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Psychological intervention for suicidal ideation, behavior, and attempted suicide

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Psychological intervention for suicidal ideation, behavior, and attempted suicide

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Editorial: Psychological intervention for suicidal ideation, behavior, and attempted suicide

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Editorial on the Research Topic
Psychological intervention for suicidal ideation, behavior, and attempted suicide

Can psychotherapy serve as an effective deterrent to the global suicide crisis, which claims approximately 720,000 lives annually? (1) With a multitude of factors, including mental illness, self-harm, and LGBTQ+ identity, contributing to heightened suicide risk (2). Psychological intervention holds promise as a preventive measure, offering early interventions based on suicide risk assessments and addressing individual mental health concerns (3). Unraveling the underlying psychological mechanisms of suicide is a critical first step toward developing novel solutions to this significant public health problem. This Research Topic presents the findings of 11 research groups that have explored psychological interventions or the risk factors targeting the process from suicidal ideation to suicide attempt (Oliveira et al., Ghadipasha et al., Reifels et al., Yu et al., Kılıçarslan et al., Valladares-Garrido et al., Werdin and Wyss, Chalker et al., Käll and Andersson, Beatty et al., Jobes and Rizvi).

A systematic review for suicide prevention in educational settings has highlighted both effective interventions and practical challenges, including Initiatives to suicide prevention, intervention, and post-suicide care (Oliveira et al.). A systematic review exploring the spatial and geographical factors associated with youth suicide identified specific groups and regions at higher risk, such as males, rural residents, and the unemployed (Ghadipasha et al.). Furthermore, a systematic review of suicide prevention measures in disaster and emergency contexts identified effective interventions while also highlighting the need for further research (Reifels et al.). In addition to these studies, this Research Topic presents the latest research findings from various perspectives, including the impact of physical exercise on suicide prevention (Yu et al.), the relationship between domestic violence and suicide (Kılıçarslan et al.), the link between romantic loss and suicidal ideation (Valladares-Garrido et al.),

the challenges of suicide prevention in Europe (Werdin and Wyss), and future research directions (Chalker et al.).

The papers presented in this Research Topic offers a valuable resource to researchers, clinicians, and policymakers engaged in suicide prevention. It is our hope that the insights gained from this research will facilitate the development of enhanced support systems for those at risk of suicide, thereby contributing to solve suicidal problem.

Author contributions

KM: Writing – review & editing, Writing – original draft. SH: Writing – review & editing. TS: Writing – review & editing.

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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Educational agents and institutions called into action in suicide prevention, intervention, and postvention

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Introduction: Suicide is the second leading cause of death in the 15 to 29 age group worldwide, and is a severe public health problem. Adolescent and young adult individuals attend educational institutions which can play an essential role in detecting and preventing suicide. For this reason, the purpose of this research is to identify what educational institutions and agents are called into action in suicide prevention, intervention, and postvention.

Methods: The method of systematic review of the literature based on the PRISMA protocol was used. The review protocol was registered in PROSPERO (PROSPERO 2020 CRD42020189127). The systematic review yielded 66 articles published between 1990 and February 2023.

Results: The results show that a wide variety of educational stakeholders are required to intervene for suicide prevention, interventions and postvention between primary education and college. The study describes the different programs that have been provided, the countries in which they have been implemented and the agents who have been targeted. It also identifies gaps in the research on suicide in the educational field.

Discussion: Overall, educational suicide initiatives report positive effects on participants' understanding, attitudes, and beliefs regarding suicide and suicide prevention, although some studies have expressed some caution.

KEYWORDS

suicide prevention, suicide intervention, suicide postvention, health education, educational change, mental health, school mental health, student mental health

1. Introduction

Suicide is a serious global public health issue (Cheng et al., 2020; World Health Organization, 2021a; Canbolat and Gençöz, 2023; Imran et al., 2023; Naveed et al., 2023). Every suicide is a tragedy that affects families, communities, and entire countries (Bengesser et al., 2000; World Health Organization, 2021b) and has long-lasting effects on the people left behind (Cain, 2002; Avrami, 2003; Mintz-Binder, 2007; Rosenberg, 2017; Vidal-Ribas et al., 2021; Connell et al., 2022). The reduction of suicide mortality has been prioritized by the World Health Organization (WHO) as a global target and included as an indicator in the United Nations Sustainable Development Goals (SDGs) under target 3.4, the WHO 13th General Program of Work

2019-20231 and the WHO Mental Health Action Plan 2013–2030. Suicide occurs throughout the lifespan and was the fourth leading cause of death among 15–29 year-old globally in 2019 (World Health Organization, 2021a).

A significant problem is preventing suicide in adolescents and young people (Greydanus et al., 2009; Sood and Linker, 2017; Sherman and Torga, 2022; Williams et al., 2022). The World Health Organization considers the educational environment excellent for suicide prevention (World Health Organization, 2020). The research indicates that there is a great need to address suicide-related mental health problems in schools (Brown and Grumet, 2009; Hooven et al., 2012; Singer, 2017; Mirick and Berkowitz, 2022). One of the saddest aspects of teen suicide is the frequently missed opportunity to stop it (Mulrine, 2001). Many studies underscore the importance of suicide prevention education throughout the high school and college years (King et al., 2008; Joshi et al., 2015; Poland and Ferguson, 2021; Testoni et al., 2021; Chaniang et al., 2022; Stickl Haugen et al., 2022; Fadillah et al., 2023). However, difficulties associated to staff shortages, ever-increasing responsibilities for student well-being (Ayer et al., 2022) and shortage of guidelines on the targets and methods of safe and effective awareness programs are highlighted (Grosselli et al., 2022). In the context of education, little study has precisely outlined who should be in charge of what actions. Schools and universities can and should play a big role in fostering discussion with young people about the subject, but more needs to be done (Burlea et al., 2012; deCou et al., 2019; Malhi and Bell, 2020; Shand and Torok, 2022). The objective of the present paper is to identify what educational institutions and agents are called into action in suicide prevention, intervention, and postvention.

In pursuit of our research goals, a systematic review is justified by the relevance and seriousness of the suicide problem worldwide. It is imperative to exhaustively identify and analyze which institutions and educational agents are called upon to act in the prevention, intervention, and postvention of suicide, considering the vital role that educational institutions can play in the early detection and prevention of this tragic phenomenon. Systematic reviews are a rigorous research methodology that allows for an objective and comprehensive synthesis of the existing literature on a specific topic. In this case, the PRISMA protocol was used to ensure a systematic and transparent collection of relevant studies related to the role of educational institutions and agents in suicide prevention. It is essential to distinguish systematic reviews from scoping reviews. While scoping reviews map the existing literature and detect key topic areas, systematic reviews answer specific research questions by identifying, selecting, and synthesizing relevant studies that meet quality and validity criteria. The implications of this systematic review are significant for policy-making and practice in suicide prevention in educational institutions. The findings have important practical implications for educational professionals and staff.

Previous systematic reviews have done the effort to bring together suicide prevention, a topic more directly associated to health, and the educational field. For example, Katz et al. (2013) conducted a systematic review of the empirical literature on school-based suicide prevention programs. This interesting previous study covers a time span from 1966 to 2012, focusing on MEDLINE and Scopus databases. Systematic reviews of Mo et al. (2018) and Torok et al. (2019) focused on gatekeeper training programs. Systematic review of Li et al. (2019) focused on suicide risk in college students. This new review, which we present here, is necessary because it is the first review to identify educational agents called into action and recommendations made for the last three decades of research, even though we acknowledge that these earlier reviews made significant contributions to the open discussion of suicide prevention in the educational field. Furthermore, we classify the programs as presenting prevention, intervention, or postvention initiatives, also considering the educational setting addressed, from primary school to college. By identifying the different academic actors involved in suicide prevention, greater collaboration and coordination can be promoted to implement effective evidence-based interventions. In addition, possible research gaps can be identified, suggesting the need to direct future research toward specific areas that still need to be sufficiently explored.

2. Methods

This review follows a broadly aggregative synthesis logic (Hart, 1998) and is registered in PROSPERO International prospective register of systematic reviews (PROSPERO 2020 CRD42020189127). The body of evidence provided here shows systematically that existing primary research results contain arguments to shape and inform practice and policies (Zawacki-Richter et al., 2020).

The research team gathered the following specific research questions that embodied scientific motivation:

1. What educational agents and institutions have been identified in the literature as settings for suicide prevention and why?
2. What prevention, intervention, and postvention programs have been carried out in the educational setting to reduce suicidal manifestations?

Based on these research questions, the authors set the main objective of this study, which is to identify what educational institutions and agents are called into action in suicide prevention, intervention, and postvention. The study also aimed to inform both the research community and policymakers on how to address future research questions and revise educational policies on suicide prevention. Based on the existing research, our hypothesis was that the literature would identify the educational stakeholders who should play a role in suicide prevention, intervention, and postvention and offer recommendations that may guide educational stakeholders when approaching suicide prevention, intervention, and postvention in educational settings.

2.1. Data source and searching strategies

The search strategy was defined in discussions held by the authors. The search terms were determined based on keywords identified in preliminary searches. Boolean operators and search terms used were: TITLE: (suici* near/5 education) OR TITLE: (suici* near/5 school*) OR TITLE: (suici* near/5 university) OR TITLE: (suici* near/5 teacher*) OR TITLE: (suici* near/5 student*) OR TITLE: (suici* near/5 educator*). The search for each keyword and phrase was done in an individual search. The authors searched the WOS, CCC, DIIDW,

KJD, MEDLINE, RSCI, and SCIELO databases. We examined articles published between 1990 and February 2023, thus covering more than three decades of research on educational initiatives of suicide prevention.

2.2. Eligibility criteria

The studies selected to be included in this review had to specifically relate to suicide prevention, intervention, or postvention in an educational setting. Moreover, they had to describe and/or assess an educational intervention specifically designed for suicide prevention, intervention, and postvention, to raise awareness of suicide-related themes, to identify and/or support at-risk groups, to promote protective factors for suicide, to offer first aid in a suicide-related emergency, and to address postvention. Finally, the studies had to have been published in a peer-reviewed journal between 1990 and 2023—data analysis finished on the 31st of February 2023. Only studies written in English were included.

Studies were excluded from the review if they did not specifically address educational aspects of suicide prevention, were not published in a peer-reviewed journal, or contained no unique relevant data about the inclusion criteria. Research trials and screenings which did not report on education intervention results were also excluded. Studies written in a language other than English were excluded.

2.3. Extraction and screening

The search strategy described above retrieved 1,294 items, which were downloaded to Endnote. After duplicate items were removed, 1,127 articles remained. The authors then conducted a pilot study in which they analyzed 10% of the corpus. After the pilot stage, we adjusted the eligibility criteria to exclude research trials and screenings that did not report on results of educational interventions, even when they addressed suicide prevention initiatives. The remaining article titles and abstracts retrieved were systematically screened by three of the co-authors in an initial process to select and remove items by applying the refined inclusion and exclusion criteria. The extraction of data from all relevant papers was completed at this point using an online Excel document shared by the authors. Research meetings were held to discuss questionable items. Ninety-four (94) articles were selected by two or three researchers to compose the corpus of the second stage of the analysis. This was reduced to a final corpus of (66) articles after the inclusion and exclusion criteria were revised, this time after reading the full manuscripts. The (66) papers in the final corpus were uploaded to the software Atlas.ti.

2.4. Quality analysis

Three people participated in the evaluation of the articles to determine their quality and risk of bias. More specifically, two reviewers independently undertook the quality assessment of the articles, and disagreements were resolved by discussion or by a third reviewer if necessary. Due to the variety of methodological approaches used by researchers to pursue their objectives, different assessment tools were used to assess the trustworthiness, relevance, and results of papers obtained. Downloadable checklists for Randomized Controlled Trials of Critical Appraisal Skills Programme (2022a,b,c), Cohort Studies and Qualitative Studies were used. We used JBI's tools for assessing quasi experimental studies (Tufanaru et al., 2020) and text and opinion (McArthur et al., 2020). The Ways of Evaluating Important and Relevant Data (WEIRD) tool (Lewin et al., 2019) was also used. A study was considered to have an adequate methodological quality when it met at least 70% of the criteria specified in the assessment tool used. At this point, no articles were excluded.

2.5. Data coding

The (66) papers in the final corpus uploaded to the software Atlas.ti were coded for type of educational institution (e.g., school, university, and others), agents (e.g., teachers, school directors, parents, social educators, and policymakers), agents' skills and knowledge (e.g., suicide risk and protective factors, and crisis management), research objectives pursued, recommendations for educational stakeholders, and future research directions suggested. Figure 1 shows the procedure for applying the PRISMA criteria (Moher et al., 2015).

3. Results

Sixty-six studies published between 1990 and February 2023 described and/or assessed an educational intervention on suicide prevention (59), intervention (3), or postvention (4). Figure 2 shows the different articles analyzed in this study across a timeline. As can be seen in the figure, most of the articles were published in the 2010–2019 decade, and there are few articles for the 1990–1999 and 2000–2009 decades. Regarding the 1990–1999 decade, three articles focused on prevention programs and one focused on a postvention program. In the 2000–2009 decade, one study focused on a postvention program, one focused on an intervention program and four focused on prevention programs. Likewise, in the 2010–2019 decade, all the studies but four focused on prevention programs. Two of them analyzed intervention programs and two analyzed postvention programs. Finally, all the studies published in the 2020–2022 years focused on prevention programs. Therefore, prevention studies predominate in each decade. The considerable number of studies published since 2010 suggests that there has been a growing interest for this area of research, although this interest still focuses primarily on prevention programs.

Table 1 summarizes the various methodological approaches used by researchers to pursue their objectives. Of the 66 studies, 50 (75.75%) used quantitative methods, 12 (18.18%) used qualitative methods, and two (3.03%) used a mixed-method approach. The methodology applied in two (3.03%) of the studies was not clearly described. Thirty-nine programs designed to approach suicide prevention (34), intervention (3), or postvention (2) in educational settings were described and/or assessed in the literature. Table 2 presents the list of programs identified, a brief description of the programs, and the study in which they appear. The educational settings addressed by the studies ranged from primary school to college. Table 3 classifies the studies in terms of the suicide phase and educational setting.

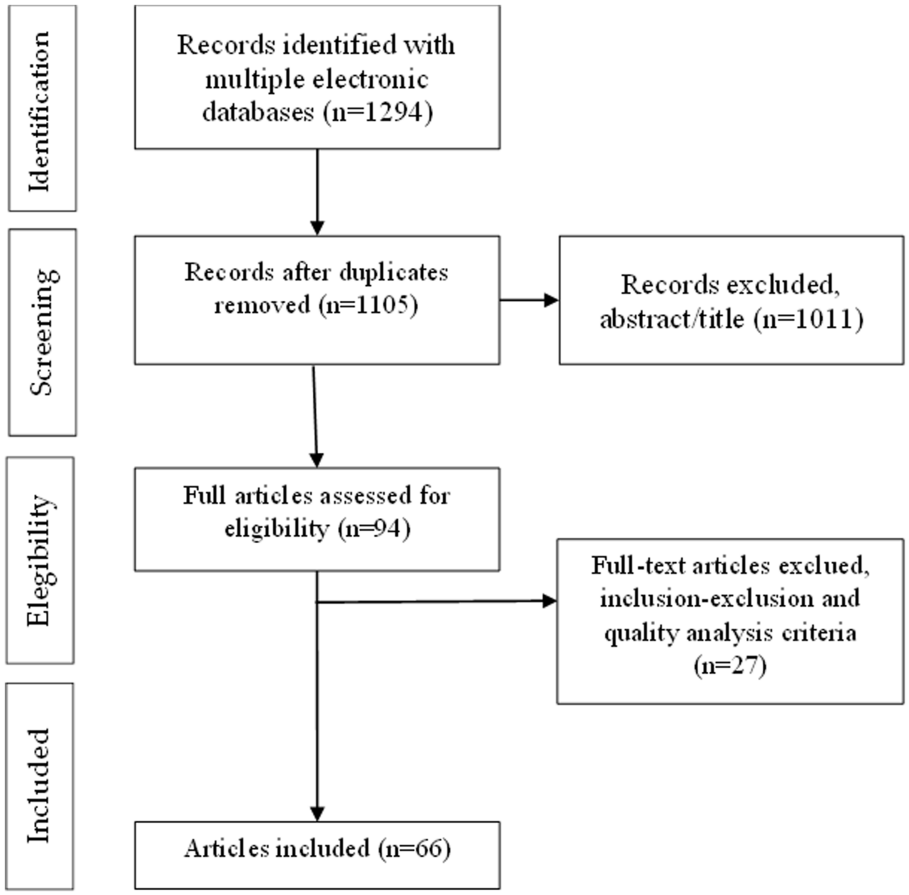

FIGURE 1
PRISMA flow chart of the selection procedure.

Regarding geographical distribution, studies proceed from the United States (37), Australia (9), Germany (6), Italy (5), Austria, Ireland and Sweden (4), Canada (3), England (3), Estonia (3), France (3), Hungary (3), Israel (3), Romania (3), Eslovenia (3), Spain (3), Japan (2), China (2), Switzerland (2), Chile (1), India (1), Kenya (1), Netherlands (1), Norway (1), South Korea (1), and Thailand (1). Notably, there are studies that proceed from more than one country. Wasserman et al. (2015), Kahn et al. (2020), and Ahern et al. (2018) analyzed data from 10 European countries: Austria, Estonia, France, Germany, Hungary, Ireland, Italy, Romania, Slovenia, and Spain. Han et al. (2018) analyzed data from China and Australia. Cox et al. (2016) analyzed data from Australia, New Zealand, and the United States.

3.1. Agents called into action in the educational context

The literature identifies various agents that play a role in suicide prevention, intervention, and postvention. Tierney et al. (1990) contend that every major stakeholder group in the school system, including board members, administrators, professional staff, support staff, parents, and students should participate (Tierney et al., 1990). Similarly, other authors have called for the whole school community to take responsibility for addressing suicide in educational contexts (Ryerson, 1990; Maples et al., 2005; Tompkins et al., 2010; Cox et al., 2016; Shannonhouse et al., 2017; Gijzen et al., 2018; Roberts et al., 2018).

In the primary school context, Roberts et al. (2018) identified agents such as teachers, psychologists, counselors, and parents. In secondary and high school contexts, the literature identified a wide range of agents who should intervene in the fight against suicide: teachers, school guidance counselors, school nurses, parents, school-based mental health professionals, such as school counselors, social workers, and school psychologists and adolescents themselves. Various agents were identified as having a role in suicide prevention, intervention, and postvention initiatives in college: college students, student organization representatives, administration staff living on campus, student affairs staff and administrators, parents and family members, college counselors, college psychologists, college faculty and staff and trained facilitators, clinical professionals who can evaluate mental health problems, campus ministers, university police officers, public safety and transportation personnel, and tribal leadership in the case of suicide attempts in American Indian communities.

3.2. Programs' characteristics and outcomes

Overall, the programs were described as safe (Robinson et al., 2015), contributing to school safety (Breux and Boccio, 2019), and

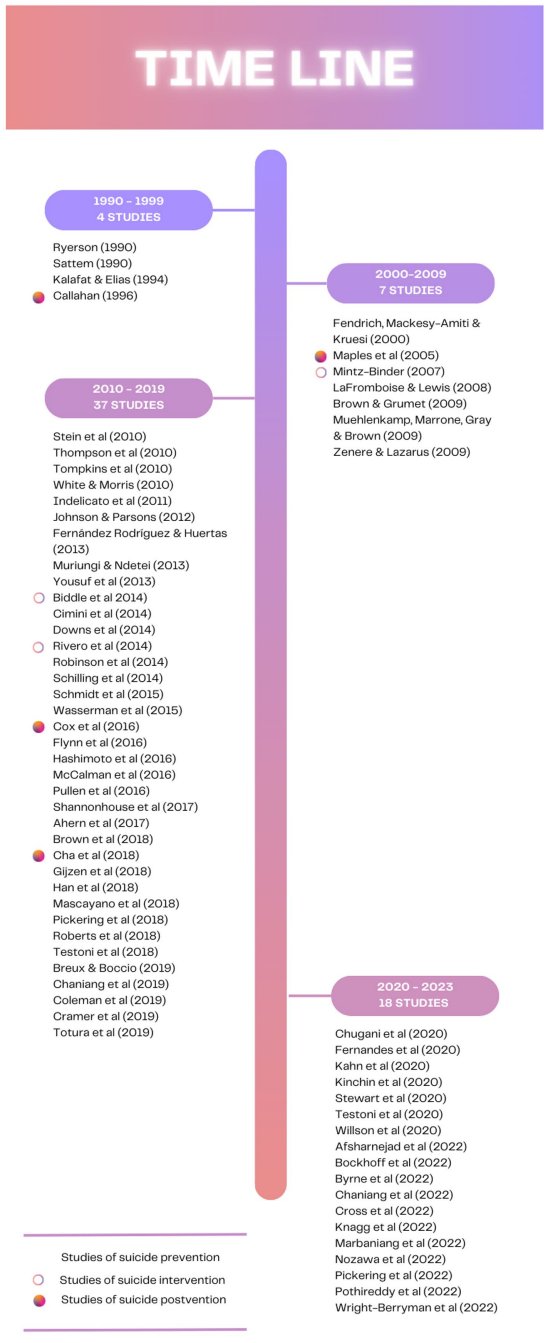

FIGURE 2
Timeline of studies describing and or assessing educational programs targeted at suicide prevention, intervention, or postvention published between 1990 and February 2023.

feasible to implement within a school setting (Kinchin et al., 2020). Educational initiatives addressing suicide had a positive impact on participants' levels of knowledge, attitudes, and beliefs regarding suicide and suicide prevention (Kalafat and Elias, 1994; Tompkins et al., 2010; Indelicato et al., 2011; Yousuf et al., 2013; Schilling et al., 2014; Schmidt et al., 2015; Flynn et al., 2016; Roberts et al., 2018; Chaniang et al., 2019; Coleman et al., 2019; Cramer et al., 2019; Totura et al., 2019). Testoni et al. (2020) reported that participants who received education about death showed improvements in the positive meaning of life and reduced anxiety. Additionally, they identified improvements in students' ability to recognize emotions and communicate them verbally (Testoni et al., 2020). Ryerson (1990) reported an increase in the number of referrals to the local mental health provider, less resistance to asking for help, improved communication, enhanced trust between students and suicide prevention program personnel, and a decrease in the number of suicides in participating school systems (Ryerson, 1990). Zenere and Lazarus (2009) and Wasserman et al. (2015) found that comprehensive school-based suicide prevention programs reduced youth suicidal behavior. Conforti et al. (2020) showed that a teacher-delivered cognitive behavior therapy skills curriculum was feasible and associated with reduced suicidality (ideation and behavior) in middle school-aged youth.

Breux and Boccio (2019) provided preliminary evidence on the effectiveness of suicide educational programs. The programs improved participants' attitudes toward the importance of school-based suicide prevention, understanding of best practices, perceptions of administrative support, and feelings of empowerment to work collaboratively and enhance their school's suicide safety. Educational stakeholders who received training in suicide prevention reported feeling more comfortable, competent, and confident in intervening with a person at risk of suicide (Muehlenkamp et al., 2009; Johnson and Parsons, 2012; Cimini et al., 2014; Hashimoto et al., 2016; Shannonhouse et al., 2017; Brown et al., 2018; Stewart et al., 2020).

Some negative outcomes of educational suicide interventions were also reported in the literature. Fendrich et al. (2000) showed that the unsolicited mass distribution of information and materials related to suicide and violence prevention is of limited usefulness. Maples et al. (2005) described the corrections made to a suicide crisis management intervention to avoid romanticizing suicide. Callahan (1996) described how a sense of "specialness" and secrecy served to heighten students' sense of melodrama over a school mate's suicide, which also furthered the spread of suicide. However, when he altered the postvention activities to avoid the atmosphere of romantic tragedy, such as reporting every expression of student suicide ideation to parents regardless of the level of severity, suicidal ideation decreased. In fact, this communication with parents was helpful because it focused attention on parent–child conflicts, thus making it possible to solve family issues that, in some cases, were contributing to suicidal ideation. Roberts et al. (2018) pointed out the importance of offering primary school teachers coaching and support in addition to regular training for addressing suicide. An in-depth qualitative study by White and Morris (2010) showed that teachers might feel insecure about approaching the subject of suicide with students and use fact-based information without giving students the opportunity to conceptualize suicide as a social historical phenomenon. White and Morris (2010) warned that there might be unexpected and sometimes unwanted learning during suicide educational initiatives. Breux and Boccio (2019) cautioned that insufficient time and stigma surrounding the topic of suicide are barriers to implementing changes after educational interventions. Han et al. (2018) reported that the program had a short-term positive influence on participants' suicide literacy, although it was not sufficient to change students' attitudes or intention to seek help. Finally, the effects of gatekeeper suicide prevention training over time have been found to be unsustainable in studies that incorporated a follow-up step in their methodology (Cimini et al., 2014; Brown et al., 2018).

TABLE 1 Methodological approaches of the 66 studies published between 1990 and February 2023 reporting a description or assessment of suicide educational interventions.

