. I still wanted more of a choice of music (slower, medium or fast), the cut off crescendo was less distracting. I used the music on HiFi speakers without the verbal guiding, I'd memorised that, that was the most impactful experience.* Carl

> *I noticed that doing the practice with the music was much more effective if I took additional time to practice beforehand; doing the 5 min practice (with music) alone was not the most powerful access to compassion, despite the music being evocative. it feels like 5 min of compassion practice of any kind is too short; more time allows me to really find a deeper connection with compassion and then the 5 min practice at that point is very accelerating.* Anna

> *After the challenges of week 1 with accepting compassion from others I attempted to visualise this in conversations where I felt the other people expressing positive emotions to me. In these conversations I would visualise the stream of light and compassion coming from them to me. I found that this actually helped me to find the parts of the conversation and their behaviour that would indicate compassion and care that I would usually miss.* Cleo

> *Yes, following up from the last box, I really have begun to feel far more compassionate toward myself as much as I am toward others. I have taken far more time to address my own suffering as it has arisen. Going into client sessions after having completed the practice, I have noticed being more engaged and open - far less tired. I really cannot overstate how much I have enjoyed and benefited from this practice of energizing compassion. To go from low motivation to address my own suffering to feeling that deep sense of belonging and connectedness and wanting to help myself...there is no better feeling.* Eddie

Unique experiences—Connecting to suffering

It is important to keep in mind that compassion is about connecting to suffering and the first movement to suffering can be stressful and distressing (Di Bello et al., 2020). These were also themes and experiences that this practice stimulated for some participants. For some, the exercise seemed to connect to tuning into some of the global distress in the world linked to the war in Ukraine, the continuing COVID threat, and climate change, to name just a few. In addition, these practices can connect one to their own personal distress and, therefore, compassion practices that focus on bringing compassion to self and others need to be designed with an awareness of these effects, allowing participants to prepare beforehand.

> *Really feeling energized was a stand-out point. I did the practice yesterday and there was a moment I just let myself cry. It wasn't because I was suffering, I think, it was because I think I felt so connected and grateful for just having that experience.* Eddie

> *From day one the volume alteration that cut off in the third crescendo distracted me from the potential benefits. I found that I needed to do my usual 15-30 minute practiseso I could focus on compassion coming in before the practise with the music. Sobbed day 1,2 and 3. The imagery that connected to being at one with compassionate other developed.* Carl

> *The meditation brought up two feelings for me I needed to somehow settle before engaging in the compassion meditation proper -firstly, grief about the state of the world, and second, a sense of distress about how little time/capacity I had to contribute beyond day to day work and parenting tasks. I had to use other compassion practices to help ground myself and develop some "wisdom" or perspective. One of the outcomes from this was to set myself a task each night to notice some activities in my day, however small, that made a compassionate contribution. The other thing was to expand on the visualisation and bring in more of a felt sense of tenderness/care. I was also aware that this practice differed from the traditional tonglen, where we engage more fully and experience in our own suffering and use this as a form of "exchange" with others.* Bethan.

Discussion

This study explored a music-enhanced energizing compassion practice. It utilized an adapted form of tonglen. The focus was really three-fold: 1. To explore the impact of using energizing

music; 2. The effects of the adapted form of tonglen for generating compassion motivation; and 3. The effect of imagining oneself as part of a compassion-focused community. Participants were invited to practice every day or most days with the music; the majority (around 70%) did so.

The self-report measures showed significant changes pre-to-post in the study variables. The effects included feeling energized, joyful, socially connected, hopeful, courageous, and wise (see Table 3). In addition, there were significant increases in self-compassion, compassion for others, compassion from others, activated positive affect, safe positive affect, social safeness, and wellbeing (see Table 4), with small to medium effect sizes. Differences in relaxed positive affect approached significance. Although the change scores for self-compassion without the use of music varied non-significantly, the degree of change is worthy of further investigation for future studies. Hence, this practice would seem to have a wide range of effects.