Methodological approach	*N*	Studies
Randomized trial	14	Robinson et al. (2014); Wasserman et al. (2015); Ahern et al. (2018); Gijzen et al. (2018); Han et al. (2018); Mascayano et al. (2018); Pickering et al. (2018); Roberts et al. (2018); Coleman et al. (2019); Kahn et al. (2020); Afsharnejad et al. (2022); Byrne et al. (2022); Nozawa et al. (2022); Pickering et al. (2022)
Pre-post study design	15	Cramer et al. (2019); Flynn et al. (2016); Johnson and Parsons (2012); LaFromboise and Lewis (2008); Muehlenkamp et al. (2009); Pothireddy et al. (2022); Shannonhouse et al. (2017); Stewart et al. (2020); Testoni et al. (2018, 2020); Tompkins et al. (2010); Totura et al. (2019); Willson et al. (2020); Wright-Berryman et al. (2022); Yousuf et al. (2013)
Pre-post study designs with follow up	11	Indelicato et al. (2011); Cimini et al. (2014); Schilling et al. (2014); Hashimoto et al. (2016); Pullen et al. (2016); Brown et al. (2018); Cha et al. (2018); Breux and Boccio (2019); Kinchin et al. (2020); Knagg et al. (2022); Marbaniang et al. (2022)
Post-intervention study design	6	Ryerson (1990); Fendrich et al. (2000); Brown and Grumet (2009); Thompson et al. (2010); Downs et al. (2014); Cross et al. (2022)
Experimental study	1	Bockhoff et al. (2022)
Case study	4	Callahan (1996); Rivero et al. (2014); Schmidt et al. (2015); Chaniang et al. (2022)
Mixed-methods design, drawing on complementary quantitative and qualitative data	2	McCalman et al. (2016); Chaniang et al. (2019)
Qualitative study using key informant interviews or discussion groups	3	Stein et al. (2010); Fernández Rodríguez and Huertas (2013); Chugani et al. (2020)
Solomon four-group design	1	Kalafat and Elias (1994)
Clinical trial	1	Muriungi and Ndetei (2013)
Inferential, retrospective, secondary regression analysis	1	Biddle et al. (2014)
Longitudinal analysis	1	Zenere and Lazarus (2009)
In-depth qualitative case study, discursively oriented	1	White and Morris (2010)
Qualitative descriptive exploratory research	1	Fernandes et al. (2020)
First-person account	1	Maples et al. (2005)
Delphi methodology	1	Cox et al. (2016)
Not clearly described	2	Sattem (1990); Mintz-Binder (2007)

3.3. Recommendations

The literature presents numerous recommendations based on the implementation and assessment of educational interventions for suicide. As 59 of the 66 articles included in this review address suicide prevention, these recommendations globally apply to the prevention setting. However, we would highlight, in line with Mintz-Binder (2007) who presents a study addressing suicide intervention, that if a suicide occurs, faculty and staff involved in teaching should neither be expected to handle these events alone nor be made to feel guilty. Mintz-Binder (2007) urges educational institutions to have a well-rehearsed plan established before these sudden events occur. This can help minimize the shock and denial responses in this traumatic situation, enabling an organized, systematic approach to be implemented.

Turning now to preventive recommendations, Willson et al. (2020) pointed out the need to continue addressing biases and stigma surrounding suicide. Tompkins et al. (2010) advised educational communities to come together to talk about suicide prevention, identify weaknesses, build on strengths, and create plans of action. Afsharnejad et al. (2022) encourage suicide prevention interventions among tertiary students to consider using online peer mentoring programs to create user groups where participants can practice their skills face-to-face.

Wasserman et al. (2015) stressed a need for the large-scale implementation of universal school-based suicide prevention programs. Ryerson (1990) recommended that extensive research into the target educational context and student population should be conducted before initiating a suicide educational program and that as many key players as possible should be involved in the tailoring

TABLE 2 Educational programs addressing prevention, intervention, or postvention described or assessed in studies published between 1990 and February 2023.

Program name	Brief description	Studies
	Prevention	
Puppet Prevention Program	A youth-system-based prevention and early identification process that uses puppets.	Sattem (1990)
Adolescent Suicide Awareness Program (ASAP)	A mental health education program for school communities designed to be implemented as a cooperative project between community mental health providers and local school systems.	Ryerson (1990)
Youth Suicide Prevention and Intervention Program	Universal suicide prevention strategies are implemented through the To Reach Ultimate Success Together curriculum in a series of skill-development lessons.	Zenere and Lazarus (2009)
STOP Suicide Program (School-Based Teen Outreach Program for Suicide)	A program funded by the Substance Abuse and Mental Health Services Administration housed in the DC Department of Mental Health, United States.	Brown and Grumet (2009)
The Medicine Wheel Program	A culturally informed circle-of-care approach that builds upon mainstream suicide prevention strategies by incorporating traditional American Indian (AI) practices, knowledge, and outreach.	Muehlenkamp et al. (2009)
Youth Suicide Prevention Program (YSPP)	The Los Angeles Unified School District's (LAUSD) suicide prevention program.	Stein et al. (2010)
Question, Persuade, Refer (QPR)	Gatekeeper training in an educational setting to identify and intervene when individuals are engaged in risky behaviors.	Tompkins et al. (2010); Indelicato et al. (2011); Johnson and Parsons (2012); Fernández Rodríguez and Huertas (2013); Muriungi and Ndetei (2013); Wasserman et al. (2015); Pullen et al. (2016); Ahern et al. (2018); Willson et al. (2020)
Signs of Suicide (SOS)	A 17-min DVD that includes (1) three age-appropriate vignettes that are less intense than the high school version; (2) a group discussion by middle school students about depression, suicide, bullying, self-injury, and getting help; and (3) a student interview with a school-based counselor to model getting help.	Schilling et al. (2014)
Yellow Ribbon Suicide Prevention Program (YRSPP)	The program integrates education on help-seeking behaviors and screening.	Schmidt et al. (2015); Flynn et al. (2016)
Youth Aware of Mental Health program (YAM)	Promotes knowledge of mental health, healthy lifestyles, and behaviors.	Wasserman et al. (2015); Ahern et al. (2018); Kahn et al. (2020)
Aussie Optimism Program (AOP)	A prevention educational program was implemented as a community-based project in collaboration with school nurses.	Roberts et al. (2018)
Screening by Professionals (ProfScreen)	A two-stage screening tool to help health professionals to identify at-risk adolescents based on mental health responses in a self-report questionnaire.	Wasserman et al. (2015); Ahern et al. (2018)
Kognito At Risk (see www.kognito.com)	The trainee interacts with virtual peers and is given a menu of choices for interactions. They are led to identify peers who may be at risk.	Coleman et al. (2019)
Healer Education Assessment and Referral (HEAR) program	This program uses secondary and tertiary prevention strategies to address depression and suicide.	Downs et al. (2014)
Suicide Prevention Program (SPP)	The program involves a collaborative model that engages every sector of the university.	Fernández Rodríguez and Huertas (2013)

(Continued)

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TABLE 2 (Continued)

Program name	Brief description	Studies
Multimodal stepped-prevention program	The program comprises screening with subsequent clinical evaluation and/or referral; gatekeeper training (QPR) for mentors; universal prevention focusing on stigma reduction; and identifying adolescents who have elevated signs of the most important risk factor for suicidal behaviors.	Gijzen et al. (2018)
Sources of Strength	The program recruits and trains key opinion leaders (i.e., peer leaders) along with school staff members as advisors.	Pickering et al. (2018, 2022)
Online psychoeducational program (ProHelp)	The program comprises two modules. Each module was designed to take approximately 5 min. The first module addresses suicide literacy, suicide and help-seeking stigma, and available help-seeking sources. The second module addresses self-reliance, social support, and myths about mental health professionals.	Han et al. (2018)
Mental Health First Aid program	The program was a 2.5-h course combining lectures, videos that demonstrated good and bad gatekeeper behavior, and small group role-plays along with the scenario of the videos.	Hashimoto et al. (2016)
Comprehensive suicide response program	The curriculum provided detailed lesson plans for three 40–45-min participatory classes.	Kalafat and Elias (1994)
Reframe-IT intervention	The intervention comprised eight modules based on cognitive behavioral therapy delivered online across the 10-week intervention period.	Robinson et al. (2014)
The Zuni Life Skills Development Program	Intervention strategies consistent with cultural and community life values and strengths.	LaFromboise and Lewis (2008)
Creating Suicide Safety in Schools (CSSS) workshop	A workshop was designed to encourage school personnel to evaluate their own schools' existing suicide prevention and intervention readiness and to plan ahead.	Breux and Boccio (2019)
Jason Foundation (JF) "A Promise for Tomorrow" program	The program promotes awareness of the problem of youth suicide, provides student trainees with the knowledge and resources to interact with at-risk youth, and encourages referral behaviors.	Totura et al. (2019)
Applied Suicide Intervention Skills Training (ASIST)	The program is a 14-h, 2-day suicide intervention training mode. SafeTALK is a condensed version of ASIST.	Shannonhouse et al. (2017)
Thai Suicide Prevention Program for Secondary School Students (TSPPSSS)	The program comprised three modules targeting adolescent peer leaders, parents, and schoolteachers.	Chaniang et al. (2019)
Beyond the Wall	Death education program aimed at helping young people cope with being told of the suicide of a student at their school and to raise awareness of their negative emotions and their representations of death to improve their ability to cope with negative thoughts.	Testoni et al. (2020)
Safety Planning Intervention (SPI)	A structured personalized safety plan collaboratively completed by clinicians and clients to assist individuals in managing a suicidal crisis.	Stewart et al. (2020)
Student Assistance Program (SAP)	Team members identify student psychosocial problems, determine whether they are within the school's realm of responsibility, and suggest interventions. When a problem is beyond the array of services provided at the school, teams assist in accessing services within the community.	Biddle et al. (2014)

(Continued)

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TABLE 2 (Continued)

Program name	Brief description	Studies
"Talk-to-Me" Mass Open Online Course (MOOC)	Online psychoeducational suicide prevention program targeting young adults. This skills training program aims to increase young adults' awareness of mental health-promoting activities, improve their resilience, develop their distress management skills and ability, and to identify the early signs of suicide ideation or behavior in themselves and others and apply suicide crisis intervention strategies.	Afsharnejad et al. (2022)
Hope Squad	Hope Squad is a school-based, peer-to-peer suicide prevention program across the United States in more than 1,000 schools across 33 states; the program has greater than 30,000 student members (see https://hopesquad.com/).	Wright-Berryman et al. (2022)
Online peer gatekeeper training program	The program covers mental health basics, current status of suicide problems, danger sign features of suicide, how to appropriately respond, demo video, and referral information for appropriate resources. Each section takes 10–20 min to view and contains a voiceover, cases, personal work, and quizzes.	Nozawa et al. (2022)
Multimodal suicide prevention program for young people	The program involves delivering universal psychoeducation (safeTALK) to all students, screening them for suicide risk, and delivering internet-based Cognitive Behavioral Therapy (Reframe IT) to those students identified as being at high risk for suicide.	Byrne et al. (2022)
Broad-Minded Affective Coping (BMAC)	A brief psychological intervention targeting suicidal ideation by enabling access to competing positive emotions and thoughts using guided imagery.	Knagg et al. (2022)
	Intervention	
School crisis intervention program	A crisis protocol made up of different phases to address suicide crisis management.	Cha et al. (2018)
Critical Incident Stress Management (CISM)	The program is a multicomponent, seven-step process that is based on step-by-step interventions, timing, activation, goals, and format.	Mintz-Binder (2007)
Consultation and Resource Evaluation (CARE) program	Essential components of the program include assessment of student suicide risk, evaluation of a student's willingness and ability to refrain from self-harm; consultation regarding needed psychiatric, psychological, and supportive educational services; and parent information and supportive educational intervention.	Rivero et al. (2014)
	Postvention	
Suicide Postvention Guidelines for schools	Designed to help secondary schools develop an Emergency Response Plan (ER Plan) and Emergency Response Team (ER Team) following a student suicide within the school.	Cox et al. (2016)
Counselors, Administrators, Parents, and Teachers (CAPT) team approach	The approach could be adapted to include the prevention and intervention phases of dealing with teen suicides.	Maples et al. (2005)

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TABLE 3 Educational setting of the studies.

Educational setting							
Phase	Primary school		Secondary and high school		College		
	N (%)	Studies	*N* (%)	Studies	*N* (%)	Studies	Total *N* (%)
Prevention	1 (1.51%)	Sattem (1990)	37 (56.06%)	Ahern et al. (2018); Bockhoff et al. (2022); Breux and Boccio (2019); Brown et al. (2018); Brown and Grumet (2009); Byrne et al. (2022); Chaniang et al. (2019); Chaniang et al. (2022); Fendrich et al. (2000); Flynn et al. (2016); Gijzen et al. (2018); Johnson and Parsons (2012); Kahn et al. (2020); Kalafat and Elias (1994); Knagg et al. (2022); Kinchin et al. (2020); LaFromboise and Lewis (2008); Marbaniang et al. (2022); Mascayano et al. (2018); McCalman et al. (2016); Pickering et al. (2018); Pickering et al. (2022); Roberts et al. (2018); Robinson et al. (2014); Ryerson (1990); Schilling et al. (2014); Schmidt et al. (2015); Shannonhouse et al. (2017); Stein et al. (2010); Testoni et al. (2018); Testoni et al. (2020); Tompkins et al. (2010); Totura et al. (2019); Wasserman et al. (2015); White and Morris (2010); Wright-Berryman et al. (2022); Zenere and Lazarus (2009)	21 (31.81%)	Muehlenkamp et al. (2009); Thompson et al. (2010); Indelicato et al. (2011); Fernández Rodríguez and Huertas (2013); Muriungi and Ndetei (2013); Yousuf et al. (2013); Cimini et al. (2014); Downs et al. (2014); Hashimoto et al. (2016); Pullen et al. (2016); Han et al. (2018); Coleman et al. (2019); Cramer et al. (2019); Chugani et al. (2020); Fernandes et al. (2020); Stewart et al. (2020); Willson et al. (2020); Afsharnejad et al. (2022); Cross et al. (2022); Nozawa et al. (2022); Pothireddy et al. (2022)	59 (89.39%)
Intervention	-	-	1 (1.51%)	Biddle et al. (2014)	2 (3.03%)	Mintz-Binder (2007); Rivero et al. (2014)	3 (4.54%)
Postvention	-	-	4 (6.06%)	Callahan (1996); Maples et al. (2005); Cox et al. (2016); Cha et al. (2018)	-	-	4 (6.06%)
	1 (1.51%)		42**(63.63%)**		**23 (34.84%)**		**66 (100%)**

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process. Tierney et al. (1990) stated that a suicide prevention program must be based on a system-wide policy and address all aspects of suicide: prevention, intervention, and postvention. Tierney et al. (1990) recommended the creation of comprehensive programs that require coordination and networking components, along with implementation commitments from every major stakeholder group in the school system. These included board members, administrators, professional staff, support staff, parents, and students.

Shannonhouse et al. (2017) stated that training is needed in school settings to respond to young people at risk of suicide. School counselors should be trained in suicide intervention skills to build the capacity of their school community and provide suicide first aid to students in need. Cox et al. (2016) recommended that school staff should not use the terms "committed suicide" or "successful suicide" when discussing a death because the word "committed" is associated with an illegal or criminal act, and "successful" implies that the individual achieved a desirable outcome. Johnson and Parsons (2012) and Shannonhouse et al. (2017) recommended that suicide should be a training priority for school staff. Every front-line staff member should know how to intervene with potentially lifesaving responses (Johnson and Parsons, 2012). Similarly, Brown et al. (2018) recommended gatekeeper workshops as school staff are important gatekeepers in preventing adolescent suicide.

However, Roberts et al. (2018) warned that teacher training alone is insufficient to ensure that teachers impart mental health promotion strategies to their pupils. They argued that teachers also need ongoing support and coaching throughout the school year if their students are to learn and integrate mental health strategies. With appropriate guidance and support, schools can be integrated into the tapestry of social institutions working to reduce the loss of young life to a preventable public health problem (Breux and Boccio, 2019).

Additionally, isolated training sessions are not recommended. Various studies highlight the value of periodic suicide prevention training and exposure to a variety of models to provide or reinforce corrective educational and practical experience (Kalafat and Elias, 1994; King and Smith, 2000; LaFromboise and Lewis, 2008; Indelicato et al., 2011). Johnson and Parsons (2012) recommended updating knowledge and skills training to mitigate erosion in confidence and increase the likelihood of effective intervention. Cimini et al. (2014) recommended booster training sessions to address skill degradation over time.

Stein et al. (2010) suggested that suicide prevention training should educate school personnel about the key components of guideline-based suicide prevention services, including information about confidentiality. The training should also suggest alternative strategies to respond to unique educational context needs, populations, and institutional resources. Roberts et al. (2018) additionally suggested that each audience member should take a pretest prior to each suicide prevention educational session to assess pre-existing knowledge levels.

Schmidt et al. (2015) proposed that educational suicide prevention efforts in schools should also focus on issues such as family problems, grief or loss, and being bullied as factors associated with suicidal thoughts. Biddle et al. (2014) further suggested psychological autopsies for all adolescents who died by suicide. Pickering et al. (2018) recommended peer-led interventions as an important complement to other intervention strategies targeting higher-risk youth. According to Cimini et al. (2014), implementing audience-specific gatekeeper training programs can be beneficial. Brown and Grumet (2009) contended that when considering screening for mental health issues in schools, the ability to follow up with at-risk youth is essential. They further stated that it is essential for positively screened young people to be linked to some additional evaluation or treatment and that this should not be decided solely by the parents. Cha et al. (2018) warned that having a crisis protocol intervention when a peer suicide occurs helps to improve trauma-related symptoms and might be an effective way to prevent suicide from spreading among students by alleviating such trauma-related symptoms.

Additionally, White and Morris (2010) highlighted the complexity of suicide as a culturally situated phenomenon. They argued against conceptualizing suicide through singular, stable, or universalizing terms that transcend time and context. They also claim that several factors contradict the overall aims of youth suicide prevention. These include expecting educators to rely exclusively on narrow "evidence-based" curricula that authorize expert knowledge and preclude all other knowledge, identifying problems within people, dismissing any uncertainty or ambiguity, inhibiting local and relational meaning-making, and stifling creativity by rigidly adhering to pre-specified and "safe" learning outcomes.

Regarding recommendations made specifically for young adults, Fernandes et al. (2020) discussed the importance of developing projects for the university community. Given the need to discuss and reflect on suicide prevention, they recommend that these projects be integrated with the health network and student support services of educational institutions. Chugani et al. (2020) recommended that campuses that can invest additional resources in student mental health and suicidality should focus on primary prevention, such as increasing coping skills and resilience. Rivero et al. (2014) suggested that campus staff should consider the array of policies, programmatic infrastructure, on- and off-campus mental health, and other support resources that can be mobilized so that each student can be managed according to their needs.

The literature review also identified recommendations regarding the dissemination of materials related to suicide. Fendrich et al. (2000) warned that when unsolicited materials are sent to schools, the most appropriate school contact person should be identified in advance. Their experience shows that distribution to the right contact person, especially when preceded by personal contact through telephone calls, is more likely to result in effective dissemination than a mass-mailing approach. Indelicato et al. (2011) and Han et al. (2018) also recommended that future suicide prevention intervention programs for university students should consider an online approach, as students generally favor that mode.

Finally, recommendations have been made regarding interventions within tribal communities (LaFromboise and Lewis, 2008). Lafromboise and Lewis (2008) strongly recommended that these interventions include protocols associated with cultural resources, indigenous values, and healing practices. They suggested that researchers should seek guidance from tribal/community leaders to develop and apply such interventions. If interventions are to be conducted effectively, researchers must intervene in the most professional and culturally competent manner possible (LaFromboise and Lewis, 2008).

4. Discussion

A high percentage of the studies included in this review used quantitative methodology to reach their objectives (75.75%), which is

helpful for objectively assessing the viability and effectiveness of the different programs. However, more qualitative or mixed studies are also needed to analyze aspects that quantitative procedures cannot assess or identify. Regarding the geographical distribution of the studies, the vast majority were carried on in the United States. This result coincides with other systematic reviews in other contexts; thus, considerably more studies are needed in other countries and cultural settings. According to the World Health Organization (2021a, 2021b), suicide rates vary considerably among countries, which suggests that sociocultural variables may explain suicidal behavior to some extent. Goldston et al. (2008) argue that consideration should be given to cultural patterns related to suicide, such as the kind of triggers or precipitants of suicidal behavior, the reactions to and interpretations of suicidal behaviors, and the search for help, which may vary across cultures. Furthermore, risk and protective factors for suicidal behavior may also be influenced by cultural context (Goldston et al., 2008). For this reason, research efforts should prioritize interventions in diverse cultural contexts and countries, as certain programs may be more suitable for specific settings. It is equally important to develop programs tailored to cultural characteristics and rigorously assess their effectiveness. The lack of culturally sensitive prevention programs tailored to educational contexts is a significant limitation that could result in economic and human costs. Hence, it is imperative to address this gap to create more effective and inclusive suicide prevention strategies.

Most studies focus specifically on suicide prevention, particularly in secondary and high schools. The focus on intervention and postvention efforts in the aftermath of suicide acts is less prominent. Therefore, more studies are needed on the development and assessment of intervention and postvention programs in the educational context. In fact, Tierney et al. (1990) pointed out that programs to reduce suicidal behavior should address all aspects of suicide, including prevention, intervention, and postvention. Furthermore, one positive outcome of the current review is that it has identified a wide range of stakeholders at different educational levels, including students, teachers, counselors, families, psychologists, administrators, and staff. However, some programs are not designed for the entire educational community, a limitation that several authors point out that needs to be redressed (Ryerson, 1990; Maples et al., 2005; Tompkins et al., 2010; Shannonhouse et al., 2017; Berk and Adrian, 2018; Gijzen et al., 2018). This can be achieved by developing comprehensive programs that facilitate the commitment of different stakeholders and the coordination between them (Tierney et al., 1990). One notable positive aspect arising from the focus on stakeholders at various educational levels in the present study is the potential for a more comprehensive and holistic approach to suicide prevention within educational institutions. This inclusive approach allows for a broader perspective on addressing the issue. It facilitates the identification of key individuals and groups that can play a significant role in shaping effective prevention, intervention, and postvention strategies. It underscores the need for more targeted and cohesive initiatives that ensure stakeholders' active involvement and coordination, as highlighted by Tierney et al. (1990).

Most suicide educational programs are effective in terms of changing students' understanding, knowledge, perceptions, and attitudes (Kalafat and Elias, 1994; Tompkins et al., 2010; Chaniang et al., 2019; Coleman et al., 2019; Totura et al., 2019). More specifically, those who attended suicide educational interventions were reportedly more knowledgeable about suicide prevention after the educational sessions and had more helpful attitudes or beliefs about suicide. However, Han et al. (2018) suggested that improved understanding in the short term does not necessarily change the intention to seek help when experiencing suicidal ideation, which may limit the real impact of programs that only assess changes in students' understanding. The work by Zenere and Lazarus (2009), Wasserman et al. (2015), and Conforti et al. (2020) suggested that suicidal ideation and behavior were reduced. Of the 58 studies analyzed, only four reported attendees actually practicing their new abilities. Johnson and Parsons (2012) reported that within 3 months of training, one staff member reported using the Question, Persuade, and Refer (QPR) response with a suicidal student. Stewart et al. (2020) stated that two-thirds of the clinical staff who attended training implemented suicide prevention initiatives at least once. Coleman et al. (2019) reported a medium-sized increase in the number of peers referred to mental health services by participants in an educational suicide initiative. Hashimoto et al. (2016) mentioned that one-third of participants had one or more opportunities to use their suicidal student management skills within a month. None of these cases assessed how attendees of educational suicide initiatives had changed their practice using their new suicidal student management skills.

Much more evidence is needed on the long-term impact of prevention, intervention, and postvention programs and whether they lead to deeper changes in students, which effectively reduces suicidal behavior in the long term. Moreover, according to Roberts et al. (2018), the assessment of prevention programs should include a comparison between a pre-test before the implementation of the program and a post-test after the program to determine whether there have been any changes. Evaluating suicide educational programs reveals a positive outcome, showcasing their effectiveness in bolstering students' knowledge and fostering more constructive attitudes toward suicide prevention. Nonetheless, a critical examination of the findings underscores crucial areas for enhancement. While short-term understanding is essential, it must be accompanied by a tangible intention to seek help, a fact that some studies suggest might be lacking. Moreover, the application of acquired skills within the educational community remains unexplored, leading to a gap in understanding how program attendees translate knowledge into practical changes when addressing suicidal students.

Several recommendations were made by the authors of these studies. These included the need for school staff and counselors to be trained (Johnson and Parsons, 2012; Shannonhouse et al., 2017); addressing biases and stigma about suicide (Willson et al., 2020); providing guidance, support, and coaching to teachers on mental health strategies (Roberts et al., 2018); and implementing prevention programs periodically to increase their impact (Kalafat and Elias, 1994; King and Smith, 2000; LaFromboise and Lewis, 2008; Indelicato et al., 2011). Studies also highlighted the need for these programs to address issues that may have a negative impact on the mental health of students, such as bullying and family problems (Schmidt et al., 2015), the need to follow up with at-risk students (Brown and Grumet, 2009), and the need for educational institutions to have a crisis protocol intervention to minimize negative reactions to a peer suicide or a sudden event (Mintz-Binder, 2007; Cha et al., 2018).

In conclusion, the current systematic review identifies educational agents and institutions called into action in suicide

prevention. It provides an overview of the prevention, intervention, and postvention programs carried out in educational institutions to reduce suicidal manifestations and shows the state of current practice. The study describes the different types of programs that have been provided, the countries in which they have been implemented, and the agents who have been targeted as well as the recommendations given by various authors. It also identifies gaps in the research on suicide in education, such as the need (1) for more qualitative or mixed studies that assess or identify aspects that are not easily explored with quantitative procedures, (2) to diversify the countries and cultural contexts in which educational initiatives on suicide are carried out, (3) to promote interventions and postventions in the aftermath of suicide acts, and, most importantly, and (4) to reduce suicidal ideation and behavior by doing more than simply identifying participants' perception of changes in their understanding of and attitudes toward suicide and suicide prevention. This information may be helpful in designing and developing appropriate new research projects and programs for reducing suicidal behaviors in educational settings.

This study has some limitations that must be considered when interpreting its results. First, it is essential to note that most of the research in the review comes from the United States, with 33 articles out of 66 used; this could imply that the findings more accurately reflect the country's reality. Second, although systematic reviews are a rigorous research methodology, it is essential to recognize that they do not allow statistical analysis of results drawn directly from primary studies, as meta-analyses do. This difference in methodological approach could have implications for interpreting the results and their generalization to other contexts.

On the other hand, it is necessary to consider the possible publication bias in the scientific literature. It is common for research with negative results to be less likely to be published, which could lead to overestimating the real effect of educational interventions on suicide prevention. It is essential to encourage the publication of all positive and negative results to obtain a more complete and accurate picture of the effectiveness of interventions in this field.

Author contributions

JMDO, J-MD, and FM-V contributed to conception and design of the study, performed data extraction and screening and quality analysis, and wrote sections of the manuscript. EG-N organized the database. JMDO 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.

Publisher's note

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Effects of physical exercise on non-suicidal self-injury in adolescents: the chain mediating role of perceived social support and self-concept

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Objective: To study the effect of physical exercise on non-suicidal self-injury in adolescents and to verify the chain mediating role of perceived social support and self-concept. Methods: A survey study was conducted on 1,426 adolescents in Chengdu, Sichuan Province. A chain mediation model was used to verify whether perceived social support and self-concept played a mediating role.

Results: Physical exercise was significantly negatively associated with non-suicidal self-injury in adolescents ($\beta = -0.53$, $p < 0.01$) and significantly positively associated with perceived social support and self-concept ($\beta = 0.52, 0.54$, $p < 0.01$), and perceived social support and self-concept were significantly negatively associated with non-suicidal self-injury ($\beta = -0.59$, $p < 0.01$; $\beta = -0.64$, $p < 0.01$), and perceived social support was able to significantly and positively associate self-concept ($\beta = 0.76$, $p < 0.01$).

Conclusion: Perceived social support and self-concept play a chain mediating role in the effect of physical exercise on non-suicidal self-injury in adolescents, and it is recommended that the development of perceived social support and self-concept be emphasized during adolescents' development, which has the potential to reduce the incidence of non-suicidal self-injurious behaviors in adolescents.

KEYWORDS

physical exercise, non-suicidal self-injury, perceived social support, self-concept, adolescents, intermediary role

1. Introduction

In a report by the World Health Organization, it was stated that suicide is the second leading cause of death among young people aged 15–29 worldwide (1), where non-suicidal self-injury (NSSI) is an important predictor of suicidal behavior (2), and NSSI has become an increasingly serious global public health problem (3). Non-suicidal self-injury is defined as: an act in which an individual intentionally injures and directly damages his or her own body tissues without suicidal intent, commonly by cutting, stabbing, or excessive friction, which can cause bleeding and bruising, and this behavior is socially unacceptable (4, 5). In recent years, the prevalence of NSSI in the adolescent population and its harmful effects have received widespread attention,

and a Meta-analysis showed that the percentage of Chinese secondary school students who had experienced NSSI behaviors was 22.37% (6). This indicates that Chinese adolescents are facing serious problems with the prevalence of NSSI behaviors and that individuals are less able to deal with their negative emotions at the adolescent stage and are prone to extreme NSSI behaviors (7). Given the high prevalence and negative effects of NSSI in adolescents, it is necessary to investigate and analyze the factors and mechanisms influencing NSSI.

A large number of studies at home and abroad have explored the risk and protective factors for suicidal behavior from a biopsychosocial as well as a cultural perspective, and physical exercise has been mentioned in some of these studies as a potential protective factor for suicidal behavior. Perceived social support is often used as a mediating variable, and participation in physical exercise promotes individuals' access to social support, and perceived social support increases as a result. Perceived social support may serve as a protective factor for adolescents and may reduce mental health problems and high-risk behaviors (including non-suicidal self-injury). According to the multidimensional and hierarchical conceptualization of self-concept, physical exercise may be a contributing factor to improved self-concept, i.e., physical exercise may promote the development of self-concept. Non-suicidal self-injury fundamentally involves directing harmful behaviors toward the self; therefore, self-concept is a potential determinant of non-suicidal self-injury. Research suggests that more critical, hostile, or negative perceptions of oneself are associated with a greater risk of non-suicidal self-injury. The cognitive-emotional model of non-suicidal self-injury further emphasizes that self-concept is important in the occurrence of non-suicidal self-injury, i.e., self-concept may mitigate non-suicidal self-injury.

Physical exercise refers to physical activities in which people make their own choices according to their physical needs, use various means of physical activity and combine them with the forces of nature and hygienic measures in order to develop their bodies, improve their health, strengthen their physique, regulate their spirituality, enrich their cultural life and dispose of their leisure time (8). Numerous studies have shown that regular physical activity can reduce people's stress, depression, and enhance their sense of well-being (9–11). Studies have shown that there is a strong link between mood and NSSI, with people with NSSI having higher levels of negative mood than those without NSSI (12). Emotion management theory states that when individuals are experiencing the effects of negative emotions, it is likely that NSSI will be used to manage negative emotions. NSSI is widely used as a means to reduce emotional distress when individuals have difficulty regulating negative emotions (13–15). Physical exercise has a significant negative impact on negative emotions, and participation in physical exercise can promote the secretion and release of β-endorphins in the body, making individuals feel pleasure and reducing the effects of negative emotions (16), which can reduce the frequency of NSSI. From a neurobiological perspective, physical exercise is considered to be one of the most direct and effective ways to alleviate negative emotions such as depression because of its ability to effectively regulate neurotrophic factor concentrations, glucocorticoids, and morphological structures in specific parts of the central nervous system (17). Numerous empirical studies have also proved that regular and moderate physical exercise has a good effect on reducing emotional experience, suppressing individual mood swings and serving to reduce the level of negative emotions (18). In addition, stressful life events (interpersonal relationships, family relationships, academic performance) are important influences on adolescents' NSSI (19). Adolescents use NSSI as a way to regulate stress when experiencing stressful life events, and stressful life events increase the prevalence of NSSI in adolescents (20–22). There is a negative correlation between physical activity and stressful life events, and reasonable physical activity can enhance an individual's frustration tolerance and thus reduce the negative impact of stressful life events (23). In addition, physical exercise can reduce negative psychological conditions and improve the psychological state of people with NSSI, thus reducing NSSI. Physical exercise may act as a protective mechanism, especially in individuals with depressive symptoms, to inhibit the behavioral impulses of NSSI (24). In summary, the following hypotheses were formulated in this study:

> *Hypothesis 1 (H1)*: Physical exercise is negatively associated with non-suicidal self-injury in adolescents.

Perceived social support refers to the emotional experience and satisfaction of individuals who feel respected, supported and understood in society. It influences human behavior and development through the psychological reality of subjective perception of support, and exhibits a gainful function on individual mental health. Perceived social support is a part of social support, as opposed to actual social support (the actual help provided by elements of the surrounding environment when the individual is under stress or in distress), and is the individual's perceptual evaluation of the social support received in the life environment, and the higher the level of perceived social support, the higher the level of life satisfaction (25). Research on social support has shown that perceived social support (subjective feelings) is more meaningful than objective social support and better highlights an individual's level of mental health (26). Perceived social support may act as a protective factor against suicide and self-harm and reduce high-risk behaviors in adolescents (27, 28). When individuals have lower levels of perceived social support, they develop higher levels of negative emotions and have a higher probability of NSSI (29), and higher levels of perceived social support have a lower probability of NSSI in the face of stress or negative emotions (30), i.e., there is a negative correlation between perceived social support and NSSI. Social support theory suggests that one of the important ways to promote physical activity is to provide support before exercise, for example, by explaining how to exercise. In addition, physical exercise is not only an individual sport, but most of the time it needs to be done by multiple people, during which they are able to meet like-minded people according to their interests, promote social skills, and gain social support. Regular physical activity and increased interaction with family, friends, and others can promote the development of mental health and more social support perceived by individuals, i.e., there is a positive correlation between physical activity and perceived social support (31). In summary, the following hypotheses were formulated in this study:

> *Hypothesis 2 (H2)*: There is a mediating role of perceived social support between physical activity and non-suicidal self-injury.

Self-concept refers to an individual's knowledge and understanding of himself or herself, and is a person's overall understanding of his or her own psychology, physical characteristics, values, behavior, and role positioning. Self-concept is an important foundation for an individual's

self-identity and self-esteem, as well as an important guide and determinant of an individual's behavior and psychology (32). Studies have shown that physical activity is closely related to self-concept and that participation in physical activity can be effective in developing some elements of self-concept (33), i.e., physical activity can develop positive self-concept in adolescents and promote psychological health development by improving body satisfaction and body self-concept (34), and there is a positive correlation between physical activity and self-concept. It is clear from the concept of NSSI and the object of the behavior occurring that NSSI is fundamentally about inflicting hurtful behaviors on oneself, so the processes associated with perceiving the self may be important, and therefore self-concept is a potential determinant of NSSI (35, 36). Empirical studies have shown that adolescents with a history of NSSI have lower self-concept scores than their peers without a history of NSSI (37) and that adolescents with NSSI exhibit higher levels of worthlessness and insecurity compared to non-NSSI adolescents (38). The above findings further confirm that the association between self-concept and NSSI is significant (39). In summary, the following hypotheses were formulated in this study:

> *Hypothesis 3 (H3)*: There is a mediating role of self-concept between physical activity and non-suicidal self-injury.

The above analysis suggested separate mediating roles for perceived social support and self-concept between physical activity and non-suicidal self-injury in adolescents. However, it has been shown that there is a correlation between perceived social support and self-concept, and that an increase in the level of perceived social support drives the development of self-concept; the more support individuals perceive from family, friends, and others, the higher their level of mental health, and thus the clearer their perception of self and the higher their level of self-concept, i.e., there is a positive correlation between perceived social support and self-concept (40, 41). Physical exercise promotes the development of individual perceived social support, adolescents feel more support from all aspects of society and improve their self-concept, and the combined effect of the two enhances adolescents' positive state of mind and reduces the probability of NSSI. In summary, the following hypotheses are proposed in this study:

> *Hypothesis 4 (H4)*: There is a chain mediating effect of perceived social support and self-concept between physical exercise and non-suicidal self-injury.

Based on the above hypotheses, a multiple mediation model of physical exercise and non-suicidal self-injury was constructed (Figure 1).

2. Methods

2.1. Participants and procedures

Based on the questionnaire-based research design, a random sampling method was used for students from 10 middle schools in Chengdu City, with up to 150 students from each middle school, students aged between 14 and 18 years old, and the questionnaires were sent to the participants between August and December 2022, with a total of 1,500 questionnaires distributed, and 1,426 valid questionnaires were received, with a sampling validity rate of 95.06%. The demographic characteristics of the sample, see Table 1. Inclusion criteria included (1) enrolled middle school students between the ages of 14 and 18 years old; (2) informed consent and voluntary participation; (3) ability to fill out surveys with the help of parents or the school microcomputer room; (4) having had at least one non-suicidal self-injurious behavior of varying degrees of severity. Exclusion criteria included (1) repeated invalid questionnaires and (2) questionnaires that took less than 1 min to complete. The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Chengdu Sport University (code 2022–85, approved 15 August 2022). All tests were communicated to each participant before the survey began, and consent was obtained from the participants themselves, their schools, teachers, and parents.

2.2. Instruments

2.2.1. Physical activity rating scale

The Physical Activity Rating Scale (PARS-3), revised by Liang Deqing, was used (42). The measurement contains 3 dimensions of physical exercise: time, frequency, and intensity. Both intensity and frequency were scored from 1 to 5, and time was scored from 0 to 4. The amount of physical exercise = intensity score × time score × frequency score. The assessment criteria were: ≤19 as small exercise; 20–42 as moderate exercise; ≥43 as large exercise. In this study, the Cronbach's alpha coefficient was 0.62.

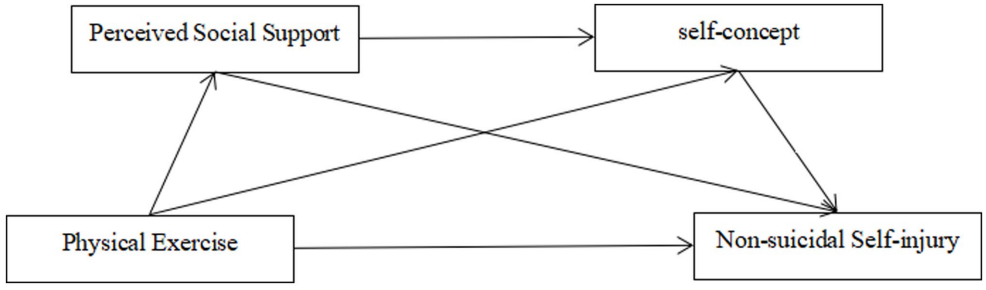

FIGURE 1
Hypothetical model diagram.

TABLE 1 Demographic characteristics of the samples.

Variables		Frequency/ Percentage (%)
Gender	Male	726 (50.91%)
	Female	700 (49.09%)
Family Location	Rural area	751 (52.66%)
	Urban area	675 (47.34%)
The Only Child in the Family	Yes	674 (47.27%)
	No	752 (52.73%)

TABLE 2 Analysis of variance in demographic variables.

Variables		Non-suicidal self-injury (Mean ± Standard deviation)
Gender	Male	1.53 ± 0.59
	Female	1.51 ± 0.60
	P	0.400
Family Location	Rural area	1.53 ± 0.59
	Urban area	1.51 ± 0.60
	P	0.657
The Only Child in the Family	Yes	1.55 ± 0.59
	No	1.49 ± 0.60
	P	0.057

2.2.2. Non-suicidal self-injury scale

The Adolescent Self-Injurious Behavior Questionnaire (43), developed by Feng Yu, was used to assess NSSI behaviors that occurred in adolescents during the past year. It was mainly used to assess the degree of NSSI behaviors of the subjects and included two subscales, self-injury frequency and self-injury degree. The frequency of self-injury was scored from 0 to 3, and the degree of self-injury was scored from 0 to 4. The total score = frequency of self-injury score × degree of self-injury score, with higher scores indicating higher levels of non-suicidal self-injury. In this study, the Cronbach's alpha coefficient was 0.87.

2.2.3. Perceived social support scale

The Chinese version of the Multidimensional Scale of Perceived Social Support (MSPSS) developed by Dahlem et al. (44) and translated and revised by Huang Li et al. (45) was used. The scale consists of 12 items, including three dimensions of individual perceived support from family, friends, and others, with four items each. The scores from "strongly disagree" to "fully agree" correspond to 1–7, respectively, and higher scores indicate higher perceived social support. In this study, the Cronbach's alpha coefficient was 0.86.

2.2.4. Self-concept scale

The Tennessee Self-Concept Scale (TSCT), developed by psychologist Fitts and revised by Lin Bang-Jie (46) in Taiwan, was used. The scale consists of 70 questions, including 2 dimensions of self-concept and composite status, with 10 factors to describe multidirectional self-concept. The higher the score on the first 9 factors, the more positive the self-concept, and the higher the score on the self-criticism, the more negative the self-concept. In this study, the Cronbach's alpha coefficient was 0.93.

2.3. Statistical methods

Statistical analysis was performed using SPSS 26.0 and AMOS 24.0. This included common method bias test; independent sample *t*-difference test; Pearson correlation analysis; regression analysis of relevant variables; model fit analysis; and Bootstrap sampling test.

3. Results

3.1. Common method bias test

Since the data for the study came from a subjective questionnaire, a common method bias test was conducted on the variables involved in the study. Harman's one-way test was used to test for common method bias, and 13 common factors with eigenvalues greater than 1 were obtained, and the first factor explained 27.32% (<40%), so the study did not have significant common method bias and met the statistical requirements (47).

3.2. Demographic differences

The demographic characteristics of the sample for this study included: gender, home location, and whether or not they were only children, and different gender, home location, and whether or not they were only children may differ on non-suicidal self-injury. Therefore, t-test and ANOVA were utilized to test whether different demographic characteristics in the sample differed on non-suicidal self-injury, see Table 2. There was no difference in non-suicidal self-injury among adolescents by gender ($p = 0.400 > 0.05$); no difference in non-suicidal self-injury by family location ($p = 0.657 > 0.05$); and no difference in non-suicidal self-injury among only children ($p = 0.057 > 0.05$).

3.3. Correlation analysis of each variable

Baron et al. showed that having correlation between the independent, dependent and mediating variables is a prerequisite for the analysis of mediating effects (48), and for this reason Pearson correlation analysis was performed for the four variables, see Table 3.

As shown in Table 3, physical exercise was significantly negatively correlated with non-suicidal self-injury ($r = -0.53$, $p < 0.01$), i.e., the level of non-suicidal self-injury may decrease with increased physical exercise. Physical exercise was significantly positively correlated with perceived social support ($r = 0.52$, $p < 0.01$) and self-concept ($r = 0.54$, $p < 0.01$), i.e., an increase in the amount of physical exercise may increase perceived social support and self-concept. Both perceived social support ($r = -0.59$, $p < 0.01$) and self-concept ($r = -0.64$, $p < 0.01$) were significantly negatively correlated with non-suicidal self-injury, and perceived social support was significantly positively correlated with self-concept ($r = 0.76$, $p < 0.01$). That is, increases in both perceived social support and self-concept may reduce the level

TABLE 3 Descriptive statistics and correlation of variables.

	M	SD	Physical exercise	Self-concept	Non-suicidal self-injury	Perceived family support
Physical Exercise	24.37	24.68	1			
Self-concept	2.72	0.65	0.54	1		
Non-suicidal Self-injury	1.52	0.59	−0.53	−0.64	1	
Perceived Social Support	2.72	0.72	0.52	0.76	−0.59	1

TABLE 4 Results of regression analysis of physical activity, perceived social support, self-concept, and non-suicidal self-injury.

	Non-suicidal self-injury			Self-concept			Perceived social support		
	β	*t*	R^2	*β*	*t*	R^2	*β*	*t*	R^2
Physical Exercise	−0.53	−23.51	0.28	0.54	24.27	0.30	0.52	22.87	0.27
Perceived Social Support	−0.59	−27.58	0.35	0.76	44.08	0.58			
Self-concept	−0.64	−31.29	0.41						

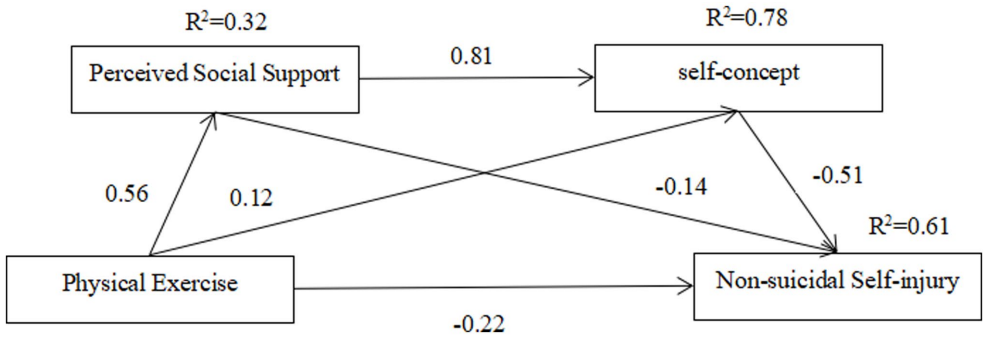

FIGURE 2
Structural equation model.

of non-suicidal self-injury, and increases in perceived social support may promote the development of self-concept.

3.4. Regression analysis of each variable

As shown in Table 4, physical exercise was significantly and negatively associated with non-suicidal self-injury ($\beta = -0.53$, $p < 0.01$); therefore, Hypothesis 1 was supported; physical exercise was significantly and positively associated with perceived social support ($\beta = 0.52$, $p < 0.01$) and self-concept ($\beta = 0.54$, $p < 0.01$); both perceived social support and self-concept were significantly and negatively associated with non-suicidal self-injury ($\beta = -0.59$, $p < 0.01$; $\beta = -0.64$, $p < 0.01$); meanwhile, perceived social support was significantly positively associated with self-concept ($\beta = 0.76$, $p < 0.01$).

3.5. Intermediation effect test

Wen et al. argued that it is more appropriate to use structural equation modeling to analyze the multiple mediation model (49). Based on this, AMOS 24.0 was used to establish structural equations for analysis, and the structural equation model diagram shown in Figure 2 was obtained. The existence of mediating effects and chain mediating effects of perceived social support and self-concept in the process of the influence of physical exercise on non-suicidal self-injury was examined.

The results of the goodness-of-fit test of the research model and data in this paper, see Table 5. Several key indicators meet the suggested values and reach the fit criteria, indicating that the overall goodness-of-fit of the theoretical model in this paper and the model diagram can be accepted, and the standardized path coefficients are shown in Figure 2.

As seen in Figure 2, physical exercise → non-suicidal self-injury ($\beta = -0.22$, $p < 0.01$), physical exercise → perceived social support ($\beta = 0.56$, $p < 0.01$), perceived social support → non-suicidal self-injury ($\beta = -0.14$, $p < 0.01$), physical exercise → self-concept ($\beta = 0.12$, $p < 0.01$), and self-concept → non-suicidal self-injury ($\beta = -0.51$, $p < 0.01$) all had significant path coefficients.

The mediation effect was verified using Bootstrap sampling test with 5,000 replicate samples. The mediation effect was verified using Bootstrap sampling test with 5,000 replicate samples. The results showed (Table 6) that perceived social support and self-concept played a fully mediating role between physical activity and non-suicidal self-injury, as shown in the following, physical activity → perceived social support → non-suicidal self-injury (95% CI: - 0.18 to −0.02), with a

TABLE 5 Fit index values of structural equation models.

	χ^2	χ^2/df	CFI	NFI	RMSEA	RFI	IFI	AGFI
Indices	2140.59	1.31	0.98	0.92	0.02	0.92	0.98	0.95

TABLE 6 Analysis of intermediary effects.

	Effect	*SE*	LLCI	ULCI	Ratio to total effect
Physical Exercise→Non-suicidal Self-injury	−0.22	0.01	−0.28	−0.16	36.6%
Physical Exercise→Perceived Social Support→Non-suicidal Self-injury	−0.08	0.05	−0.18	−0.02	13.4%
Physical Exercise→Self-concept→Non-suicidal Self-injury	−0.06	0.02	−0.10	−0.03	10.7%
Physical Exercise→Perceived Social Support→Self-concept→Non-suicidal Self-injury	−0.23	0.04	−0.33	−0.15	39.3%

mediating effect size of −0.08; physical activity → self-concept → non-suicidal self-injury (95% CI: −0.10 ~ −0.03), with a mediated effect size of −0.06; and perceived social support → self-concept acted as a chain mediator, as evidenced by the fact that physical activity → perceived social support → self-concept → non-suicidal self-injury (95% CI, −0.33 to −0.15), with a mediated effect size of −0.23. The ratios of the three mediating effects to the total effect were 13.4, 10.7 and 39.3%, respectively. The 95% confidence interval of the three indirect effects did not contain the zero value, indicating that the three indirect effects were all significant. Therefore, hypotheses H2, H3, and H4 were supported.

4. Discussion

4.1. Direct effect of physical exercise

The results of the study showed a negative association between physical exercise and non-suicidal self-injury in adolescents ($\beta = -0.53$, $p < 0.01$), with a direct effect of 36.6%. Hypothesis H1 was verified to be valid. The high prevalence and harm of NSSI in the adolescent population is mainly due to the fact that adolescents are prone to a number of psychological problems, such as: loneliness, interpersonal relationships, and depression (50, 51). Physical exercise has been proven to have a good effect on alleviating depressive symptoms, and teamwork during participation in sports allows adolescents to meet more friends with the same interests, reducing daily loneliness, drawing closer to peers through sports activities, and promoting interpersonal relationships. In-person sports activities can make adolescents feel supported and cared for by their parents, effectively controlling the generation of psychological problems and thus reducing the probability and frequency of NSSI (52–55). In summary, physical activity makes a positive contribution to the treatment and mitigation of NSSI in adolescents. Physical activity can be a potential treatment to reduce the probability of adolescent NSSI; for adolescents with NSSI, participation in physical activity may alleviate NSSI.

4.2. Mediating role of perceived social support

The results of this study showed that perceived social support had a separate mediating role between physical exercise and adolescent non-suicidal self-injury, with physical exercise positively associated with adolescent perceived social support ($\beta = 0.518$, $p < 0.01$) and perceived social support negatively associated with adolescent non-suicidal self-injury ($\beta = -0.591$, $p < 0.01$), with a mediating effect accounting for 13.4% of the total. Hypothesis H2 was verified to be valid. The effect of physical activity on adolescents' perceived social support may be due to the fact that in team sports, adolescents gain the opportunity to interact with their peers, which helps them perceive support from their peers (56). When individuals encounter difficulties, care and help from family members will help them get through them more smoothly, and the more they perceive this outside support, the more they can actively solve problems and avoid the risk of NSSI occurring. When adolescents participate in physical activity and receive social support, they become more interested in physical activity, and conversely physical activity promotes the development of perceived social support. When adolescents perceive more social support, it also means more love and respect from various sources, such as family and friends. They will feel less rejection and refusal, and they will be in a relatively secure environment (57, 58). The development of perceived social support directly drives emotional de-escalation and reduces negative emotions, which in turn will reduce the likelihood of NSSI (59). In summary, perceived social support mediates the effect of physical activity on non-suicidal self-injury in adolescents and is negatively associated with adolescent NSSI. Adolescents' participation in physical exercise may improve perceived social support, and perceived social support plays a positive role in alleviating adolescents' non-suicidal self-injurious behavior. Improving adolescents' ability to perceive social support through physical exercise may achieve the effect of alleviating non-suicidal self-injurious behavior and promote adolescents' healthy development.

4.3. Mediating role of self-concept

This study found a separate mediating role for self-concept between physical activity and adolescent non-suicidal self-injury, with physical exercise positively associating with adolescent self-concept ($\beta = 0.54$, $p < 0.01$) and self-concept negatively associating with adolescent non-suicidal self-injury ($\beta = -0.64$, $p < 0.01$), with a mediating effect accounting for 10.7% of the total. Hypothesis H3 was verified to be valid. Physical exercise is not only a physical act, but

there is also an interaction with the environment, and self-concept, as a psychological variable, is easily influenced by the external environment (60), and the physical satisfaction and psychological enjoyment that adolescents receive during physical exercise may be an important factor in promoting the development of self-concept, which is consistent with the results of previous studies (61). Adolescents' NSSI is inflicted on themselves and is characterized by dissatisfaction with their bodies or a need to release stress, in short, a socially unacceptable maladaptive behavior (37). Self-concept is essentially a perception of the self, and when adolescents have a high level of self-concept, they have a clearer perception of the self and show more positive aspects, which reduces the probability of NSSI. In summary, self-concept plays a mediating role in the effect of physical exercise on non-suicidal self-injury in adolescents, physical activity has a positive effect on improving self-concept in adolescents, there is a negative correlation between self-concept and non-suicidal self-injury, and improved self-concept may reduce the probability of NSSI, and play a positive role in preventing and treating NSSI in adolescents.