In regard to the experiential and qualitative findings, stand-out experiences included increased energy and connection to self and others. As noted in our report on the physical sensations, many experienced feelings of warmth, calmness, and strength. These themes arose in other parts of the interview too. For example, Hilary noted that listening for the first time felt "*exhilarating, emotional, uplifting. Feeling energised after each practice and that I have more to offer than I give myself credit for.*" There were also experiences of feeling strengthened and energized. For example, Danielle noted *"I think when I'm feeling stuck, afraid, beaten down, or just crappy, I can listen to it and re-connect to my inner compassionate warrior, or even imagine it lifting me."* Participants reported that this "new" practice had enabled them to expand their understanding and appreciation for the dimensions of compassion. It gave them a more embodied experience of compassion. They also reported how they intended to continue using the practice in both a personal and professional capacity. Participants also noted an increased sense of social connectedness, belonging, and being part of a group of others, rather than pursuing compassion alone. The qualitative analysis indicated that many participants enjoyed using the music, however, nine participants did not like it. Consequently, we are exploring variations where individuals can choose their own music that will give them a sense of activation and enthusiasm in follow-up studies.

As often noted, the first movement to compassion is to address suffering. This can be distressing and stressful. Although we did not set out to explore this, some clients did note that they experienced distressing emotions when they connected to the realities of the human dark side and suffering in the world. Given the global environment that participants (along with all of us) experienced at the time of the study—war in Ukraine, the continuing COVID threat, and climate change—this distress is important to anticipate but equally not to be overwhelming.

Limitations

This study recruited a small number of members from a compassion discussion list ($n = 43$) who were already familiar with the basic evolution-based compassion model. Indeed, only 4.7% of participants reported that they did not use compassion-based practices very much (for mindfulness and other meditation practices this was 9.3%), suggesting that the majority of participants in this group were regularly engaging in related practices. Subsequent research will therefore need to work with naïve participants and explore if the practice can have the same powerful effects. The small numbers also made it difficult to investigate specific effects like practicing with and without music. This will need to be addressed in subsequent studies. In addition, subsequent studies could invite clients to choose their own energizing music.

Another limitation inherent to studies incorporating self-report measures is the risk of demand characteristics biasing results. However, as this was a small proof-of-concept trial, it is hoped that the rich experiences reported as part of the qualitative analysis may help to support the quantitative responses. Subsequent studies may incorporate a single or double-blind design with a control group to mitigate against possible demand characteristics. There was little data collected from male participants. It is unclear whether this was because male participants showed less interest in the exercise than female participants, or whether this was a natural variation resulting from the sampling methods used. Future research should therefore aim to address this, so that we gain a better understanding of how male participants, in particular, experience the exercises.

Conclusion

In summary, as a proof of concept, this study has shown the potential value of integrating energizing music with an energizing compassion focus, which had a positive impact on participants. Clearly, subsequent research will wish to identify and explore aspects of specific components. For example, to what degree did the energizing music or the sense of being part of a community impact results, and which aspects carried the most powerful impact? This study was not designed to explore that but rather whether this combination of energizing and engaging in a sense of community was acceptable to participants and of value. This is worthy of subsequent research including physiological and long-term effects.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation. Available by contacting the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by University of Derby College of Health, Psychology and Social Care Research Ethics Committee. The participants provided their written informed consent to participate in this study.

Author contributions

PG and JB were involved in all aspects of the study. PP, HG, and JB analyzed data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1150592/full#supplementary-material

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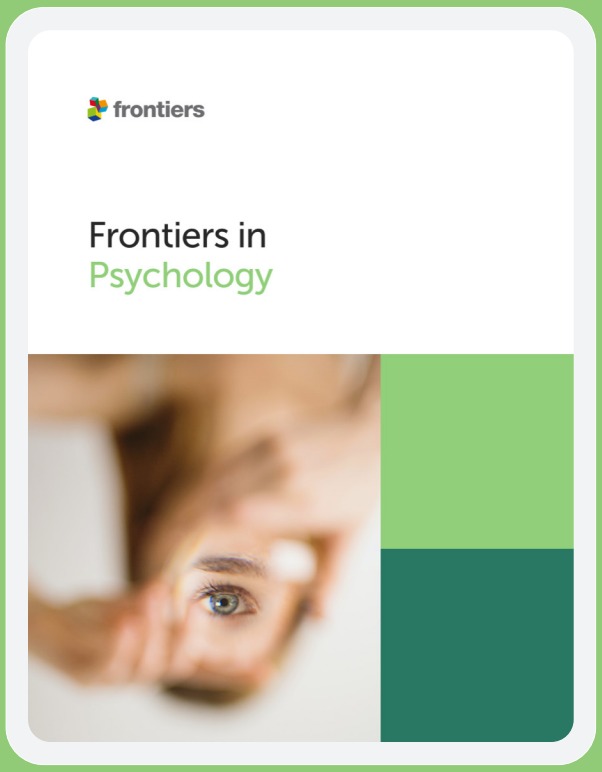

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