4.4. Chain mediating role of self-concept and perceived social support

The results of this study indicated that perceived social support and self-concept were chained mediators between physical exercise and non-suicidal self-injury in adolescents, with perceived social support significantly and positively correlating with self-concept ($\beta = 0.76$, $p < 0.01$), with a mediating effect of 39.3%. Hypothesis H3 was verified to be valid. The chain mediating effect indicated that physical exercise enhanced adolescents' perceived social support. The enhancement of perceived social support promoted the development of self-concept, which ultimately had a positive effect on improving adolescents' NSSI. Perceived social support significantly and positively associated with self-concept, and the more support and care from family, friends and others, the higher the level of self-concept of individuals (41). When facing some difficulties in daily life and stresses that are difficult to relieve alone, support from all aspects of society can be used to get through them, while perceived social support and self-concept as very important psychological indicators for adolescents also play a positive role in the development of adolescent mental health, including reducing the probability of NSSI in adolescents.

4.5. Research limitations and perspectives

This study clarifies the relationship between physical exercise and non-suicidal self-injury and its underlying mechanisms, which has theoretical and practical implications. However, this study still has certain limitations and needs further improvement in the future. First, the physical exercise studied in this paper is referred to collectively as physical exercise in all sports, and its dimension needs to be extended so that future research can be conducted for specific sports items. Second, this study only considered the mediating role of perceived social support and self-concept, and it is unclear whether there are other effects between physical activity and non-suicidal self-injury in adolescents that can be further studied and analyzed in the future. Third, the data in this study came from subjective questionnaire tests of the subjects and lacked objective tests; objective tests could be added to the study to test the subjects in the future. Adolescents are a high prevalence group of non-suicidal self-injurious behavior and need more attention. Adolescents are a high prevalence group of non-suicidal self-injurious behaviors and need more attention. In the future, we should pay attention to the causes of non-suicidal self-injurious behaviors among adolescents; how to treat or prevent non-suicidal self-injurious injuries among adolescents; and how to alleviate non-suicidal self-injurious behaviors, and so on, in order to promote the healthy development of adolescents.

5. Conclusion

This study analyzed and validated the relationship between physical activity, perceived social support, self-concept, and non-suicidal self-injury in adolescents. It was found that gender, family location, and being an only child did not differ in terms of adolescent non-suicidal self-injury. Physical activity and adolescent non-suicidal self-injury are significantly negatively correlated and play an important role in reducing the probability of adolescent non-suicidal self-injury. Perceived social support and self-concept were chain-mediated and separately mediated between physical activity and adolescent non-suicidal self-injury. Participation in physical activity may promote the development of perceived social support and self-concept in adolescents, which contributes to the reduction in the probability of non-suicidal self-injury in adolescents.

Therefore, adolescents should participate in more physical exercise, which is conducive to healthy physical and mental development; society and families should give adolescents a variety of support to create a good environment for adolescents to grow up; adolescents should learn to pay more attention to their own development and change, and to improve various levels of cognition of the self; schools and societies should strengthen the dissemination of information on the hazards of non-suicidal self-injury and the prevention of such aspects, so that adolescents can scientifically understand non-suicidal self-injury, and consciously resist non-suicidal self-injury; conducting physical activity may be a potential solution to reducing the incidence of non-suicidal self-injurious behavior in adolescents, and physical activity could be included in treatment indicators when non-suicidal self-injurious behavior occurs in adolescents.

Data availability statement

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

Ethics statement

Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

HY and QM: conceptualization, methodology, software, validation, formal analysis, writing—review and editing and resources. HY, QM, and KL: investigation and data curation. HY: writing—original draft preparation. 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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Suicide risk communication and intervention preferences for veterans and service members

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Despite the investment of public resources to fight staggering suicide rates among veterans, we know little about how veterans and service members in crisis communicate suicidal ideations, and what interventions they are willing to receive. We aim to identify communication and suicide intervention preferences of veterans and service members in times of crisis. Descriptive statistics were used to explore veterans communication of suicidal ideations. While 89.9% of participants indicated they were willing to speak to someone when having thoughts of suicide, less than 26% of participants indicated they were willing to bring up their thoughts with a crisis line or veterans organization. Rather, they indicate that family members (62.2%) and military friends (51.1%) would be their primary outreach. Logistic regression was used to determine whether or not preferred interventions varied by participant demographic characteristics. While the majority of participants indicated they were willing to allow intervention (88.6%), no one method was accepted by the majority of the population. The most accepted means of communication was to proactively contact a friend or family member about general life struggles (32.6%) or suicide-specific concerns (27.5%). Many participants were open to receiving resources (42.0%), suicide-specific mental health treatment (36.3%), and some sort of lethal means safety intervention (19.1%–26.4%). The age, marital status, and veterans status of participants significantly impacted what interventions they were willing to allow. We discuss the implications of these findings and the need for evidence-based, multimodal interventions in order to assist veterans in need.

KEYWORDS

veteran health care, mental health, suicide prevention, suicide intervention, suicide behavior

1 Introduction

Suicide among military service members and veterans has been a primary concern of the mental health field, the Department of Defense (DoD), and the Department of Veterans Affairs (VA) for well over a decade (1–4). For the past 15 years, there have been extensive planning and recommendations directed to address the high rates of suicide. In 2019, the President's Roadmap to Empower Veterans and End the National Tragedy of Suicide (PREVENTS) task force was formed by the White House and VA (5). In 2021, the White House also established a list of priority goals and activities for reducing military and veteran suicide (6). Yet, in the most recent National Veteran Suicide Prevention Annual Report, the rate of suicide among U.S. veterans was still 57.3% higher than the rate among non-veterans, and suicide was the second leading cause of death among veterans under the age of 45 (7).

We still know very little about who veterans talk to about their suicidality and what methods they use to communicate their struggles. This is important so that we might learn how to intervene earlier when a person initially expresses that they would be better off dead or they are thinking about killing themself. Of initial disclosures, over 89% of them were through relationships including friends, family, and domestic partners. The remaining 10% reported to medical professionals, mental health professionals and crisis hotlines (8). However, we know from previous veteran-centered work that the social and help seeking behaviors exhibited by military populations often differ from the general population due to the culture of military life (9–13).

The recommendations currently in place to decrease suicide among service members and veterans are evidence-based and actionable, but in order to maximize the effectiveness of these strategies, we need to understand how people are communicating that they are at increased risk of suicide and what is desired by those who are at increased risk of suicide. This study aims to identify those help seeking behaviors that are most commonly accepted by veterans when having thoughts of suicide. In addition, we explore how these help seeking behaviors differ by background characteristics and history of suicidal ideation. These insights can be used to inform future efforts in suicide prevention with veterans and service members, expanding our current understanding of the methods of communication and intervention efforts accepted by individuals. We will address this need by exploring the following research questions:

Research questions:

1. How do veterans and service members communicate their thoughts of suicide?
2. What interventions are veterans and service members willing to allow when they have thoughts of suicide?
3. How do the allowable suicide prevention interventions differ by demographic characteristics?

2 Methods

This study was led by researchers at the non-profit organization Stop Soldier Suicide (SSS), and was done in partnership with Veteran Tickets Foundation (Vet Tix) (14), which offers veterans and service members free tickets to social events. Vet Tix has over 1.6 million users, or Vet Tixers. Within its online platform, the organization has a system for frequently asking short questionnaires to the Vet Tixers. SSS worked with Vet Tix to add four questions (Appendix 1) to its online survey platform related to suicide prevention. All research methods described in this study have been approved under an exempt status by the Advarra Institutional Review Board (Project approval number: 00065053).

2.1 Survey design

Survey questions were designed by SSS staff to help the organization better understand how to reach individuals with thoughts of suicide and what help they would be willing to receive. Veterans at SSS and Vet Tix reviewed and refined the proposed questions following discussions on question content and interpretation. Question interpretation and optimization discussions included staff at SSS, many of which belong to the target demographic. The final four questions administered were: (1) If you had thoughts of suicide, whom would you trust to talk with about those things, (2) If you had thoughts of suicide, how would you bring it up with others, (3) If you had thoughts of suicide, what would you allow others to do to help you, and (4) Have you ever had thoughts of killing yourself? At the end of the survey, participants were given the contact information for SSS in case they wished to use its 24/7 crisis and support services (see Appendix 1 for the full questionnaire). Vet Tix users that had previously completed surveys had preexisting demographic data available for use. Any participants who had not previously answered demographic questions were asked those prior to the four additional SSS questions.

2.2 Participant recruitment

The survey was made available to Vet Tix users for a 1 month period in the fall of 2022. A statement was included in the weekly email announcement notifying all Vet Tixer subscribers that the questions specific to SSS would be available. Additionally, when users logged into their account they were given the opportunity to click on a link to fill out Vet Tix questionnaires which included all Vet Tix questions and the four new SSS questions.

Vet Tixers who respond to the questionnaires are typically given one to five digital "appreciation coins" per question, which they can later use to have a greater chance of winning one of the more popular social event tickets on Vet Tix. For this study, Vet Tixers were given five appreciation coins per question and were permitted to answer or skip any combination of the four survey questions.

2.3 Data curation and cleaning

Vet Tix shared data in the form of a CSV file with Stop Soldier Suicide for all participants who consented to and responded to the SSS questionnaire. This data file included de-identified demographic information collected by Vet Tix, the responses to the SSS suicide prevention questions, and information on VA utilization based on another set of Vet Tix questions. The original data file included 99,262 participants. Additional data cleaning was performed to ensure that all data points were collected from those currently serving, veterans, or severely wounded veterans. Additionally, those individuals who reported being part of Law Enforcement Operations or the Space Force were excluded due to limited sample size and the increased probability of identifiable respondents. Individuals with an age greater than 100 or having reported serving more than 65 years were excluded due to concerns with data validity. This resulted in a sample size of 99,045. We then filtered the results to include individuals that responded to any of the four SSS questions, decreasing the sample size to 38,185. Lastly, the decision was made to filter the results to include only those individuals who responded to all 4 of the SSS suicide prevention questions, resulting in a final sample size of 31,180. Please note that the full SSS dataset ($N = 38,195$) was used in a follow-up analysis, and it was confirmed that the use of complete data ($N = 31,180$) did not change the

narrative or substantially alter any of the descriptive statistics reported below.

2.4 Participant characteristics

Our sample includes members of the Army, Navy, Air Force, Marine Corps, and Coast Guard, but is largely composed of those currently or previously serving in the Army (44.6%) (Supplementary Table S1). Respondents were primarily veterans (79.9%) or severely wounded veterans (0.6%), although a substantial number were currently serving (19.5%).

Age was estimated based on years of service plus 18 for those who were enlisted and plus 22 for those who were ever officers. Estimated age ranged from 19 and 91 years (mean = 45.41, SD = 12.29 years) (Supplementary Table S1). A full description of participant demographics can be found in Supplementary Table S1.

2.5 Statistics analysis

All analyses were conducted in R (v4.2.2). Descriptive statistics were performed to determine whom veterans would feel comfortable reaching out to in crisis, how they would do so, and what interventions they would allow. In the survey (Appendix 1), participants were asked to select any responses that apply. As such, responses do not add to 100% in each case. To calculate these values, the number of participants that had selected each option were divided by the total number of participants ($N = 31{,}180$).

In order to evaluate whether or not particular demographic characteristics were likely to influence which interventions a participant may allow, logistic regression was performed. Each allowable intervention was evaluated as a response variable with covariates including: previous suicidal ideation, age, marital status, military status, and military branch.

3 Results

Of the 31,180 respondents, 18.7% said that they had prior thoughts of suicide, 67.1% said they did not have prior thoughts of suicide, and 14.1% preferred not to say (Supplementary Table S1).

3.1 Communicating suicidal ideation

The majority of respondents stated that if they were to experience thoughts of suicide they would trust talking about those thoughts with family (62.2%) and military friends (51.1%), while a significant proportion also indicated that they would trust mental health providers with their thoughts about suicide (44.8%) (Figure 1). However, veterans and service members were far less likely to trust talking about their thoughts of suicide with non-military friends than military friends (18.0% vs. 51.1%). Respondents were also considerably less likely to talk about their thoughts of suicide with the Veterans Crisis Line (VCL) or National Suicide Prevention Line (SPL; 26.2%), Chaplains (22.8%), veteran service organizations (VSOs; 16.9%), other health care providers (10.5%), or their boss (4.4%). Only 10.1% of respondents stated that they would not trust talking with anyone about their thoughts of suicide.

When these findings were stratified by whether or not participants had experienced previous suicidal ideation (Figure 1), it was found that those individuals who did have a self-reported history of suicidal thoughts were equally as likely to reach out to family (51.1%), military friends (51.9%), or mental health providers (51.7%). Interestingly, those individuals who report no previous thoughts of suicide are more likely to report they would be willing to reach out to personal resources such as family, non-military friends, chaplains, or their boss than the respondents who did have previous thoughts of suicide (Figure 1).

If the veterans and service members hypothetically had thoughts of suicide, they said that they would most likely bring it up with others by proactively contacting a friend or family member and talking about their general life struggles (32.6%) or the suicide-specific thoughts they were experiencing (27.5%) (Figure 2). Another common theme was that when participants said they would reach out for help from friends and family, respond to questioning by others, or look online for resources, they said they would be more likely to address general life struggles than to directly address suicide (Figure 2). For example, while 17.6% of participants report a willingness to discuss their general life struggles on social media, that number decreased to 5% in reference to suicide-specific thoughts. Only 15.4% of participants stated that there were no methods by which they would bring up their struggles with others.

Generally, participants without a history of suicidal ideation report a lower willingness to reach out for help by all proposed means than those with a history of suicidal ideation (Figure 2). Those individuals that preferred not to confirm or deny a history of suicidal ideation were universally the least likely to report a willingness to communicate their struggles with others regardless of proposed source or method (Figures 1, 2).

3.2 Allowing for intervention

Nearly half of all respondents said they were willing to allow others to know about their thoughts and intentions of suicide (48.1%) or allow others to provide them with resources to help them through life struggles (42.0%) (Figure 3). While 36.3% of participants were willing to be supported in receiving mental health treatment specific to thoughts of suicide, only 20.1% of participants said they were willing to let mental health providers come to their home and discuss their thoughts and intentions. Only 12.9% of participants were willing to allow a downloaded app to track their mood and provide support and 11.4% were not willing to allow any type of intervention. Consistent with means of communicating suicidal ideation, individuals who prefer not to disclose their history of suicidal ideation were least likely to allow each proposed intervention.

A subset of questions specifically addressed gun safety, in which 26.4% of participants were willing to allow trusted others to help them lock up guns and other lethal things in their homes, 24.4% were willing to let trusted others hold their guns temporarily, and 19.1% were willing to allow trusted family or friends to be notified in the case that guns or other lethal means are accessed (Figure 3).

In our multivariate analysis (Table 1), we found various characteristics of veterans and service members that were significantly

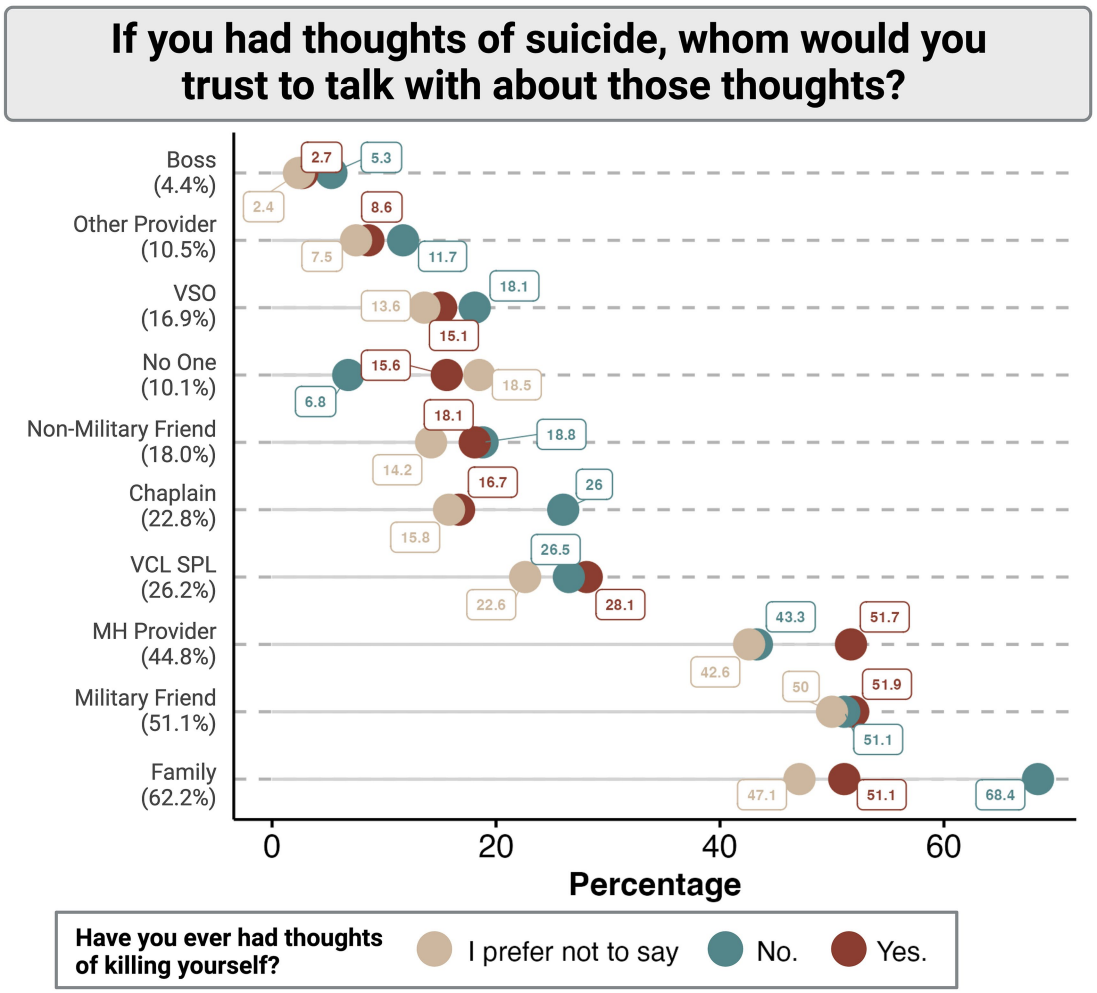

FIGURE 1
Distribution of trusted persons in communication of suicidal ideations among participants stratified by the presence or absence of previous suicidal thoughts. VSO, Veteran Serving Organization; VCL SPL, Veterans Crisis Line or National Suicide Prevention Line; MH, Mental health.

related to their willingness to allow different interventions when having thoughts of suicide. First of all, respondents who reported prior thoughts of suicide and those who preferred not to say whether they had prior thoughts of suicide generally said they would also be less willing to allow others to intervene if they were actively having thoughts of suicide compared to those who reported never having had prior thoughts of suicide. This is evident in both the large odds ratios (ORs) for the outcome of not allowing others to help (model 1), and the smaller than one ORs for all proposed interventions (models 2–9). There were a few exceptions to this trend. Compared to those with no prior thoughts of suicide, those who had prior thoughts of suicide had 1.41 times greater odds [95% confidence interval (CI): 1.30–1.53] of saying they would allow for an app to be downloaded on their phone that helps track their mood and receive support, 1.16 times greater odds (95% CI: 1.09–1.23) to receive suicide-specific mental health treatment, and 1.11 times greater odds (95% CI: 1.04–1.19) to allow trusted others to hold onto their guns until they felt better.

The types of allowable interventions varied by age (Table 1). Younger age groups (18–44 years) had significantly greater odds of saying they would allow others to know about their thoughts and intentions compared to older age groups (model 2). Younger age groups were also more willing to download an app to help them improve their mental health; and they had greater odds for saying they would allow for their guns to be locked up, allow trusted others to hold onto their guns, or allow trusted others to be notified when accessing their guns (models 7–9). However, age groups ranging from 18–54 had significantly lower odds than those 65 and older to say they were willing to receive suicide-specific mental health treatment. Younger age groups from ages 18–44 also had significantly lower odds than those 65 and older to be willing to allow others to provide them with resources to help with life struggles.

For many of the suicide prevention interventions, veterans had lower odds of allowing them compared to those who are currently serving in the military (Table 1). This was specifically the case for allowing for a mental health app to be downloaded on their phone (OR: 0.91; 95% CI: 0.83–1.00), allowing a team of mental health providers come to their house (OR: 0.87; 95% CI:0.80–0.94), receiving mental health treatment specific to suicide (OR: 0.92, 95% CI: 0.86–0.99), and all three interventions that were presented related to guns.

Marital status was also significantly related to the odds of being willing to allow for different interventions (Table 1). Those who were married had significantly lower odds than those who were single to

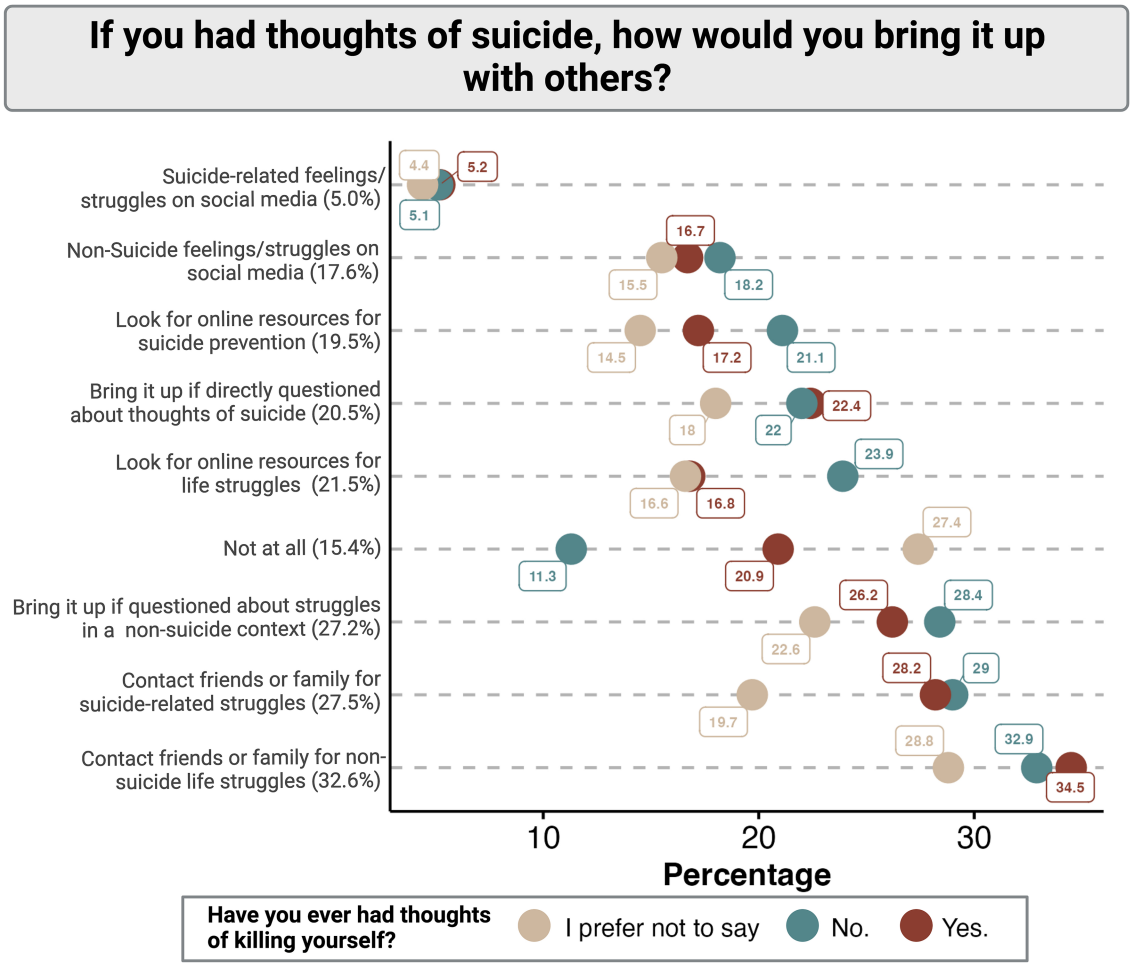

FIGURE 2
Distribution of suicide ideation communication methods among participants stratified by the presence or absence of previous suicidal thoughts.

allow others to provide resources, a mental health app to be downloaded on their phone, or for receiving a visit from a mental health team or suicide-specific mental health treatment. However, those who were married had significantly higher odds than those who were single to allow trusted others to help lock up guns or other lethal means, hold onto their guns, or be notified when accessing guns or other lethal means.

As education level increases, general patterns can be seen indicating an increased likelihood to accept resources, download mobile apps to track emotional wellbeing, and allow for in home and out of home mental health care (Table 1). However, education level was not consistently related to the likelihood of participants to allow firearm related interventions (i.e., trusted others to help lock up firearms, trusted others to hold onto guns, or trusted others to receive firearm access notifications). Interestingly, income level was only a significant predictor at all levels for the intervention of allowing trusted others to hold onto firearms, which increased with income (Table 1).

4 Discussion

The results from this study align with and add new insights to the existing literature. A previous study in the non-military population reported that a majority of participants with a history of suicidal ideation informally disclosed their thoughts with friends (73.3%), family (58.8%) or domestic partners (75.6%). Formal disclosures occurred with medical professionals (35.9%), mental health professionals (48.1%) or crisis hotlines (16.0%) (8). Our study indicates that service members and veterans may differ slightly from one another in the trusted individuals with whom they communicate suicidal thoughts. Our results closely match those based on the general population and a previous study on veterans with diagnosed psychological problems in terms of family, mental health professionals and crisis hotlines (8, 12). However, while the general public is willing to trust their friends with their thoughts of suicide at a high rate, service members and veterans are far more likely to trust their military friends (51.1%) than their non-military friends (18.0%). Additionally, they are less likely to trust general medical providers with their thoughts of suicide (10.5% vs. 35.9% in the general public). Participants in the study by Ammerman et al. (8) also reported that there was no significant difference in the level of perceived helpfulness of recipient reaction between disclosures in formal and informal settings. Even though we did not ask about this in our study, this implies that any attempts to communicate suicidal thoughts, whether in a formal or informal setting, could be equally as productive and should be considered suicide prevention resources.

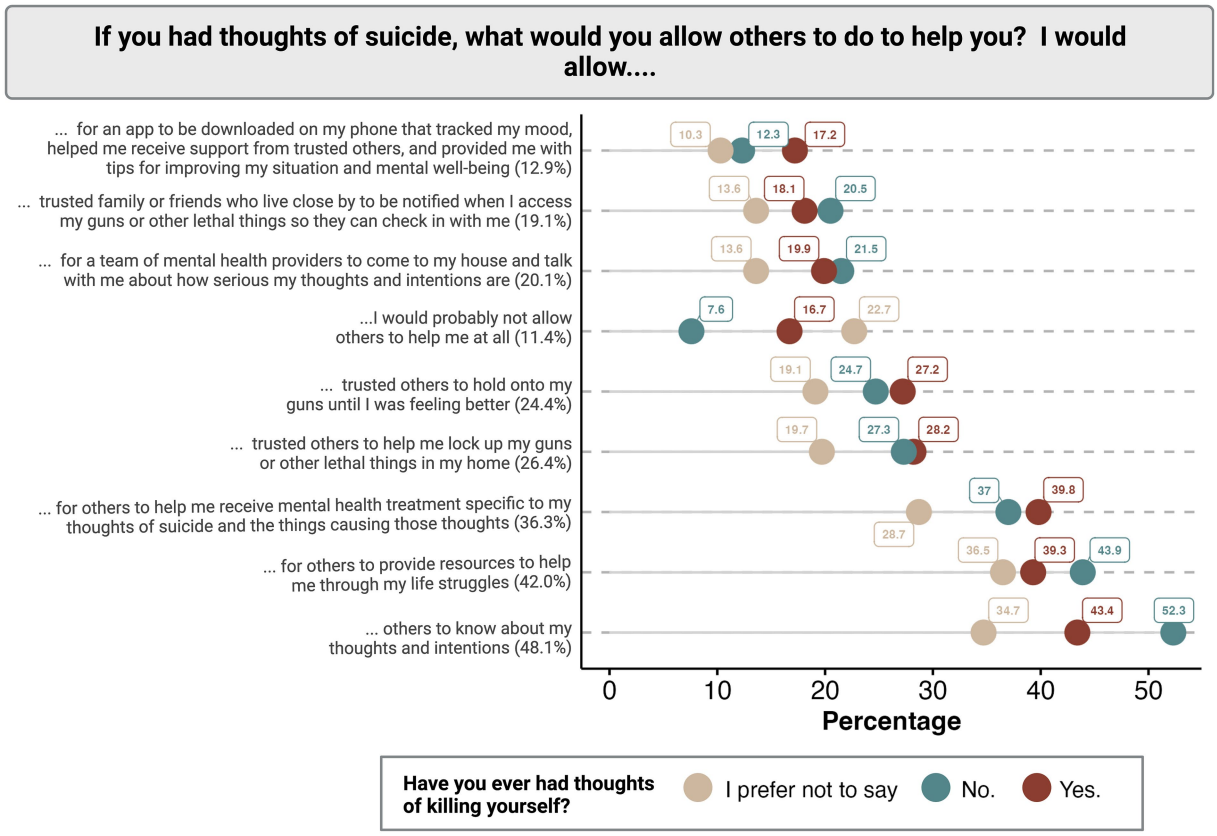

FIGURE 3
Distribution of accepted suicide interventions among participants stratified by the presence or absence of previous suicidal thoughts.

There are striking differences in the types of interventions allowed by those who report they have, or have not had previous suicidal thoughts. Participants who report not having previous suicidal thoughts indicate that they would allow trusted others to know about their thoughts, offer resources, receive gun notifications, or allow provider to enter their home. Alternatively, those participants who report previous suicidal thoughts are more likely to allow mental health treatment, for an app to track their mood and offer resources, or a trusted individual to hold or temporarily lock up their guns. These results indicate that participants who have had the experience of previously requiring suicide-based intervention may be in favor of action-based interventions that are not particularly invasive to their privacy which may require others to come to their home or receive unwanted notifications about their habits.

The subset of the miliary population that does not wish to disclose the presence or absence of prior suicidal ideations has been shown to be at particularly high risk. Our data suggests that these service members are also less likely to communicate current suicidal thoughts or allow any type of intervention on their behalf. This aligns with the outcomes form The National Health and Resilience in Veterans study, which reported that individuals who declined to respond to a history of self-injurious thoughts and behaviors were more likely to screen positive for PTSD, increased trauma burden, loneliness, and other risk factors associated with suicide (15). Additionally, a previous study utilizing the PHQ-9 indicated that 71.6% of suicides were among patients who responded "not at all" when asked if they had "thoughts that you would be better off dead, or thoughts of hurting yourself in some way" (16). These data together display the importance in providing care to those individuals who are not willing to disclose their history with suicidal ideation.

While a great deal of VA and DOD efforts toward suicide prevention have gone into the effective diagnosis and treatment of mental health issues, there has more recently been an acknowledgement of the importance of lethal means safety (17, 18). Nearly 70% of all service member suicides and 50% of military family member suicides used a firearm (19–21). However, veterans have reported that holding lethal means safety discussions in a health setting with high-risk individuals is acceptable when done properly (22), indicating that veterans and service members are open to potential gun-based interventions. As nearly 25% of respondents in our study indicate they would allow one or more interventions including having a trusted individual lock up their guns, hold their guns temporarily, or receive notifications in the event of a lethal-means access event, the potential for crisis response involving safer storage of lethal-means is a promising avenue for future suicide prevention research.

While respondents above the age of 55 were significantly more likely to allow mental health treatment than those under 55, there were a number of alternative interventions that were more commonly accepted by the younger respondents. With a wave of veterans at increased suicide risk coming from our more recent operations, specifically Operation Enduring Freedom, Operation Iraqi Freedom and Operation New Dawn (19), the mental health field must adapt the available suicide prevention resources to be inclusive of this more recent generation in order to decrease suicide rates in the coming decades. With decreasing age, respondents were more likely to allow lethal-means safety interventions, the use of technology-based services, and

TABLE 1 Summary of logistic regression analysis.

		#1 ...I would probably not allow others to help me at all	#2 ... others to know about my thoughts and intentions	#3 ... for others to provide resources to help me through my life struggles	#4 ... for an app to be downloaded on my phone that tracked my mood, helped me receive support from trusted others, and provided me with tips for improving my situation and mental well-being	#5 ... for a team of mental health providers to come to my house and talk with me about how serious my thoughts and intentions are	#6 ... for others to help me receive mental health treatment specific to my thoughts of suicide and the things causing those thoughts	#7 ... trusted others to help me lock up my guns or other lethal things in my home	#8 ... trusted others to hold onto my guns until I was feeling better	#9 ... trusted family or friends who live close by to be notified when I access my guns or other lethal things so they can check in with me
Prior suicide thoughts (Ref = "No")	I prefer not to say	**3.560 (3.250–3.880)*****	**0.480 (0.450–0.510)*****	**0.760 (0.710–0.810)*****	**0.790 (0.710–0.870)*****	**0.580 (0.530–0.640)*****	**0.710 (0.660–0.760)*****	**0.630 (0.580–0.690)*****	**0.700 (0.650–0.760)*****	**0.590 (0.530–0.640)*****
	Yes	**2.420 (2.220–2.650)*****	**0.690 (0.650–0.730)*****	**0.850 (0.800–0.900)*****	**1.410 (1.300–1.530)*****	**0.920 (0.850–0.990)***	**1.160 (1.090–1.230)*****	1.020 (0.960–1.090)	**1.110 (1.040–1.190)****	**0.820 (0.760–0.890)*****
Age (Ref = 65+)	18–24	**0.600 (0.460–0.780)*****	**1.670 (1.430–1.960)*****	**0.920 (0.780–1.070)***	**2.100 (1.660–2.680)*****	**0.860 (0.710–1.040)***	**0.780 (0.660–0.910)*****	**2.290 (1.920–2.720)*****	**1.970 (1.640–2.360)*****	**2.930 (2.400–3.580)*****
	25–34	**0.760 (0.640–0.900)****	**1.620 (1.450–1.800)*****	**0.820 (0.740–0.920)*****	**2.020 (1.690–2.440)*****	0.940 (0.830–1.080)	**0.770 (0.690–0.860)*****	**1.980 (1.740–2.260)*****	**1.830 (1.600–2.090)*****	**2.440 (2.090–2.850)*****
	35–44	**0.790 (0.670–0.920)****	**1.490 (1.350–1.650)*****	**0.900 (0.820–1.000)***	**1.890 (1.590–2.260)*****	0.930 (0.820–1.050)	**0.810 (0.740–0.900)*****	**1.680 (1.490–1.900)*****	**1.680 (1.480–1.910)*****	**2.110 (1.820–2.450)*****
	45–54	0.920 (0.790–1.070)	**1.250 (1.130–1.380)*****	0.920 (0.840–1.020)	**1.530 (1.280–1.830)*****	0.890 (0.790–1.000)	**0.800 (0.720–0.880)*****	**1.290 (1.150–1.470)*****	**1.370 (1.210–1.550)*****	**1.560 (1.350–1.810)*****
	55–64	0.860 (0.720–1.010)	**1.180 (1.060–1.320)****	1.050 (0.940–1.170)	**1.480 (1.230–1.780)*****	0.980 (0.860–1.110)	0.950 (0.850–1.060)	**1.130 (0.990–1.280)***	**1.160 (1.010–1.330)***	**1.310 (1.120–1.530)*****
Military status (Ref = "I am currently serving")	Veteran	1.050 (0.940–1.170)	0.990 (0.930–1.050)	0.960 (0.900–1.030)	**0.910 (0.830–1.000)****	**0.870 (0.800–0.940)*****	**0.920 (0.860–0.990)*****	**0.850 (0.800–0.920)*****	**0.850 (0.790–0.910)*****	**0.850 (0.790–0.910)*****
	Severely wounded veteran	1.240 (0.810–1.850)	**0.690 (0.510–0.940)***	0.960 (0.710–1.290)	0.770 (0.470–1.210)	0.710 (0.470–1.050)	0.860 (0.620–1.160)	**0.570 (0.380–0.820)****	0.790 (0.550–1.120)	0.690 (0.450–1.020)

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TABLE 1 (Continued)

		#1 ...I would probably not allow others to help me at all	#2 ... others to know about my thoughts and intentions	#3 ... for others to provide resources to help me through my life struggles	#4 ... for an app to be downloaded on my phone that tracked my mood, helped me receive support from trusted others, and provided me with tips for improving my situation and mental well-being	#5 ... for a team of mental health providers to come to my house and talk with me about how serious my thoughts and intentions are	#6 ... for others to help me receive mental health treatment specific to my thoughts of suicide and the things causing those thoughts	#7 ... trusted others to help me lock up my guns or other lethal things in my home	#8 ... trusted others to hold onto my guns until I was feeling better	#9 ... trusted family or friends who live close by to be notified when I access my guns or other lethal things so they can check in with me
Marital status (Ref = "Single")	Cohabitation	**0.790 (0.640–0.960)***	1.020 (0.900–1.160)	0.940 (0.820–1.070)	1.150 (0.970–1.370)	0.990 (0.850–1.160)	0.970 (0.850–1.100)	**1.210 (1.050–1.400)****	**1.300 (1.130–1.510)*****	1.100 (0.930–1.290)
	Divorced	0.930 (0.800–1.070)	1.000 (0.900–1.100)	0.970 (0.880–1.070)	1.030 (0.900–1.190)	1.030 (0.910–1.160)	0.950 (0.860–1.050)	1.100 (0.980–1.230)	**1.130 (1.010–1.270)***	1.050 (0.930–1.190)
	Married	**0.860 (0.770–0.970)***	1.040 (0.960–1.120)	**0.890 (0.830–0.970)***	**0.830 (0.750–0.930)****	**0.890 (0.810–0.980)***	**0.860 (0.800–0.930)****	**1.160 (1.060–1.260)*****	**1.120 (1.030–1.230)*****	**1.110 (1.010–1.220)****
	Separated	1.260 (0.960–1.620)	0.970 (0.800–1.180)	1.020 (0.840–1.240)	1.000 (0.760–1.310)	1.000 (0.780–1.270)	0.910 (0.740–1.110)	**1.270 (1.020–1.570)***	**1.350 (1.090–1.680)****	1.140 (0.890–1.450)
	Widowed	0.980 (0.710–1.350)	0.830 (0.670–1.030)	0.980 (0.790–1.220)	1.120 (0.810–1.520)	0.990 (0.760–1.280)	0.880 (0.700–1.090)	0.850 (0.640–1.110)	1.080 (0.830–1.400)	0.900 (0.650–1.220)
Military Branch (Ref = "Marine Corps")	Air Force	**0.830 (0.730–0.940)****	1.040 (0.960–1.130)	**1.100 (1.010–1.200)****	**1.130 (1.000–1.280)****	**1.140 (1.030–1.270)****	**1.140 (1.050–1.250)*****	1.020 (0.930–1.120)	1.070 (0.970–1.170)	1.080 (0.970–1.210)
	Army	**0.900 (0.810–1.010)***	1.050 (0.970–1.130)	0.950 (0.880–1.020)	**1.100 (0.990–1.240)***	**1.150 (1.040–1.260)****	**1.090 (1.010–1.180)****	1.010 (0.930–1.100)	1.080 (0.990–1.180)	**1.110 (1.010–1.220)***
	Coast Guard	0.850 (0.630–1.130)	1.150 (0.960–1.370)	**1.190 (1–1.420)***	**1.290 (1.010–1.650)***	**1.280 (1.040–1.580)***	**1.180 (0.990–1.410)***	1.060 (0.880–1.290)	0.900 (0.730–1.100)	1.140 (0.920–1.410)
	Navy	0.890 (0.790–1.010)	**1.090 (1.000–1.180)***	1.040 (0.960–1.130)	**1.120 (0.990–1.270)***	**1.180 (1.060–1.310)*****	**1.160 (1.070–1.270)*****	0.970 (0.880–1.070)	1.030 (0.930–1.130)	1.100 (0.990–1.220)

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TABLE 1 (Continued)

		#1 ...I would probably not allow others to help me at all	#2 ... others to know about my thoughts and intentions	#3 ... for others to provide resources to help me through my life struggles	#4 ... for an app to be downloaded on my phone that tracked my mood, helped me receive support from trusted others, and provided me with tips for improving my situation and mental well-being	#5 ... for a team of mental health providers to come to my house and talk with me about how serious my thoughts and intentions are	#6 ... for others to help me receive mental health treatment specific to my thoughts of suicide and the things causing those thoughts	#7 ... trusted others to help me lock up my guns or other lethal things in my home	#8 ... trusted others to hold onto my guns until I was feeling better	#9 ... trusted family or friends who live close by to be notified when I access my guns or other lethal things so they can check in with me
Education (Ref = "High school or equivalent")	Trade, technical, or vocational school	0.920 (0.770–1.100)	**0.880 (0.780–0.990)***	**1.270 (1.130–1.430)*****	1.130 (0.940–1.370)	0.940 (0.800–1.100)	1.090 (0.960–1.230)	1.050 (0.920–1.200)	1.030 (0.900–1.190)	0.990 (0.850–1.160)
	Some college credit, no degree	0.900 (0.780–1.030)	1.020 (0.930–1.110)	**1.150 (1.050–1.260)****	**1.180 (1.030–1.370)***	1.090 (0.970–1.220)	**1.130 (1.030–1.250)***	1.040 (0.940–1.150)	1.050 (0.950–1.170)	1.040 (0.930–1.170)
	Associate degree	**0.850 (0.730–0.990)***	1.040 (0.940–1.140)	**1.210 (1.100–1.340)*****	1.150 (0.990–1.350)	1.090 (0.960–1.230)	**1.190 (1.070–1.320)*****	1.030 (0.920–1.150)	0.960 (0.860–1.080)	1.020 (0.900–1.160)
	Bachelor's degree	**0.840 (0.740–0.970)***	1.070 (0.980–1.170)	**1.280 (1.170–1.410)*****	**1.310 (1.140–1.510)*****	**1.230 (1.090–1.370)*****	**1.240 (1.130–1.360)*****	1.020 (0.920–1.130)	0.970 (0.880–1.080)	1.010 (0.900–1.130)
	Master's degree	**0.770 (0.660–0.890)*****	**1.130 (1.020–1.240)***	**1.330 (1.210–1.470)*****	**1.500 (1.300–1.750)*****	**1.280 (1.130–1.450)*****	**1.390 (1.250–1.540)*****	1.100 (0.990–1.230)	1.010 (0.910–1.140)	1.020 (0.900–1.160)
	Doctorate degree	0.820 (0.600–1.090)	**1.210 (1.010–1.450)***	**1.520 (1.270–1.830)*****	**1.480 (1.130–1.920)****	**1.430 (1.150–1.770)*****	**1.280 (1.060–1.540)***	**1.230 (1.010–1.500)***	0.970 (0.790–1.200)	1.100 (0.870–1.370)
	Professional degree	**0.580 (0.380–0.850)****	1.190 (0.950–1.490)	**1.470 (1.170–1.840)*****	1.320 (0.930–1.830)	1.080 (0.810–1.430)	**1.510 (1.200–1.900)*****	1.060 (0.820–1.370)	0.970 (0.740–1.260)	0.860 (0.630–1.150)

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TABLE 1 (Continued)

		#1 ...I would probably not allow others to help me at all	#2 ... others to know about my thoughts and intentions	#3 ... for others to provide resources to help me through my life struggles	#4 ... for an app to be downloaded on my phone that tracked my mood, helped me receive support from trusted others, and provided me with tips for improving my situation and mental well-being	#5 ... for a team of mental health providers to come to my house and talk with me about how serious my thoughts and intentions are	#6 ... for others to help me receive mental health treatment specific to my thoughts of suicide and the things causing those thoughts	#7 ... trusted others to help me lock up my guns or other lethal things in my home	#8 ... trusted others to hold onto my guns until I was feeling better	#9 ... trusted family or friends who live close by to be notified when I access my guns or other lethal things so they can check in with me
Income (Ref = "Less than $25,000")	$25,000–$49,999	1.030 (0.870–1.220)	1.020 (0.910–1.150)	0.990 (0.880–1.120)	1.060 (0.880–1.270)	1.010 (0.870–1.170)	0.990 (0.870–1.120)	0.940 (0.820–1.090)	**1.180 (1.020–1.370)***	1.000 (0.860–1.170)
	$50,000–$74,999	0.910 (0.770–1.090)	1.070 (0.950–1.200)	1.050 (0.940–1.190)	1.110 (0.930–1.320)	1.040 (0.890–1.200)	1.040 (0.920–1.170)	1.110 (0.970–1.270)	**1.260 (1.090–1.460)****	1.030 (0.890–1.210)
	$75,000–$99,999	0.930 (0.780–1.110)	1.090 (0.970–1.240)	1.090 (0.960–1.230)	1.100 (0.920–1.320)	1.070 (0.920–1.250)	1.050 (0.930–1.190)	1.110 (0.970–1.280)	**1.330 (1.150–1.540)*****	1.070 (0.910–1.250)
	$100,000–$149,999	0.970 (0.820–1.170)	**1.140 (1.010–1.290)***	0.990 (0.870–1.120)	1.080 (0.900–1.300)	1.030 (0.890–1.210)	1.030 (0.910–1.170)	1.100 (0.960–1.270)	**1.350 (1.160–1.570)*****	1.030 (0.880–1.210)
	$150,000–$199,999	0.960 (0.770–1.190)	1.130 (0.980–1.300)	1.060 (0.920–1.230)	1.060 (0.860–1.310)	1.130 (0.950–1.350)	1.040 (0.900–1.210)	**1.210 (1.030–1.420)***	**1.440 (1.210–1.700)*****	**1.260 (1.050–1.510)***
	$200,000+	0.960 (0.750–1.230)	**1.380 (1.170–1.610)*****	0.950 (0.810–1.110)	1.030 (0.810–1.300)	1.130 (0.930–1.380)	1.040 (0.890–1.230)	1.130 (0.940–1.360)	**1.360 (1.120–1.640)****	1.130 (0.920–1.390)

Results are reported as odds ratios with 95% confidence intervals. Statistical significance is indicated with bold face text, and levels of significance is indicated with an asterisk (*$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$).

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other less direct mental health treatments. Future suicide prevention research targeting veterans of this era should focus on "new-age" technologies as well and how we can adapt our current practices to meet the needs our veterans that are not currently being met.

4.1 Limitations

This study includes a subset of veterans and active duty members that have self-selected to participate in Vet Tix programs. The survey was administered online through the Vet Tix webpage, which requires internet access and targets the population of veterans that use technology comfortably and therefore may not be generalizable to the greater veteran population. Due to limitations in the survey platform, participants were able to co-select responses equivalent to "none" and additional responses indicating acceptance. For example, a participant could indicate that they were not likely to accept help from anyone, but also select "military friends" as a second option. While we feel this information is insightful as two potential avenues of action, it is also possible that one some occasions, the multiples selections were an error due to the design of the survey.

While self-report data is common in suicidality research, it is worth noting that covariate data collection took place prior to survey administration, and may therefore be influenced by time disparities between demographic reports and self-reported behaviors. Additionally, we were unable to collect data on psychiatric history, such as psychiatric diagnoses, treatments, and other factors that may influence an individual's help seeking and intervention behaviors.

5 Conclusion

This study underscores the need for basic mental health awareness training in the broader military, veteran, and general populations, so that there is a clear understanding of what to do next if a loved one shares thoughts of suicide or significant life struggles. In addition, although some assume that a veteran would never be willing to part with their weapon, these results suggest that some service members and veterans would be open to lethal means safety, especially at times of risk. Finally, given that some individuals are more open to traditional mental health treatment while others are more open to technological and app-based resources, it is important that the field continue to pursue evidence-based and multimodal methods of intervening, so that resources can be made available that are desirable or a good fit for the individual veteran or service member.

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://github.com/Stop-Soldier-Suicide/Vet-Communication-Intervention.git.

Ethics statement

The studies involving humans were approved by Advarra Institutional Review Board (Project approval number: 00065053). 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

JR, KeH, and SVB contributed to conception and design of the study. SW, JR, and KaH organized and executed data collection. JR and AB organized the data. AB performed the statistical analysis. AB and JR 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1215925/full#supplementary-material

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The role of effective factors on suicidal tendency of women in Turkey

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Background/Aim: This study aims to identify the variables that influence the suicidal tendency of women who are married, have had a relationship or are currently in a relationship in Turkey.

Methods: This study uses cross-sectional data from the 2014 Hacettepe University Institute of Population Studies National Research on Domestic Violence Against Women in Turkey. Data from 6,458 women between the ages of 15 and 49 were analyzed in this dataset. Binary logistic regression was used to determine the factors influencing women's suicidal tendencies.

Results: Based on the analysis's findings, age, education level, health status, number of children, the sector in which the spouse/partner works, the drinking status of the spouse/partner, the situation where the spouse/partner fights with another man in a way that involves physical violence, the cheating status of the spouse/partner, the controlling behaviour of the spouse/partner, exposure to various types of violence by both the spouse/partner and someone other than the partner, and the household income level variables were found to be associated with the suicidal tendency of women.

Conclusion: Prioritizing women who are, in particular, between the ages of 15 and 24, live in the south of Turkey, have a high school education, are in poor health, are childless, have low household incomes, live with an unemployed spouse or partner, and are exposed to various forms of violence from their partner or other sources can be achieved more effective results in reducing and preventing women's suicidal behaviors.

KEYWORDS

suicide attempts, suicidal tendency, suicide risk factors, intimate partner violence, binary logistic regression, Turkey

1 Introduction

Suicide is the deliberate taking of one's own life, which ends in death. If it does not result in death, it is called a suicide attempt (1). Suicide, which begins with mental and behavioral planning, is a complex behavior that culminates in fatal or nonfatal attempts (2). Suicidal behavior, thought, planning, and attempts are serious, avoidable public health issues that

significantly increase morbidity and mortality and add to the global disease burden (3, 4). Although the majority of suicide attempts do not end in death, they pose a risk of severe injury and increase the likelihood of a second attempt (5). According to studies, the risk of suicide/death in suicide attempters increases 30–40 times compared to the general population (6).

Suicide, an important global public health problem, has become a growing social problem as interaction and communication complexity in existing societies has increased (7). According to the report of the World Health Organization (WHO) in 2021, more than 700,000 people end their lives by suicide every year. This shows that one person commits suicide every 40 s. 1.3% of all deaths in the world occur by suicide. In addition, while suicide ranks seventeenth among the causes of death, it has risen to fourth place among individuals between the ages of 15–29 (8).

The rate of suicide attempts, which has reached a high level, has demonstrated that this behavior should be addressed appropriately around the world. Studies have determined that suicide events that are not intervened with the appropriate methods and promptly increase the likelihood of recurrence and the risk of achieving the goal of dying (9). Suicide-inducing behaviors are not random occurrences. Events that develop over time and hurt a person's mental health compel that person to develop suicidal tendencies over time. Although the units where individuals at risk of suicidal behavior are treated are psychiatry services, it is known that there are individuals who attempt suicide even during the treatment process (10). It is important to classify and understand the factors that cause suicide correctly and to develop effective strategies to prevent and reduce it (11). Suicidal tendency is prevalent in all social groups and classes (2). Considering the studies examining suicide cases around the world, it was concluded that the factors triggering suicide for women and men may differ (12–16).

In the literature, there are remarkable studies on suicide and gender (17–28). According to some of these studies, there was no difference in self-harm between the sexes (17, 19, 23). Studies also report that women have a higher rate at this point (20, 25). This difference can be explained by the fact that both species view events and situations differently. For instance, while men can more easily control their emotions, women tend to act more emotionally (29, 30). This emotional structure can make it difficult for women to cope with events. These difficult times, which cannot be overcome, can manifest in women as self-harm or suicide. The use of less painful suicide methods (medication, wrist cutting, etc.) by women may also be indicative of their emotional characteristics (31). In addition, the fact that women are exposed to more abuse than men is shown as one of the reasons why suicidal ideation is more common in women (7).

Examining studies of women's suicidal behaviors and causes reveals that women's greater willingness to accept assistance and treatment with alcohol and drugs (32) and having small children (28) reduce the risk of suicidal thoughts and behavior. It is also seen that the suicide risk of a never-married woman is lower than that of a married woman and a man (33). In another study, hopelessness was found to be closely associated with suicidal thoughts in women (34). In addition, studies suggest that obesity (35), depressive processes (36, 37), alcoholism (38), and, albeit infrequently, advanced age (39) and fatigue (40) induce suicide in women.

Suicidal ideation refers to *the act of thinking about or a state of preoccupation with taking one's own life; the act of considering or planning suicide* (Merriam-Webster (41)). Recent studies have revealed that women have higher suicidal ideation than men (42–48). These studies can be examined as suicidal ideation in adolescent, pregnant, and working women. Adolescent women have higher suicidal ideation than adolescent men (49–52). Factors that increase suicidal ideation in adolescent women are menarche, irregular menstrual cycle, overweight (53), and public stigma (54). The pregnancy period in women is expressed as a period of high risk for suicidal ideation (55). Factors that increase suicidal ideation during this period are unplanned pregnancy, poor social support, common mental disorders (56), intimate partner violence (57), depressive symptoms (58), anxiety, lower level of education, age, and an unemployed professional status (59, 60). Although an unemployed professional status increases suicidal ideation in women, work and family stresses in working women raise suicidal ideation as well (61).

Apart from studies focused on adolescent, pregnant, and working women, some previous studies have investigated suicidal ideation in women in general (46, 48, 62, 63). According to the findings of these studies, factors that affect suicidal ideation in women are loneliness (63), alcohol consumption (62), age, depression, stress, social support (48), bipolar disorder, depressive symptoms, eating disorder, interpersonal problems, posttraumatic stress disorder, previous abortion, being a victim of dating violence (46).

Many studies have found that victims of domestic violence have higher rates of suicidal ideation, similar to victims of dating violence (11). Researchers and human rights advocates have recently paid considerable attention to domestic violence as a cause of suicide attempts among women (64). Partner violence was identified as one of the most consistent risk factors for female suicide attempts in a separate study (65). When the starting point of the causes of suicide in general is examined, it is determined that there is violence in the family or close environment experienced during childhood and/or adolescence (66). Violence can also affect the physical and mental health of children and/or adolescents, making them vulnerable to issues like social isolation, alcoholism, anxiety disorders, post-traumatic stress disorder, depression, and suicidal ideation (67, 68).

When suicide rates are compared on a regional basis as Africa, the Americas, the Eastern Mediterranean, Europe, Southeast Asia and the Western Pacific, Europe has the second highest rate. In Turkey, located in this region, the total number of suicides committed in 2019 was 2,003. Five hundred seventeen of them are women. While the female suicide rate in Turkey was 1.8 per 100,000 in 2000, this rate dropped to 1.2 by 2011. Despite this significant progress, by 2019, the relevant rate remained at 1.2 (8). Although men account for the majority of fatal suicides in Turkey, this situation may vary between regions. In Turkey, the rate of female suicide is observed to increase from west to east (69). For instance, it has been determined that women commit suicide at a higher rate than men in Southeastern Anatolia (70). In another study, one-year suicide cases were examined in a hospital, and it was determined that 64.18% of 416 patients were women (71). In another study conducted in Adıyaman, it was determined that 71.9% of patients who committed suicide within a given period were women (72).

The majority of suicides (79%) occur in low- and middle-income countries (2). As a result of Islam's prohibition on suicide, the rate of suicide is relatively low in Islamic countries, but it is on the rise in these regions (73). For this reason, this study aims to determine the factors affecting the suicidal tendency of women who are married, have had a relationship or are still in a relationship in Turkey. To

examine the effects of sociodemographic and economic factors of the spouse/partner on the suicidal tendencies of women, only married women who had been in a relationship or were currently in a relationship were included in the study. The complex interaction of numerous factors causes suicide. Despite the difficulty of predicting suicide, certain sociodemographic risk factors can be identified. These factors will also be examined from a regional and demographic standpoint. According to the literature review, although there are regional or provincial suicide studies in Turkey, there is no study that examines Turkey as a whole and explains regional differences. This study will add a unique value to the literature as a source for analysing Turkey. Survey data obtained from the TURKSTAT research survey were used in the study. These data are utilized because they reflect the country as a whole and because the study allows international comparisons and sheds light on national needs.

2 Methods

2.1 Data source

In this study, the cross-sectional data of the National research on domestic violence against women in Turkey conducted by Hacettepe University Institute of Population Studies in 2014 were used. The most recent National research on domestic violence against women in Turkey data shared by Hacettepe University Institute of Population Studies is that of the year 2014. This research's main strength and advantage is very significant, and unfortunately, the actual topic is always suicidality. A particularly important and neglected topic is women's mental health. The sample size is more than enough, although the data is from 10 years ago.

The National research on domestic violence against women in Turkey is one of the most comprehensive studies conducted nationwide to understand the dimension, content, causes, effects and risk factors of domestic violence experienced by women in Turkey. It was initially displayed in 2008 to ascertain the various facets and causes of violence against women as well as to fulfil the need for data collection on this matter. In terms of illustrating the evolution of domestic violence against women since the 2008 research, the National Research on Domestic Violence Against Women in Turkey conducted in 2014 is noteworthy (74).

The research questionnaire was designed by taking the questionnaires used by WHO's "Multi-country Study on Women's Health and Domestic Violence against Women" into account (75). New questions have been added to the questionnaire per the country's needs, focusing on legal regulations (74).

Within the scope of the research on violence, Turkey was divided into 30 strata to provide estimates at the national, urban/rural, 12 regionals, and five regional levels. Except for the Istanbul region, one of the 12 regions, the ratio between urban and rural populations in the remaining areas is approximately 75 to 25%. About 5 per cent of the households in Istanbul were chosen from rural areas. In the research, settlements with a population of 10,000 or more constitute urban, and settlements with less than 10,000 constitute rural strata. The research sample is cluster sampling (74).

April 8, 2014, marked the beginning of the study's 2014 field application, which ended on July 11, 2014 (74). The research team distributed the questionnaires for the study on domestic violence against women in Turkey. At every stage of the study, the ethical guidelines established by the World Health Organization were adhered to, and steps were taken to guarantee the security of the research team and the women questioned. Consent was secured from each respondent before the interview, and interviewees signed the questionnaire attesting to this fact. The researchers were aware of the subject's sensitivity before, during, and after the interview because they had received training on the Code of Ethics and Safety. If there were multiple women in the family between the ages of 15 and 59, the interviews were done with one randomly chosen woman from each household. This was done to avoid asking the same questions to multiple women in the household. The interviews were done in a confidential location thanks to the research teams' exceptional attention to detail. Additionally, instruction on interview confidentiality was given to each interviewee. Additionally, respondents were notified that their responses would be kept private during the approval and notification process (74).

In the 2014 survey, 7,462 women completed the questionnaire and were interviewed in person; the study's rejection rate was 4.4%. In interviews with women, the response rate was 83.3% (74). These records were supplemented with women's weights determined in compliance with the study's sample design (74).

Household surveys (which asked about the number of people living in the home, the number of rooms, and welfare indicators) and women's questionnaires (which asked about sociodemographic information and other details about the woman and her spouse/partner) were used in the Domestic Violence Against Women Research in Turkey. Two different Excel files containing these data were sent. Two different Excel files containing these data were sent. After the merger, 7,070 women's data were processed, and the analysis did not include 392 women whose household information could not be collected.

When the data of 612 women who had never been in a relationship at the time of the survey were removed, the number of units was determined to be 6,458 in the study because the suicidal inclination of married, single, or involved women was studied.

2.2 Outcome variable

In the Research on Domestic Violence Against Women in Turkey, women were asked the following questions about suicidal tendencies. "Have you ever contemplated suicide?" and "Have you ever attempted suicide?" The suicidal tendency measured by these questions served as the dependent variable. If the women participating in the study answered yes to one or more of the conditions mentioned, they had a suicidal tendency. If they did not experience any of them, they did not have a suicidal tendency. As a result, the dependent variable of the study is the suicidal tendency status of the women who received the code 1 if women have a suicidal tendency and 0 otherwise.

2.3 Independent variables

In this study, which examines the suicidal tendency of women, sociodemographic, economic, and domestic violence questions asked of survey participants were analyzed, and variables predicted to be effective were included in the model.

Variables related to sociodemographic and economic characteristics of women are as follows: region (west, south, central, north, east), age (15–24, 25–34, 35–44, 45–54, 55 and over), education level (illiterate, primary school, secondary school, high school, university), state of health (excellent/good, poor/very poor, moderate), number of children (no children, one child, two or more), spouse/partner's employment status (unemployed, public, private), spouse/partner's drinking status (no, yes), the situation where the spouse/partner fights with another man in a way that involves physical violence (no, yes), spouse/partner's cheating status (no, yes), if the spouse/partner prevents the woman from meeting with her friends (no, yes), the situation where the spouse/partner interferes with the clothes (no, yes), if the spouse/partner interferes with the woman's use of social media (no, yes), exposure to economic violence by spouse/partner (no, yes), the state of being exposed to emotional violence by the spouse/partner (no, yes), being exposed to physical violence by the spouse/partner (no, yes), sexual violence by the spouse/partner (no, yes), exposure to physical violence by someone other than a spouse/partner (no, yes), exposure to sexual violence by someone other than spouse/partner (no, yes), exposure to emotional violence by someone other than spouse/partner (no, yes), exposure to economic violence by someone other than spouse/partner (no, yes) and household income level (1st Income level (min), 2nd Income level, 3rd Income level, 4th Income level (max)).

This analysis only takes into account categorical variables with two-state or ordinal scales. To observe the impact of the categories of all the variables to be included in the binary logistic regression model, ordinal and nominal variables were defined as dummy variables (76).

2.4 Statistical analysis

Survey statistics in Stata 15 (Stata Corporation) were used to account for the complex sampling design and weights. Weighted analysis was performed (77). First, the study's participant women's frequencies and percentages were calculated based on how often they were exposed to sexual violence by their partners or spouses. The association between sexual assault and independent variables was investigated using the chi-square independence test. The categories from which any observed differences originate are also revealed by the Pearson chi-square (χ^2), in addition to the importance of the reported differences (78). Then, suicide risk variables were found using binary logistic regression analysis.

3 Results

3.1 Characteristics of study participants

The frequency and percentages of the independent variables connected to the proposed model will be interpreted in this section. The variables influencing women's exposure to sexual violence are shown in Table 1, along with the Chi-Square test findings.

Table 1's chi-square independence test findings indicate that there is a substantial correlation between all parameters and women's suicidality.

According to Table 2, 33.1% of the survey sample is comprised of women from the western region, while 8.1% are from the southern region. Women in the 25–34 age group constitute 30.7% of the study group, and women aged 55 and over make up 7.9% of the study group. Primary school graduate women constitute 45% of the sample and university graduates 8%. Women with excellent/good health state constitute 45.8% of the sample, and those with poor/very poor health constitute 13.1%. Women with no children constitute 13.9% of the sample, while those with two or more children constitute 70.6%.

Those whose spouses/partners do not work account for 19.1% of the sample, while those whose spouses/partners work in the private sector account for 68.1%. 20% of the sample consists of women whose spouses/partners drink, while 10.4% of the sample consists of women whose spouses/partners have cheated on them. 14.3% of the sample consists of women whose spouses/partners prevent them from meeting with friends. Women whose spouse/partner interferes with the clothes accounted for 34.3% of the sample. Women whose spouse/partner interferes with the use of social media constitute 18.8% of the sample. Women exposed to economic, emotional, physical and sexual violence by their spouses/partners constitute 27.5, 41.2, 33 and 10.9% of the sample, respectively. Women who have been exposed to physical, sexual, emotional and economic violence by someone other than their spouses/partners constitute 13.1, 6.2, 20.5 and 39.6% of the sample, respectively.

3.2 Multivariate analyses

The study employed the binary logistic regression model to identify the variables influencing the suicidal tendencies of the female participants. Table 2 presents the estimated model findings.

According to the data presented in Table 2, the region, age, education level, health status, number of children, the sector in which the spouse/partner works, the drinking status of the spouse/partner, the spouse/partner's fight with another man involving physical violence, the spouse/partner's cheating status, the spouse/partner's obstruction of friend meetings, the interference with clothing and social media use, the spouse/partner's economic, emotional, physical and sexual violence, exposure to physical, sexual, emotional and economic violence of someone other than spouse/partner and household income level variables are found to be significant.

3.3 Marginal effects

Table 3 shows the marginal effects of factors affecting women's suicidality. Additionally, multicollinearity between the model's independent variables was examined. Those with variance inflation factor (VIF) values of 5 and above are thought to cause moderate multicollinearity, and those with values of 10 and above cause a high degree of multicollinearity (79). According to the VIF results presented in Table 3, there is no variable that causes the multicollinearity problem between the variables.

According to the binary logistic regression model given in Table 3, women residing in the middle region are 26.4% less likely to be suicidal than women residing in the south region, all other variables being constant. Similarly, women residing in the eastern region are 25% less likely to be suicidal than women residing in the southern region. The suicidal tendency of 35-44-year-old women is 39.1% higher than that of 45-54-year-old women. Similarly, women aged

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TABLE 1 Factors affecting suicide tendency of women and chi-square test statistics.

Variables		Suicide tendency		*n* (%)	χ^2	*P*
		No	Yes			
Region	West	1712 (32.5)	425 (35.6)	2,137 (33.1)	10.655	0.031
	South	411 (7.8)	113 (9.5)	524 (8.1)		
	Central	1,112 (21.1)	239 (20.0)	1,351 (20.9)		
	North	773 (14.7)	149 (12.5)	922 (14.3)		
	East	1,255 (23.8)	269 (22.5)	1,524 (23.6)		
Age	15–24	613 (11.8)	180 (15.1)	803 (12.4)	26.588	0.000
	25–34	1,626 (30.9)	359 (30.0)	1985 (30.7)		
	35–44	1,398 (26.6)	352 (29.5)	1750 (27.1)		
	45–54	1,207 (22.9)	205 (17.2)	1,412 (21.9)		
	55+	409 (7.8)	99 (8.3)	508 (7.9)		
Education	Illiterate	1,017 (19.3)	224 (18.7)	1,241 (19.2)	24.232	0.000
	Primary school	2,387 (45.4)	520 (43.5)	2,907 (45.0)		
	Secondary school	669 (12.7)	210 (17.6)	879 (13.6)		
	High school	748 (14.2)	168 (14.1)	916 (14.2)		
	University	442 (8.4)	73 (6.1)	515 (8.0)		
Health State	Excellent/good	2,607 (49.5)	350 (29.3)	2,957 (45.8)	206.212	0.000
	Moderate	2079 (39.5)	574 (48.0)	2,653 (41.1)		
	Poor/Very poor	577 (11.0)	271 (22.7)	848 (13.1)		
Number of Children	None	696 (13.2)	201 (16.8)	897 (13.9)	11.841	0.003
	One	834 (15.8)	166 (13.9)	1,000 (15.5)		
	Two or more	3,733 (70.9)	828 (69.3)	4,561 (70.6)		
Sector in which the spouse/partner works	Unemployed	963 (18.3)	267 (22.4)	1,230 (19.1)	24.063	0.000
	Public	719 (13.7)	109 (9.2)	828 (12.8)		
	Private	3,571 (68.0)	815 (68.4)	4,386 (68.1)		
Drinking status of the spouse/partner	No	4,327 (82.2)	839 (70.2)	5,166 (80.0)	87.720	0.000
	Yes	936 (17.8)	356 (29.8)	1,292 (20.0)		
The situation where the spouse/partner fights with another man in a way that involves physical violence	No	4,843 (92.0)	960 (80.3)	5,803 (89.9)	145.903	0.000
	Yes	420 (8.0)	235 (19.7)	655 (10.1)		
Spouse/partner's cheating status	No	4,876 (92.6)	910 (76.2)	5,786 (89.6)	284.262	0.000
	Yes	387 (7.4)	285 (23.8)	672 (10.4)		
If the spouse/partner prevents the woman from meeting with her friends	No	4,676 (88.8)	861 (72.1)	5,537 (85.7)	224.699	0.000
	Yes	587 (11.2)	334 (27.9)	921 (14.3)		
The situation where the spouse/partner interferes with the clothing of the woman	No	3,610 (68.6)	634 (53.1)	4,244 (65.7)	104.356	0.000
	Yes	1,653 (31.4)	561 (46.9)	2,214 (34.3)		
If the spouse/partner interferes with the woman's use of social media	No	4,391 (83.4)	854 (71.5)	5,245 (81.2)	91.426	0.000
	Yes	872 (16.6)	341 (28.5)	1,213 (18.8)		
Exposure to economic violence by spouse/partner	No	3,985 (76.7)	637 (54.0)	4,622 (72.5)	247.225	0.000
	Yes	1,212 (23.3)	542 (46.0)	1754 (27.5)		
Exposure to emotional violence by the spouse/partner	No	3,402 (64.6)	393 (32.9)	3,795 (58.8)	405.213	0.000
	Yes	1861 (35.4)	802 (67.1)	2,663 (41.2)		
Exposure to physical violence by the spouse/partner	No	3,813 (72.4)	516 (43.2)	4,329 (67.0)	377.537	0.000
	Yes	1,450 (27.6)	679 (56.8)	2,129 (33.0)		

(Continued)

TABLE 1 (Continued)

Variables		Suicide tendency		*n* (%)	χ^2	*P*
		No	Yes			
exposure to sexual violence by the spouse/partner	No	4,882 (92.8)	873 (73.1)	5,755 (89.1)	389.864	0.000
	Yes	381 (7.2)	322 (26.9)	703 (10.9)		
Exposure to sexual violence by someone other than a spouse/partner	No	4,718 (89.6)	892 (74.6)	5,610 (86.9)	192.107	0.000
	Yes	545 (10.4)	303 (25.4)	848 (13.1)		
Exposure to emotional violence by someone other than a spouse/partner	No	5,035 (95.7)	1,025 (85.8)	6,060 (93.8)	164.843	0.000
	Yes	228 (4.3)	170 (14.2)	398 (6.2)		
Exposure to physical violence by someone other than a spouse/partner	No	4,379 (83.2)	758 (63.4)	5,137 (79.5)	233.998	0.000
	Yes	884 (16.8)	437 (36.6)	1,321 (20.5)		
Exposure to economic violence by someone other than a spouse/partner	No	3,302 (62.7)	596 (49.9)	3,898 (60.4)	67.370	0.000
	Yes	1961 (37.3)	599 (50.1)	2,560 (39.6)		
Household income level	1st Income level (min)	1,281 (24.3)	357 (29.9)	1,638 (25.4)	26.209	0.000
	2nd Income level	1,305 (24.8)	286 (23.9)	1,591 (24.6)		
	3rd Income level	1,310 (24.9)	312 (26.1)	1,622 (25.1)		
	4th Income level (max)	1,367 (26.0)	240 (20.1)	1,607 (24.9)		

15–24 have a suicidal tendency that is 36.9% greater than women aged 45–54. When compared to women aged 45–54, the suicidal tendencies of women over 55 and women aged 25–34 are 29.6 and 28.3% higher, respectively, than those of women aged 45–54. Considering the education level, the suicide tendency of illiterate and primary school graduates is 33 and 27.7% less, respectively, than high school graduates. Women with excellent or good health are 84% less suicidal than women with poor or very poor health. Women with one child have a suicidal tendency that is 27.9% lower than women with no children. Likewise, women with two or more children are 28.6% less likely to commit suicide than those without children.

Examining the findings regarding the spouse/partner reveals that the suicidal tendencies of women whose spouses work in the public and private sectors are 33.1 and 21.4% less than those whose spouses do not work, respectively. Women whose partners consume alcohol are 23% more likely to commit suicide than women whose partners do not consume alcohol. Women whose spouse or partner fights with another man using physical violence have a suicidal tendency 17.8% higher than other women. The suicidal tendency of women who were cheated on by their spouses/partners is 28.3% higher than those who were not cheated on. The suicidal tendency of women whose spouses/partners prevent them from meeting with friends is 17.4% higher than other women. The suicidal tendency of women who were interfered with by their spouse/partner on how they were dressed was 21.6% higher than those who did not. The suicidal tendency of women whose spouse/partner does not allow them to use social media is 14.8% higher than other women. Finally, women who were exposed to economic, emotional, physical and sexual violence by their spouse/partner were 27.6, 36.3, 33.3 and 49.3% higher, respectively, compared to those who were not.

Suicidal tendencies are 21.5, 54.5, 19.6, and 17% higher in women who have been subjected to physical, sexual, emotional, and economic violence by someone other than their spouse or partner compared to other women. The suicidal tendencies of women whose household income levels are at the first- and third-income levels are 17.9 and 20.8% higher, respectively, than the suicidal tendencies of women whose household income levels are at the fourth or maximum level.

4 Discussion

In this study, binary logistic regression analysis was used to examine the factors influencing the suicidal tendencies of married women in Turkey. Many factors affecting the suicidal behavior of women have been identified. In this study, the region, age, education level, health status, number of children, the sector in which the spouse/partner works, the drinking status of the spouse/partner, the spouse/partner's fight with another man involving physical violence, the spouse/partner's cheating status, the spouse/partner's obstruction of friend meetings, the interference with clothing and social media use, the spouse/partner's economic, emotional, physical and sexual violence, exposure to physical, sexual, emotional and economic violence of someone other than spouse/partner and household income level variables were found to be associated with suicidal tendency of women.

The study found a correlation between the area variable and women's suicidal behavior. It has been determined that regional employment, differences in regional development, and geographical location can trigger suicidal behavior in women (80). For instance, there is a gradual increase in female suicide from the west to the east of Turkey (81). The region factor can be evaluated both domestically and internationally (80). On a national basis, a positive correlation was found between low- and middle-income countries and suicides (82, 83).

In contrast, a different study found that countries with low and middle incomes have fewer female suicidal tendencies than countries with high incomes (84). It has been observed that female suicide rates vary across continents. The Asian Continent has been found to have the highest female suicide rate (85).

The age of women was found to be connected with suicidal thoughts in the study. Compared to women aged 45–54, it was found

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TABLE 2 Estimated model results of factors affecting women's suicide tendency.

Variables		β	Standard deviation	P	VIF
Constant term		−1.562	0.279	0.000	
Region (reference: south)					
	West	−0.038	0.143	0.785	3.41
	Central	−0.327	0.156	0.036	2.85
	North	−0.154	0.164	0.347	2.40
	East	−0.310	0.159	0.051	3.19
Age (reference: 45–54)					
	15–24	0.452	0.191	0.018	2.12
	25–34	0.343	0.135	0.011	2.05
	35–44	0.480	0.125	0.000	1.75
	55+	0.360	0.172	0.037	1.28
Education (reference: high school)					
	Illiterate	−0.414	0.164	0.012	2.62
	Primary School	−0.348	0.135	0.010	2.99
	Secondary School	−0.125	0.157	0.428	1.91
	University	−0.149	0.203	0.461	1.75
Health State (reference: poor/very poor)					
	Excellent/good	−1.059	0.128	0.000	2.85
	Moderate	−0.398	0.114	0.001	2.53
Number of Children (reference: none)					
	One	−0.354	0.161	0.029	2.06
	Two or more	−0.363	0.152	0.018	2.77
Sector in which the spouse/partner works (reference: unemployed)					
	Public	−0.413	0.169	0.015	1.65
	Private	−0.270	0.110	0.015	1.66
Drinking status of the spouse/partner (reference: no)					
	Yes	0.302	0.100	0.003	1.16
The situation where the spouse/partner fights with another man in a way that involves physical violence (reference: no)					
	Yes	0.224	0.133	0.093	1.13
Spouse/partner's cheating status (reference: no)					
	Yes	0.359	0.122	0.003	1.18
If the spouse/partner prevents the woman from meeting with her friends (reference: no)					
	Yes	0.219	0.120	0.069	1.25
The situation where the spouse/partner interferes with the clothing of the woman (reference: no)					
	Yes	0.269	0.092	0.003	1.22
If the spouse/partner interferes with the Woman's use of social media (reference: no)					
	Yes	0.186	0.110	0.092	1.26
Exposure to economic violence by spouse/partner (reference: no)					
	Yes	0.346	0.095	0.000	1.22
Exposure to emotional violence by spouse/partner (reference: no)					
	Yes	0.449	0.105	0.000	1.50
Exposure to physical violence by spouse/partner (reference: no)					
	Yes	0.415	0.104	0.000	1.56
Exposure to sexual violence by spouse/partner (reference: no)					
	Yes	0.635	0.122	0.000	1.30
Exposure to physical violence by someone other than a spouse/partner (reference: no)					
	Yes	0.271	0.118	0.022	1.23
Exposure to sexual violence by someone other than a spouse/partner (reference: no)					
	Yes	0.712	0.142	0.000	1.11
Exposure to emotional violence by someone other than a spouse/partner (reference: no)					
	Yes	0.245	0.106	0.021	1.27
Exposure to economic violence by someone other than a spouse/partner (reference: no)					
	Yes	0.212	0.091	0.020	1.16
Household income level [reference: 4th income level (max)]					
	1st income level (min)	0.222	0.129	0.085	1.76
	2nd income level	−0.021	0.123	0.861	1.56
	3rd income level	0.259	0.122	0.033	1.54
Classification success				0.837	
Pseudo R^2				0.177	
Cox Snell/ML R^2				0.156	
AIC				5079.05	
BIC				5322.35	
Log-likelihood				−2503.53	

that women aged 15–24, 25–34, and 35–44 had greater suicidal tendencies. Similar to these results, in a study conducted in Van province in Turkey between 2005 and 2011, it was found that the majority of women who committed suicide were between the ages of 16 and 20, with statistically significant age differences (86). Another study conducted in Turkey between 1990 and 2010 found that the highest suicide rate was among those aged 15 to 24, and the number of suicides in women was significantly higher than in men (87). A study conducted in Jamaica found that the average age of women who committed suicide was 34 (88). In another study, the increase in suicide rates among women aged 15 to 24 is highlighted (89). In a study comparing the rates of women and men committing suicide, it was found that women who commit suicide are younger than men who commit suicide (90).

One of the most remarkable findings of the study is that women's suicidal tendencies increase with their level of education. In studies examining the education level of women in suicide attempts and suicide completion behavior, it was determined that individuals who completed suicide were more educated than those who attempted suicide (90). However, in terms of the role of socioeconomic position

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TABLE 3 Estimated marginal effect values of factors affecting women's suicide tendency.

Variables		Marginal effects	Std. Error
Region (reference: south)			
	West	−0.031	0.112
	Central	−0.264[b]	0.125
	North	−0.123	0.131
	East	−0.250[c]	0.127
Age (reference: 45–54)			
	15–24	0.369[b]	0.154
	25–34	0.283[b]	0.111
	35–44	0.391[a]	0.103
	55+	0.296[b]	0.140
Education (reference: high school)			
	Illiterate	−0.330[b]	0.131
	Primary School	−0.277[b]	0.106
	Secondary School	−0.097	0.122
	University	−0.117	0.159
Health State (reference: poor/very poor)			
	Excellent/good	−0.840[a]	0.099
	Moderate	−0.298[a]	0.083
Number of Children (reference: no)			
	One	−0.279[b]	0.126
	Two or more	−0.286[b]	0.117
Sector in which the spouse/partner works (reference: unemployed)			
	Public	−0.331[b]	0.137
	Private	−0.214[b]	0.086
Drinking status of the spouse/partner (reference: no)			
	Yes	0.240[a]	0.079
The situation where the spouse/partner fights with another man in a way that involves physical violence (reference: no)			
	Yes	0.178[c]	0.104
Spouse/partner's cheating status (reference: no)			
	Yes	0.283[a]	0.094
If the spouse/partner prevents the woman from meeting with her friends (reference: no)			
	Yes	0.174[c]	0.094
The situation where the spouse/partner interferes with the clothing of the woman (reference: no)			
	Yes	0.216[a]	0.073
If the spouse/partner interferes with the Woman's use of social media (reference: no)			
	Yes	0.148[c]	0.087
Exposure to economic violence by spouse/partner (reference: no)			
	Yes	0.276[a]	0.075
Exposure to emotional violence by spouse/partner (reference: no)			
	Yes	0.363[a]	0.085
Exposure to physical violence by spouse/partner (reference: no)			
	Yes	0.333a	0.083
Exposure to sexual violence by spouse/partner (reference: no)			
	Yes	0.493[a]	0.090
Exposure to physical violence by someone other than a spouse/partner (reference: no)			
	Yes	0.215[b]	0.092
Exposure to sexual violence by someone other than a spouse/partner (reference: no)			
	Yes	0.545[a]	0.103
Exposure to emotional violence by someone other than a spouse/partner (reference: no)			
	Yes	0.196[b]	0.084
Exposure to economic violence by someone other than a spouse/partner (reference: no)			
	Yes	0.170[b]	0.073
Household income level (reference: 4th Income level (max))			
	1st income level (min)	0.179[c]	0.104
	2nd income level	−0.017	0.101
	3rd income level	0.208[b]	0.098

[a]$p < 0.01$; [b]$p < 0.05$; [c]$p < 0.10$.

(education and unemployment) in the relationship between IPV and suicide attempts, a study carried out in the Philippines found that low education level was a risk factor for both intimate partner violence and suicide attempts compared to high or secondary education level (91). In Leon (Nicaragua), it is seen that the education level of women who live in poverty and have a positive attitude toward suicide is at the primary level, and they cannot even complete primary education (92). In a study conducted in Batman province in Turkey, it was determined that those who committed suicide had, on average, 3.9 years of education and that nearly half of the 13 suicide victims were illiterate (93). Similarly, it was determined that the majority of women who applied to Batman Regional State Hospital in Turkey due to suicide attempts were illiterate (70). In another study conducted in the same province, it was determined that the majority of women who committed suicide or attempted suicide were illiterate and had completed primary school (94).

In the study, a correlation between health status and suicidal tendencies was determined. It has been determined that women with excellent or good health are less likely to commit suicide than women with poor or very poor health. Examining the studies reveals that the likelihood of suicidal behavior increases in patients receiving long-term treatment, no treatment, or painful treatment procedures (95–99). Similarly, in a study conducted in the province of Batman in Turkey, it was found that suicidal individuals had a significant mental illness, particularly a severe mental illness such as major depressive

disorder (93). According to another study on suicide and suicide attempts in Batman, Turkey, the majority of women committed suicide due to illness (94). According to a study of suicide and suicide attempts in the Muğla region, physical and psychological discomfort are among the causes of both suicide and suicide attempts (100).

The study found a relationship between women's suicide tendencies and the number of children they had. It has been determined that women with two or more children are less likely to commit suicide than women without children. Similarly, a study examining the relationship between the number of children in a marriage and the suicide rate found that the risk of suicide decreased with increasing numbers of children (101). On the other hand, the study conducted with African-American women revealed that the number of children born to women who attempted suicide and those born to women who did not attempt suicide were comparable (102). In another study in which more than 40% of women attempted suicide, the low percentage of women who had never given birth is notable (92). In another study, it was found that more than 50 % of women with suicidal behaviors had two or three children (103).

The study's findings indicate that women's suicide tendencies are correlated with the industry in which the husband or partner works. It has been determined that women whose spouses or partners work in the public or private sector are less likely to commit suicide than those whose spouses are unemployed. Similar to the results of the study, in another study conducted in Iran, it was determined that the officially working spouses of those who attempted suicide had a low suicidal tendency (104). According to another study on intimate partner homicide-suicide, the majority of the perpetrators are unskilled workers (88).

According to the study, there is a correlation between the drinking status of the spouse/partner and the suicidal tendency. In a study, it was stated that there is/may be a relationship between alcohol and suicidal ideation (105). In another study, it was determined that the drinking/gambling habits of a woman's spouse or partner could trigger suicide attempts (100). According to the study, it was detected that there is a relationship between the spouse/partner fighting with another man in a way that includes physical violence and suicidal tendencies. There are studies in the literature indicating that fighting with a spouse can lead to suicidal thoughts (106, 107).

According to the study, women who experienced controlling behavior from their partners or spouses exhibited higher levels of suicidal thoughts. Similar to the findings of this study, family members of suicidal criminals described them as abusive, jealous, controlling, possessive, and obsessive in a study conducted in Jamaica. In addition, when suicides were examined in depth, a newspaper article revealed that women were not permitted to communicate with men, use social media, or have their phones tampered with (88). Turkey, on the other hand, is characterized by a traditional family structure and a social structure that cannot protect women from violence. The problem that arises from the women's inability to express their ideas clearly in family relationships, particularly as a result of the pressure they experience, may manifest as a suicide attempt (108). In other studies, it has been found that suicide attempts are very high in women with spouses/partners with controlling behaviors (109, 110).

According to the findings of the study, domestic violence is associated with suicide. Those who experience economic, mental, physical, or sexual abuse at the hands of their spouse or partner are more likely to consider suicide than those who do not. Similarly, it has been determined that African American women who have experienced intimate partner violence and attempted suicide are primarily exposed to physical and non-physical violence (102). Women who have experienced physical, sexual, or any other type of violence are much more likely than those who do not disclose abuse to report mental health issues and suicidal thoughts, according to a study done on women in Delhi (111). A study in Leon (Nicaragua) found that 43.4% of female IPV victims living in poverty attempted to commit suicide at some point in their lives (92). According to research conducted in the Philippines, 8% of the women said that IPV caused them to experience psychological suffering and make suicide attempts (91). A Turkish study found that women who have considered suicide or attempted suicide are more likely to be victims of economic violence (112). Research has indicated that women who witness sexual abuse by their spouses or partners may experience suicidal thoughts (113). On the other hand, in Harare, Zimbabwe, researchers discovered that while sexual violence was not linked to suicidality in women, emotional and physical abuse was (114).

The study found a correlation between exposure to emotional, economic, sexual, and physical abuse by someone other than a spouse/partner and suicidal behavior. Other studies have found that exposure to physical, psychological, and/or sexual abuse by individuals other than a spouse/partner during childhood has a significant impact on the likelihood of committing suicide as an adult (115–117). In another study, it was found that the father's feelings of argumentation, anger, hostility toward the mother, and emotional violence against the child increased the child's future suicidal tendencies (118). Another study found a strong correlation between women's experiences with physical attacks by non-spouses after the age of 18 and their suicide attempts. Additionally, the same study revealed a correlation between sexual abuse experienced after the age of 18 and suicidal ideation (92).

The study discovered a link between women's suicidal tendencies and household income. As household income decreases, the likelihood of suicidal behavior increases. Consistent with this finding, a Japanese study found that suicide ideation declined with rising household wealth (119). Similarly, a study conducted in South Korea found that when household income decreases significantly, suicidal tendencies increase (120). Additionally, it is stated that suicidal ideation increases in situations where household income decreases, such as retirement (121). In contrast to this study, other research has found that those with a minimum income attempt suicide at a lower rate than those with higher incomes (92, 102).

This research has a number of limitations. First, the study's data are secondary. The variables required for statistical analysis are already present in the data set. However, some variables, such as the individual's occupation not in the data set and the homeownership status, could not be analyzed. Second, the data obtained regarding women's suicidal tendencies consists of the women's responses. Therefore, the data obtained through this data collection method may be biased. Finally, the data used in the study is from 10 years ago. The most recent National research on domestic violence against women in Turkey data shared by Hacettepe University Institute of Population Studies is that of the year 2014.

5 Conclusion

Female suicides are the result of a complex set of factors. This study's findings are significant for understanding the causes of

women's suicidal behavior and as a source of information on suicide prevention. Even though suicide prevention and women's support work are crucial to social education and awareness-raising about women's roles, empowering women in the most deprived environments, and social rejection of violence against women, suicide prevention and support work for women still pose a significant challenge in Turkey. This study's findings can serve as a valuable guide for the development of culturally appropriate strategies for understanding suicidal behaviors in females for the prevention of suicides. In particular, it can help policymakers and social actors raise the issue's visibility.

To reduce and prevent women's suicidal behaviors, more effective results can be achieved by giving priority to women who are particularly between the ages of 15 and 24, reside in the south of Turkey, have a high school diploma, are in poor health, do not have children, have low household income levels, are living with an unemployed spouse/partner, and are exposed to various forms of violence by their partner or non-partner. In addition, effective suicide prevention programs can be created with social policies and mindful practices that will reduce the controlling behaviors of the spouse/partner.

Women can be encouraged to participate more actively in corporate life, penalties can be increased, and facilities can be set up to help women get their emotional lives back on track. It is possible to make sure that women are informed of their legal rights and what to do if they experience one of the forms of violence.

Existing legal protections for women against emotional, economic, sexual, and physical abuse at the hands of individuals other than their spouses/partners can be developed and strengthened. Activities promoting public awareness that are insensitive to the unjust treatment that drives women to suicide are of vital importance.

Suicide as a result of violence against women should be discussed at all levels of education, and awareness campaigns should be organized to raise awareness. Important members of society, including religious and political leaders, artists, and athletes, should be encouraged to participate in the awareness campaign. In addition, instead of sensationalizing the event, media reporters can warn the public about patterns of murder-suicide, dispel myths, and educate the public about responsible reporting.

The regulations envisioned in practice today are inadequate, even though they are meant to prevent and support women who commit suicide. Many violent victims who are in danger of trying suicide think that if they disclose the abuse to the police, they will not be protected and will instead face further violence. To boost public trust in the judicial system, domestic abuse allegations should be handled in police stations and courtrooms openly and understandably. To further prevent the use of firearms for suicide and all other types of violence, it is imperative to support individual disarmament and outlaw the possession of firearms within the home.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: the data underlying this study is subject to third-party restrictions by the Turkey Statistical Institute. Data are available from the Turkish Statistical Institute (bilgi@tuik.gov.tr) for researchers who meet the criteria for access to confidential data. The authors of the study did not receive any special privileges in accessing the data. Requests to access these datasets should be directed to bilgi@tuik.gov.tr.

Author contributions

ŞK: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing. SÇ: Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. AG: Conceptualization, Writing – review & editing. ÖA: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

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Conflict of interest

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Association between love breakup and suicidal ideation in Peruvian medical students: a cross-sectional study during the COVID-19 pandemic

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Objective: We aimed to determine the association between a major romantic breakup and suicidal ideation in medical students from three universities in Peru.

Methods: A cross-sectional study was conducted during the first pandemic wave in 2021 on medical students from three universities in northern Peru. The outcome was suicidal ideation, measured with question nine of the Patient Health Questionnaire-9 (PHQ-9). Generalized Anxiety Disorder Scale-7 (GAD-7) and Insomnia Severity Index (ISI) were also used to assess mental health symptoms. The exposure was the experience of a major love breakup during the pandemic. In addition, its association with other covariates (age, sex, family members infected with COVID-19, deceased family members with COVID-19, insomnia, and anxiety, among others) was examined.

Results and discussions: Out of 370 students, 19.5% reported a major love breakup during the pandemic (95%CI: 15.5–23.8), and 34.3% had suicidal ideation (95%CI: 29.4–39.4). Having a major love breakup was associated with a higher prevalence of suicidal ideation (PR: 1.49, 95%CI: 1.32–1.67, $p < 0.001$). Moderate insomnia (PR: 2.56, 95%CI: 1.70–3.87, $p < 0.001$) and anxiety symptoms (PR: 1.94, 1.10–3.44, $p = 0.023$) were also associated with suicidal ideation.

Conclusion: Our study provides evidence of a significant association between a major love breakup and suicidal ideation. This finding emphasizes the need for further research to better understand this association and

inform the development of effective suicide prevention policies in medical education.

KEYWORDS

medical students, mental health, love, suicidal ideation, COVID-19, pandemic, Peru

1 Introduction

Worldwide, suicide is responsible for more than 700,000 deaths annually and is the fourth leading cause of death in young people aged 15–29 years, with a higher percentage of deaths in low- and middle-income countries (1). Suicidal ideation (SI) is considered the most important risk factor for suicide (1, 2), a public health problem that has recently begun to be studied in Latin America (3).

Medical students have a prevalence of SI from 13.7 to 33.3% (4–6). Due to the COVID-19 pandemic, not only was physical health affected (7–9), but mental health has also deteriorated significantly in various populations (10–15). Similarly, in the context of the COVID-19 pandemic, SI increased from 13.4 to 16.9%, according to a study of Mexican students (16), a result similar to a French study (17). In Peru, 17.9% of medical students had SI during the COVID-19 pandemic, which was found to be associated with a higher frequency of depression and anxiety (18). During the year 2010, it was estimated that 19.9% of 2,521 adolescent students had suicidal ideation, according to the Global School-based Student Health Survey (19). In 11,609 Peruvian adolescents, a combined prevalence of suicidal ideation of 8.5% was found after analyzing data from the Demographic and Family Health Surveys from 2013 to 2019 (20). Additionally, the development of this disease is influenced by several potential protective factors: the search for psychological help or support in their family (21), no mental health disorders and/or use of illegal substances (22), and to have stability in their love relationship (23, 24). Conversely, having depression, poor social support, less frequent conversations, and ending a stable romantic relationship all behave as aggravating risk factors for the development of SI (5, 25–27). It is known that the gender role influences the presentation of mental health disorders, evidencing very noticeable changes due to the performance of roles and the reduction of opportunities with paid jobs in women in whom affective disorders are more frequent and are increased by the presence of "macho" thinking" (28, 29), the presence of factors such as harassment and illegitimate tasks that condition the development of mental health disorders (30). Here we highlight a variable that has been focused on in groups other than medical students (5, 22–24, 31), as is the termination or breakup of a love relationship. Relationships are one of the most important social interactions for human beings, and their termination can cause physical and mental problems, such as suicidal thoughts and behaviors (32, 33). The impact of rupture is even greater in young people such as medical students (34). The breakdown of romantic relationships has increased during the pandemic due to government-imposed restrictions such as social distancing that led to staying at home (30) and actions not unrelated to Peru (35, 36). Results have been found in a higher proportion of women and health professionals (37) and even more so in the university population that has undergone curricular changes that have led to the development of mental health and stress disorders (38).

The necessity of this study stems from the urgent need to comprehensively understand the mental health challenges faced by medical students during the COVID-19 pandemic, with a specific focus on the potential impact of romantic relationship breakups. The increased incidence of romantic breakups during the pandemic, attributed to factors like social distancing and curricular changes, underscores the necessity of examining its impact on mental health (39). This is especially pertinent for medical students who navigate a unique intersection of academic and personal challenges. Given the alarming increase in suicidal ideation (SI) during the pandemic, especially among medical students (18), there is a crucial gap in our understanding of the unique factors contributing to this vulnerability. While existing studies have explored the prevalence of SI and its association with different variables (40), there is a dearth of conclusive evidence regarding the psychological ramifications of romantic breakups in medical students.

However, there is no conclusive evidence in medical students that the psychological impact of a breakup is compounded by the physical and mental exhaustion produced by the academic load (31, 38), which would lead to an increased presence of SI (1). In addition, the studies that evaluated these variables had confounding and information biases because they did not include variables that have been shown to be associated with the outcome, such as mental health disorders, and because they were measured with instruments that have not been validated in the context of the study population (24, 41, 42). Finally, the studies were conducted on smaller samples (16, 24, 43).

Therefore, in the present study, we evaluated whether love breakup influences the presence of SI, together with other variables of interest such as insomnia, a history of having a family member who died from COVID-19 and obesity, variables not included in previous studies, and that could potentially act as confounders (5, 18).

2 Methods

2.1 Study sample and setting

We conducted an analytical cross-sectional study based on a secondary analysis of a study assessing the association between Smartphone overuse and mental health disorders (44). This study was carried out among medical students in Piura between July and October 2020, a time when Peru was experiencing the first COVID-19 wave and with the restrictive measures imposed by the government to limit the increase in the number of infections. The present study aimed to evaluate whether a love breakup is associated with suicidal ideation in medical students.

The population consisted of medical students over 18 years of age who completed and accepted the informed consent form and responded to the survey. From Universidad Privada Antenor Orrego, Universidad Nacional de Piura and Universidad Cesar Vallejo. Prior to data collection, authorization was requested from the three participating universities. Subsequently, the research was conducted from July to October 2020, in the context of the first COVID-19 pandemic wave, when university higher education was providing virtual teaching in Peru. The form was designed and reviewed in Google Forms, then disseminated to the official social network groups of each year of study of the participating medical schools. The questionnaire was shared at times when the students were not in evaluations, and the approximate duration was 10 min. The questionnaire consisted of (1) informed consent, (2) socio-educational data, and (3) mental health data (PHQ-9, GAD-7), including insomnia (ISI). Finally, the data were exported from Google Forms to a database in Microsoft Excel, which underwent strict quality control prior to statistical analysis.

2.2 Study sample

The inclusion criteria for the primary study included students who had a cell phone with permanent access to the internet for their activities. The exclusion criteria for the primary study included self-reporting of a diagnosis of a mental health disorder (anxiety and depression). For the primary study (44), the sample consisted of 370 participants, representing a participation rate of 16.6% from the total population of 2,228 medical students across the three universities. This distribution included n1 = 151, n2 = 121, and n3 = 98 students from each respective university. The study selected participants by convenience sampling.

For this secondary analysis, the statistical power was estimated, yielding a value of 97.37%. This calculation was based on the proportion of suicidal ideation in the group without love breakup ($p^1 = 0.295$) and the corresponding proportion in the group with love breakup ($p^2 = 0.541$). Additionally, the respective sample sizes were considered, with n1 = 298 for the group without love breakup and n2 = 72 for the group with love breakup.

2.3 Instruments

Patient Health Questionnaire-9 (PHQ-9): An instrument that was validated in Peru, consisting of nine items with questions related to the presence of depressive symptoms in the last 2 weeks, evaluated on a Likert-type scale (45). The instrument has presented sensitivity and specificity values of 88 and 92%, respectively (46). In this research, the last item of the PHQ-9 was used to measure suicidal ideation ("how often have you been bothered during the past 2 weeks by thoughts that you would be better off dead or thoughts of hurting yourself in some way?") (45). This instrument has been adapted for Peruvian university students with a Cronbach's alpha consistency of 0.87 (47).

Generalized Anxiety Disorder Scale-7 (GAD-7): An instrument that evaluates the presence of anxiety symptoms. The instrument consists of seven items with scores ranging from zero (not at all) and three (almost every day), the total score ranges from zero to 21. The cut-off points used for the study were 0 to 4 as having no anxiety and 5 points or more as having anxiety. (48). The instrument has shown sensitivity and specificity values of 89 and 82%, respectively (48), in addition to a Cronbach's alpha consistency of 0.89 in Peruvian students (49). This instrument has been adapted for Peruvian university students (50).

Insomnia Severity Index (ISI): An instrument that assesses the presence of insomnia symptoms by means of an instrument that evaluates seven items, an instrument that has been validated in Spanish (51). It is composed of 7 items that assess the nature, severity, and impact of insomnia, with a total score of 28 points. The cut-off points used for insomnia were 0 to 7 as the absence of pathology, 8 to 14 as mild insomnia, 15 to 21 as moderate to severe insomnia and 22 to 28 as severe insomnia. The sensitivity and specificity was 86.1 and 87.7%, respectively (52), in addition to a Cronbach's alpha consistency of 0.84 (53). This instrument has been adapted for the Latin American population, showing high psychometric properties (54).

Sociodemographic and educational data: age in years, sex, single marital status (no, yes), obesity (no, yes; based on body mass index calculation using self-reported weight and height), self-report of having had a family member infected (no, yes) and deceased by COVID-19 (no, yes), and self-report of having suffered a serious economic problem in the last 3 months (no, yes). It is important to mention that these variables were chosen based on the literature review and the context in which the study was conducted.

2.4 Primary outcome

The dependent variable was suicidal ideation, defined as a student's response to question 9 of PHQ-9. The question assesses whether respondents had thoughts that they would prefer to be dead or to harm themselves in some way. The initial responses were no days, several days, more than half of the days, and almost every day. For the analysis of this research, it was dichotomized into no and yes (several days-almost every day).

2.5 Secondary outcomes

The primary independent variable was major love breakup, defined as a student's self-report of having suffered a major relationship breakup during the COVID-19 pandemic (no, yes).

Secondary independent variables were age in years, sex (female, male), single (no, yes), having obesity (no, yes), report of having had a close relative with COVID-19 (no, yes), report of having had a deceased relative with COVID-19 (no, yes), report of having suffered a serious financial problem in the past 3 months (no, yes), insomnia (no, below the threshold, moderate, severe), and anxious symptoms (no, yes).

2.6 Statistical analysis

The statistical analysis was performed in Stata 16.1.

For descriptive analysis, we showed absolute and relative frequencies for categorical variables. For numerical variables, we evaluated the assumption of normal distribution and then reported the best measure of central tendency and dispersion.

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For the bivariate analysis, the association of interest (love breakup vs. suicidal ideation) was evaluated, as well as the rest of the categorical covariates, through the chi-square test of independence. In the case of numerical variables, the Mann–Whitney U test was useful after evaluating the assumption of normal distribution. The significance level was 5%.

For the simple and multiple regression analysis, we used generalized linear models with Poisson distribution, robust variance, and universities as groups or clusters. This allowed us to estimate prevalence ratios (PR) and 95% confidence intervals (95%CI) for the association of interest and the rest of the exposure variables. In the multiple regression analysis, confounding variables served as a model adjustment to assess the association between love breakup and suicidal ideation. Collinearity between the variables of interest was assessed with the variance inflation factor, giving an overall estimate of 2.17.

2.7 Ethical aspects

The primary study was approved by the Ethics Committee of the Norbert Wiener University, Lima, Peru. Code: 1516–2022. The questionnaires were anonymous, and informed consent was obtained from all participants prior to their participation in the research, in accordance with the ethical procedures established by the Ethics Committee of Norbert Wiener University (Lima, Peru). The instruments were administered after an explanation of the benefits and risks of participating in the study, after which the responses were coded, a situation that allowed us to ensure the anonymity of the participants. The ethical principles of the Declaration of Helsinki were maintained.

3 Results

3.1 Characteristics of the participants

Of the 370 students analyzed, 61.9% were male, and the median age was 20 years (19–23); 7.6% were obese, 20.5% had moderate insomnia, and 68.9% had anxious symptoms; 19.5% reported having had a major love breakup during the pandemic (95%CI: 15.55–23.87); 34.3% of the students presented suicidal ideation (95%CI: 29.49–39.41; Table 1).

TABLE 1 Characteristics of participants ($n = 370$).

Characteristics	n (%)
Age (years)*	20 (19–23)
Sex	
Male	141 (38.1)
Female	229 (61.9)
Academic year	
First	68 (18.4)
Second	72 (19.6)
Third	70 (18.9)
Fourth	68 (18.4)
Fifth	40 (10.8)
Sixth	35 (9.5)
Seventh	17 (4.6)
Single marital status	
No	363 (98.1)
Yes	7 (1.9)
Obesity	
No	342 (92.4)
Yes	28 (7.6)
Family member diagnosed with COVID-19	
No	146 (39.5)
Yes	224 (60.5)
Family member deceased due to COVID-19	
No	276 (74.6)
Yes	94 (25.4)
Financial hardship	
No	247 (66.8)
Yes	123 (33.2)
Insomnia severity index	
No	119 (32.2)
Subthreshold	169 (45.7)
Moderate	76 (20.5)
Severe	6 (1.6)
Anxiety	
No	115 (31.1)
Yes	255 (68.9)
Love breakup during pandemic due to COVID-19	
No	298 (80.5)
Yes	72 (19.5)
Suicidal ideation	
No	243 (65.7)
Yes	127 (34.3)

*Age expressed as median and p25–p75.

3.2 Love breakup and other factors associated with suicidal ideation in bivariate analysis

Students who reported having a major love breakup during the pandemic had a 24.7% higher frequency of suicidal ideation compared to students who did not have a love problem (54.2% vs. 29.5%; $p < 0.001$). Having anxious symptoms increased the frequency of suicidal ideation in students by 35.9% compared to those without anxiety (45.5% vs. 9.6; $p < 0.001$). Students with severe insomnia had a 53.2% higher frequency of suicidal ideation compared to those without sleep problems (66.7% vs. 13.5%; $p = 0.001$). Additionally, age ($p = 0.003$), obesity ($p < 0.001$), having a family member with COVID-19 ($p = 0.008$), having had a deceased family member with COVID-19 ($p = 0.020$) were significantly associated with having suicidal ideation in the evaluated students (Table 2).

TABLE 2 Love breakup and other factors associated with suicidal ideation, bivariate analysis.

Variables	Suicidal ideation		*p**
	No (*n* = 243)	Yes (*n* = 127)	
	n (%)	n (%)	
Age (years) †**	20 (18–22)	21 (19–24)	**0.003**
Sex			0.137
Male	86 (61.0)	55 (39.0)	
Female	157 (68.6)	72 (31.4)	
Single marital status			0.631
No	4 (57.1)	3 (42.9)	
Yes	239 (65.8)	124 (34.2)	
Obesity			**<0.001**
No	234 (68.4)	108 (31.6)	
Yes	9 (32.1)	19 (67.9)	
Family member diseased by COVID-19			**0.008**
No	84 (57.5)	62 (42.5)	
Yes	159 (71.0)	65 (29.0)	
Family member died by COVID-19			**0.020**
No	172 (62.3)	104 (37.7)	
Yes	71 (75.5)	23 (24.5)	
Financial hardship			0.379
No	166 (67.2)	81 (32.8)	
Yes	77 (62.6)	46 (37.4)	
Insomnia			**0.001**
No	103 (86.6)	16 (13.4)	
Subthreshold	115 (68.1)	54 (31.9)	
Moderate	23 (30.3)	53 (69.7)	
Severe	2 (33.3)	4 (66.7)	
Anxiety			**<0.001**
No	104 (90.4)	11 (9.6)	
Yes	139 (54.5)	116 (45.5)	
Love breakup during pandemic due to COVID-19			**<0.001**
No	210 (70.5)	88 (29.5)	
Yes	33 (45.8)	39 (54.2)	

*value of *p* of categorical variables calculated with Chi-Square test. **value of *p* of categorical-numerical variables calculated with the U-test (Mann–Whitney). †Median—interquartile range. Bold numbers emphasize significant value of ps ($p < 0.005$).

3.3 Love breakup and other factors associated with suicidal ideation in simple and multiple regression analyses

Table 3 shows the simple and multiple regression analyses. The simple regression model showed that students with strong love breakups during the pandemic had an 83% higher prevalence of suicidal ideation (PR: 1.83; 95%CI: 1.60–2.10). This was maintained in the multiple regression model in terms of direction and magnitude: having a major romantic breakup increased the prevalence of suicidal ideation by 49% (PR: 1.49; 95%CI: 1.32–1.67).

Having moderate insomnia increased 156% the prevalence of suicidal ideation (PR: 2.56; 95%CI: 1.70–3.87). Students with anxious symptoms had a 94% higher prevalence of suicidal ideation (PR: 1.10–3.44). Additionally, for each additional year of age, students had a 3% higher prevalence of suicidal ideation (PR: 1.03; 95%CI: 1.01–1.05). Female students had an 11% lower prevalence of suicidal ideation (PR: 0.89; 95%CI: 0.80–0.99; Table 3).

4 Discussion

4.1 Prevalence of suicidal ideation in medical students

We found that the prevalence of SI was 34.3% differing notably from pre-pandemic studies. In Ecuador, among medical and psychology students, severe SI was reported at 4.5%, moderate at 19.1%, and mild at 76.4%. It should be noted that the different results could be due to the use of a different instrument, such as the ISO-30 (Inventory of Suicide Orientations) (55). Similarly, Colombian medical students showed a 17.7% SI prevalence (56), while in Mexico, it was 8.7% among undergraduate and graduate students (3). In Peru, applying the MINI (Mini-International Neuropsychiatric Interview) test revealed a 11.2% SI prevalence among medical students (57), and other studies across various disciplines reported SI rates ranging from 8.9 to 35.2%, using self-developed instruments (58, 59). These results are supported by a meta-analysis that has shown that in Latin America, the prevalence of SI is 13.8%, lower than in Europe and the United States (3). Similarly, our result differs from those reported by medical students in other countries, such as Italy (4), Iran (60), and Ethiopia (5) (13.7, 17.0, and 23.7%, respectively). It should be noted that these studies were conducted in the pre-pandemic period. Moreover, the pandemic itself may have played a significant role in exacerbating mental health challenges, including SI. The unique stressors brought about by the COVID-19 crisis, such as social isolation, uncertainties about the future, and disruptions in daily life, could contribute to higher SI rates among our study population compared to pre-pandemic periods.

In the context of COVID-19, our results differ from a US study reporting 12.7% SI in undergraduates during the second wave (61) and from a study in Mexican medical students reporting 18.6% SI in the first wave (16). Likewise, it is higher than that found in medical students in Peru during the first pandemic wave, where a prevalence of 17.9% of SI was estimated (18). The disparate results could be due to the different moments of the application of the instrument since our study was at the beginning of the pandemic during the first wave, when the uncertainty and consequences in the near future caused fear and anxiety in the population, while the other study was conducted at the end of the second wave (61). At this point, we also highlight that no other Latin American study has been found in the pandemic context on the evaluation of SI, so our study adds data to the current literature.

In Peru, data from the National Institute of Mental Health indicate a 43.2% increase in monthly SI consultations during the pandemic

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TABLE 3 Love breakup and other factors associated with suicidal ideation, regression analysis.

Characteristics	Suicidal ideation					
	Simple regression			Multiple regression		
	PR	95%CI	*p**	PR	95%CI	*p**
Age (years)	1.05	1.01–1.10	**0.048**	1.03	1.01–1.05	**0.009**
Sex						
Male	Ref.			Ref.		
Female	0.81	0.55–1.18	0.272	0.89	0.80–0.99	**0.040**
Single marital status						
No	Ref.			Ref.		
Yes	0.80	0.26–2.45	0.692	1.12	0.21–6.01	0.892
Obesity						
No	Ref.			Ref.		
Yes	2.15	1.68–2.74	**<0.001**	1.25	0.79–1.97	0.350
Family member diseased by COVID-19						
No	Ref.			Ref.		
Yes	0.68	0.53–0.88	**0.003**	0.95	0.74–1.20	0.652
Family member died by COVID-19						
No	Ref.			Ref.		
Yes	0.65	0.37–1.15	0.138	0.70	0.44–1.10	0.121
Financial hardship						
No	Ref.			Ref,		
Yes	1.14	0.82–1.58	0.434	1.13	0.87–1.47	0.357
Insomnia						
No	Ref.			Ref.		
Subthreshold	2.38	1.40–4.03	0.001	1.58	0.94–2.64	0.084
Moderate	5.19	2.98–9.04	<0.001	2.56	1.70–3.87	**<0.001**
Severe	4.96	2.79–8.82	<0.001	1.93	0.86–4.37	0.112
Anxiety						
No	Ref.			Ref.		
Yes	4.76	2.76–8.20	<0.001	1.94	1.10–3.44	**0.023**
Love breakup during pandemic due to COVID-19						
No	Ref.			Ref.		
Yes	1.83	1.60–2.10	**<0.001**	1.49	1.32–1.67	**<0.001**

*Adjusted for age, sex, single marital status, obesity, family member diseased or dead by COVID-19, financial hardship, insomnia, and anxiety. Universities were set as clusters. Bold numbers emphasize significant *p* values ($p < 0.005$).

(62). This supports the results found in our study, which could be explained by the fact that medical students were exposed to more stressors. In addition, it was conducted in a different geographical area and with a different instrument than those used in the aforementioned studies, such as the Beck Depression Instrument (BDI-II) (4), and the Depression, Anxiety and Stress Scale (DASS) (5).

4.2 Frequency of severe love breakup in medical students

The present study found that 19.5% of the students reported having had a major romantic breakup in the last 3 months, lower than that reported by studies conducted in the pre-pandemic context by Espinosa et al. with a frequency of 46.9% of breakups in university students of various degrees of the FESI, UNAM in Mexico, possibly due to cultural differences, stress, anxiety, and lack of management of interpersonal problems. Similarly, it has been reported that 59.6% of university students in careers other than human medicine reported a romantic breakup (63).

This difference could be explained by the fact that 66.5% of these students belonged to the psychology career, while the medical students came expressing stress, anxiety, and SI without mentioning any love breakup. Our result is different because it was carried out in the context of the pandemic; however, we did not find other studies that evaluate this variable in the context of the pandemic. The fact that at

least two out of 10 students presented a strong romantic breakup during the pandemic could be explained because social distancing measures such as staying at home were established, a situation that led to the development of stress that was greater because confinement predisposes the couple to stay alone and that their problems are highlighted and cannot be solved due to the lack of social and work interactions (64).

4.3 Association between having had a major breakup and suicidal ideation

Students who reported having had a major love breakup had a 38% higher prevalence of SI during the pandemic. This is similar to the findings of Tan et al. (25) in Malaysian medical students, one of the significant predictors of SI was breaking up a stable romantic relationship (OR: 5.4). Furthermore, it is consistent with another study in which the prevalence of suicide was higher (17.0%) in Iranian medical students who were separated or divorced (60). On the other hand, Barajas Marquez (65) reported that university students who had had a recent love breakup presented a higher level of depression. This is consistent with what was reported prior to COVID-19 by Espinoza-Sierra et al., who stated that the main cause of university students visiting the crisis, emergency, and suicide care center (CREAS) is the breakup of a couple, followed by bereavement and relationship problems. While for McLaughlin and Gunnell (66), who collected information on deaths of university students in the United Kingdom between 2010 and 2018, it is worth noting that the study was conducted in a pre-pandemic context, the most influential factors in suicidal behavior were love breakups, failing subjects, economics and recent bereavement. This is also evidenced in a systematic review that reported that separation or love breakup represents the most important risk factor for the development of SI in young people aged 15–29 years (32). The association found differs from that reported by Kazan (32) in Australia during the pre-pandemic context, where it was reported that women especially experienced relief and benefited from ending an abusive or negative relationship. The latter study, however, was conducted in the general adult population and not in medical students like the present study (32) and explored the quality of the relationship rather than the specific event of a breakup. It is worth noting that we did not find other studies evaluating this association, particularly during the context of the COVID-19 pandemic.

This association may be intricately linked to the profound impact of partner-related challenges, which can serve as potent triggers for SI. The heightened vulnerability observed could be attributed to a cascade of factors, most notably the diminished resilience that has become increasingly evident in the context of the pandemic (67, 68). The emotional toll of love breakups, exacerbated by the isolation and uncertainties imposed by the pandemic, may contribute to a diminished capacity for emotional control. The lack of psychological support from institutions and, crucially, the corresponding family support further exacerbates the emotional distress experienced by individuals navigating through the aftermath of a significant romantic relationship dissolution (67, 68). Understanding the psychological mechanisms underlying this association necessitates delving into the intricate dynamics of coping strategies and emotional regulation. The pandemic has undoubtedly magnified the importance of resilience in the face of adversities, and the breakdown of a romantic relationship may act as a pivotal stressor, pushing individuals toward heightened SI. The absence of robust support systems, both from institutions and family, may leave individuals grappling with emotional distress without adequate avenues for coping and recovery (67, 68).

4.4 Other factors associated with suicidal ideation

Having insomnia was associated with an 85% higher prevalence of SI. This result is similar to that described before the pandemic by Liu et al. (69) in Chinese university students who presented 5 times the risk of suffering SI (OR: 4.98). This is consistent with that described by Khader et al. (70), who reported that university students with insomnia presented four times more SI in the pre-pandemic context. This is consistent with that described by King et al. (71), who conducted a study at a Canadian university and found a positive association between insomnia and suicidal ideation. Moreover, it is consistent with the findings of Akram et al. (72), who conducted a study in the pre-pandemic context and found a positive correlation between insomnia and suicidal ideation in American college students. This association is explained by different postulated mechanisms, such as the decrease or alteration of serotonin 5-HT receptors (an amino acid involved in the maintenance of sleep) in subjects with suicidal tendencies (73), nightmares (74) and the alteration of the hypothalamic–pituitary axis (75). However, its association remains under constant investigation, although bidirectionality has also been found because people with SI also have the subsequent development of insomnia between this association and insomnia (76).

The study found a 3% increase in the prevalence of SI for each additional year of age, aligning with Schwenk's pre-pandemic research on US medical students. Schwenk reported a higher SI frequency in third and fourth-year students (7.9%) compared to first and second-year students (1.4%) (77). In contrast, Khader's pre-pandemic study in Pakistani university students across different disciplines did not identify a significant positive association between the completed university year and SI (70). This observed age-SI association in our study may be influenced by the academic load, organizational challenges, and exposure to death and suffering perceptions during clinical practice.

Female students had an 11% lower SI prevalence, contrary to studies by Osama et al. (78) and Schwenk et al. (77), which linked higher SI rates in women to elevated depression levels (18.0%). This discrepancy may stem from societal expectations on women, placing a significant social burden on them to provide stability at home. This pressure is accentuated in regions with high machismo percentages, leading to increased insecurity, limited expression of opinions, and reduced capacity to fulfill responsibilities. The United Nations reports global intimate partner violence in women aged 15 to 49, ranging from 33.0 to 51% (79), further compounding emotional image-related challenges in women (80).

Having anxiety increased the probability of SI by nine times. This is similar to that reported by Xu et al. (81), who found that

Chinese medical students in the first pandemic wave presented who had anxiety symptoms were more likely to have SI (OR = 1.66). In Peru, Crisol-Deza et al. (18) reported that SI was associated with a higher probability of anxiety in medical students during the first wave of the pandemic (OR: 2.01). This is consistent with that described by Asfaw et al. (5) in Ethiopian students in the pre-pandemic context, where anxiety and depression were associated with an increased likelihood of SI. We have not found a study that identifies depression as an attenuating factor for the development of SI. This association could be due to the characteristics of a university student, loneliness, social shelter, and economic limitations that increased during the context of the pandemic, as mentioned above, due to government restrictions to limit the increase in infections.

4.5 Limitations and strengths

Our study has important limitations. First, the cross-sectional study design does not allow us to establish causality between variables. Second, selection bias, since a convenience sample was taken, it is not possible to infer the results for the entire population of interest. Third, being a secondary data analysis study, there is an unmeasured confounding effect since potential confounders such as the level of resilience of the students and the level of family communication, which behave as predisposing factors to various mental health disorders, have not been investigated (82, 83).

However, the study presents strengths. First, to our knowledge, it is the first study to evaluate this association of variables conducted during the COVID-19 pandemic, particularly during the first wave, the most critical time in Peru (84–88). Second, it was possible to capture a broad and varied sample (years of study) of students, and it is reinforced by the stratified choice of the sample by the university, which will serve as an aid to the strategies of the corresponding institutions. Third, several validated and widely used instruments were used in the scientific field, in addition to using a timely methodology considering the mediation of intervening variables.

4.6 Relevance of findings in mental health

This study adds to the current literature an underexplored finding, which proposes a precedent for future research in mental health. The students surveyed show a significant prevalence of romantic breakups that might trigger suicidal ideation and suicide in the worst-case scenario. Our results could be the basis for driving possible implications at the public health level by promoting services that eliminate the detrimental aspects of love breakup through counseling and psychology sessions for the couple in university welfare centers. We believe that social and educational programs should be promoted that encourage critical reflection on SI with the aim of reversing its factors, among them the growing love breakup. We recommend that through the tutoring areas of each university, periodic evaluations should be carried out for early detection and management of suicidal behavior to develop coping strategies and solve these problems.

5 Conclusion

Three and two out of 10 medical students experienced SI and a major love breakup, respectively. Our main result suggests that experiencing a major love breakup might predispose to the development of SI. As secondary results, insomnia, anxiety, and being older in the university stage were associated with SI. We recommend the development of further research that clarifies the association between major love breakups and SI and that medical schools provide periodic evaluations of mental health for the timely prevention of suicide.

Data availability statement

The dataset generated and analyzed during the current study is not publicly available because the ethics committee has not provided permission/authorization to publicly share the data, but it is available from the corresponding author upon reasonable request.

Ethics statement

The studies involving humans were approved by Universidad Cesar Vallejo, Piura, Peru. 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

DV-G: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JZ-V: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. FS-H: Conceptualization, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MG-M: Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. NM-A: Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. VF-R: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CP-V: Conceptualization, Data curation, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. VV-P: Conceptualization, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. DL-F: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing

– original draft, Writing – review & editing. MV-G: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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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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Suicide prevention during disasters and public health emergencies: a systematic review

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Background: Disasters and public health emergencies increasingly affect populations around the world, posing significant wide-ranging challenges for societies as well as for effective public health and suicide prevention. Intervention research is essential to inform evidence-based responses. Yet, despite evident public concern and growing research interest in heightened suicide risks and impacts, little is known about effective suicide prevention interventions in these contexts. We conducted a systematic review to examine the outcomes of suicide prevention strategies implemented in disasters and public health emergencies.

Methods: We searched five databases (Medline, Embase, PsycINFO, Web of Science, PTSDpubs) from inception to December 2022 for peer-reviewed quantitative studies that reported relevant intervention outcomes (changes in the frequency of suicide, suicide attempts, self-harm) for populations affected by disasters and public health emergencies. We assessed the quality of eligible studies using the Quality Assessment Tool for Quantitative Studies, and distilled review findings through narrative synthesis. The study protocol was registered with PROSPERO (CRD42021276195).

Results: Ten eligible and mostly observational studies were included in this review, which examined a range of universal, selective, and indicated interventions. Three of five studies of interventions in public health emergencies indicated the potential effectiveness and buffering effects of generic disaster related mental health support, access to urban parks, as well as the beneficial role of video-enabled tablets in facilitating treatment access and outcomes. Similarly, three of five studies of interventions in disaster contexts provided evidence of the beneficial role of universal economic security measures, national gun laws and buy back schemes, and volunteer-delivered mental health support. Overall, four of six studies with favorable outcomes examined interventions specifically deployed in disaster or public health emergency contexts, whereas two studies examined ongoing existing interventions. Three studies, respectively, of suicide prevention focused interventions or generic interventions reported favorable outcomes. The quality of included studies was variable, with two studies being rated as 'strong', four studies rated as 'moderate', and four studies rated as 'weak'.

Conclusion: Notwithstanding the limited scope and variable quality of published evidence, our review findings highlight the breadth of interventions that have been applied in such contexts with some success. There is a need for further research on effective interventions and intervention adaptations to inform evidence-based suicide prevention responses to disasters and public health emergencies.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42021276195, PROSPERO ID CRD42021276195.

KEYWORDS
suicide, suicide prevention, disasters, public health emergencies, pandemics

1 Introduction

Suicide is a major global public health concern that calls for effective and concerted preventive intervention (1). Each year, approximately 700,000 people die by suicide (2). Suicide is a complex phenomenon which is influenced by a range of contextual factors that include prevailing social, socio-economic, and environmental conditions. These can no longer be relied upon as immutable or enduring, and are rather in themselves often subject to ever more rapid change and disruption (3, 4).

Disasters and public health emergencies (such as pandemics and epidemics) are increasingly affecting populations around the world (5, 6), with significant wide-ranging implications for societies, human livelihoods, health, and wellbeing, as well as public health (7). Many established proximal and contextual risk factors for suicide (8, 9), such as adverse life events, losses, financial stressors, social isolation, reduced social support and healthcare access, are present or elevated in the wake of disasters (10) and public health emergencies (11). While suicidal behavior trajectories can vary following disasters (with some indications of an early drop and delayed increase pattern) (12), overall suicide rates have been found to increase among whole populations and male subpopulations (13).

Suicidality has also been of significant public concern during protracted public health emergencies, such as prominently in the unfolding Covid-19 pandemic (14). National suicide rates did not increase in the first 15 months of the COVID-19 pandemic (15, 16). Yet, systematic reviews and expert guidance highlight a continued need for vigilance (17) in view of elevated distress levels among affected populations (18), rising self-harm presentations among young people (19), heightened suicidality risk among COVID-19 patients (18), increased demand for non-acute support services (20, 21), and strain on frontline healthcare workers (22). All of these have implications for targeted suicide prevention efforts during these challenging and disruptive circumstances (23).

Although the broader evidence base for effective suicide prevention approaches across the spectrum of universal, selective, and indicated interventions is consolidating (24, 25), little is known about the outcomes of suicide prevention activities during disasters and public health emergencies. In fact, much research to date has focused on the epidemiology of suicidality in such contexts, while there is an urgent need for research on interventions (18, 26) to inform evidence-based suicide prevention responses (27). What types of routine existing or disaster-specific suicide prevention interventions have been found to be effective in such contexts therefore remains an open question. To our knowledge, this is the first systematic review to examine the outcomes of suicide prevention strategies implemented in the context of disasters and public health emergencies.

2 Methods

This systematic review is presented following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (28) and the review protocol was prospectively registered with PROSPERO (CRD42021276195).

2.1 Eligibility criteria

Studies meeting the following eligibility criteria were included:

- Population: Populations affected by disasters (marked by natural, human-induced, technological hazards) or public health emergencies (including epidemics, pandemics, infectious disease outbreaks)
- Intervention: Any type of strategy, program, intervention with an explicit focus on suicide prevention or postvention (or other intervention reporting suicidality/self-harm outcomes) for populations affected by disasters or public health emergencies
- Context: New, existing, or adapted suicide prevention strategies, programs, interventions implemented in the context of disasters and public health emergencies (including rapid or slow onset events, and protracted emergencies)
- Outcomes: Changes in the frequency of suicide attempts, suicide deaths, or self-harm (reported by any measure)
- Study design: Quantitative studies (or quantitative components of mixed-method studies)
- Comparator: Intervention studies including any comparator (e.g., before/after, by sub-group, by intervention type)
- Article type: English language, peer-reviewed, empirical studies, human

Exclusion criteria:

- Context: Euthanasia, assisted dying, warfare, armed conflict, civil unrest, economic crisis
- Outcomes: Non-suicidal self-injury, suicidal ideation, composite suicidality measures
- Study design: Qualitative studies
- Article type: Commentaries, editorials, conference abstracts, dissertations/theses, grey literature

2.2 Information sources

We searched five literature databases, Medline (Ovid), Embase (Ovid), PsycINFO (Ovid), Web of Science (Clarivate), and PTSDpubs/PILOTS (ProQuest), and conducted additional reference list screening of selected review papers and forward citation searches of relevant study protocols.

2.3 Search strategy

All databases were initially searched on 14 January 2022 (from database inception to search date), and the entire search was updated on 7 December 2022. The searches used a combination of MeSH terms and database specific key words regarding the three domains of outcome (suicidality and self-harm), context (disaster, public health emergency, infectious disease outbreak), and intervention. Full search strategies for all databases and definitions of key terms are included in the Supplementary Material.

2.4 Selection process

A two-stage record screening and study selection process was undertaken by two researchers, using EndNote. First, two researchers (LR, KK) independently screened the titles and abstracts of records to identify potentially eligible studies. Second, two researchers (LR, KK) independently assessed the full texts of potentially eligible studies against the review inclusion and exclusion criteria to identify studies to be included in the review. Any disagreements were resolved through discussion or referral to a third researcher (KA).

2.5 Data extraction and synthesis

One researcher (LR) extracted the following data from included studies using a piloted data extraction tool (set up in MS Excel), and all data were checked by a second researcher (KK):

- Study characteristics (title, primary author, journal, publication year, study aim, design, language)
- Sample characteristics (sample size, mean age, age range, gender, ethnicity, country, study period)
- Type of disaster exposure (disaster type, year, exposure measure)
- Intervention characteristics (intervention type, modality, setting, timing relative to disaster, new/existing/adapted)
- Outcome measures (for suicide, suicide attempts, self-harm)
- Results (main findings, effect sizes, limitations)

Study findings were distilled through narrative synthesis (including tabulation and grouping by context and intervention subgroups). Substantial study heterogeneity (regarding interventions, outcome measures, target populations, and settings) precluded formal meta-analysis and calculation of pooled effect estimates.

2.6 Study quality appraisal

We used the Quality Assessment Tool for Quantitative Studies to assess the methodological quality of the included studies (29). The instrument includes six components (selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts) to be scored as strong, moderate, or weak. A study was rated 'strong' if none of its components was rated 'weak'. A study was rated 'moderate' if one of the components was rated 'weak', and it was rated 'weak' if two or more of its components were rated as 'weak' (29). The instrument also assesses the integrity of the intervention and analyses (e.g., appropriate statistical methods). Two researchers (KK, KA) independently assessed the quality of the included studies. There was substantial agreement between the two researchers ($\kappa = 0.64$), and they resolved any disagreement by discussion, or by referral to a third researcher (LR).

3 Results

3.1 Study selection

The study selection process is presented in the flow chart diagram (Figure 1). Database searches yielded a combined total of 12,061 records. Following removal of 4,707 duplicates, 7,354 records were initially screened by title and abstract, leading to the exclusion of 7,234 records. Full-text eligibility assessment of 120 remaining reports resulted in the exclusion of 109 reports (including 45 reports not constituting empirical studies, 37 reports not examining relevant outcomes, 18 reports reflecting ineligible article types, 5 reports not examining an intervention, and 4 reports lacking a relevant context). Additional reference list and forward citation searches identified 5 potentially eligible reports, which were excluded at full-text assessment at these did not meet the inclusion criteria. Ultimately, 11 reports relating to 10 studies were included in the systematic review (30–40). Of the two reports referring to the same study (38, 39), only the most recent was considered (38), as the other did not provide additional relevant data.

3.2 Study characteristics

Table 1 presents the characteristics of included studies, published between the years 2008 and 2022. In terms of geographical location, five of the ten studies were conducted in Asia (India, Japan, South Korea), two studies, respectively, in North America (Canada, U.S.A.) and Oceania (Australia), and one study in Europe (U.K.). Five studies examined interventions in the context of public health emergencies (Covid-19 pandemic, 2009 H1N1 swine flu pandemic, 2015 Middle East Respiratory Syndrome or MERS epidemic), while the other five studies focused on disaster contexts (marked by mass shootings, tsunamis, or multiple hazards). Most study designs were observational in nature, including cohort studies, time series, or interrupted time series analyses, and only one study adopted a randomized controlled trial design.

The examined intervention types included psychiatric hospital treatment, disaster related mental health support, video-enabled tablets, CBT-skills training, and varied universal measures (including national gun laws and buy back scheme, a suicide prevention act, economic security measures, as well as urban parks). Interventions were either ongoing existing measures (30, 31, 34, 37, 40) or specifically deployed in disaster contexts (32, 33, 35, 36, 38). Some interventions included an explicit focus on suicide prevention (31, 33, 34, 37), whereas other generic interventions did not (30, 32, 35, 36, 38, 40). Target groups for interventions were whole populations (30, 34, 36, 38), people in disaster affected areas (33, 35), rural veterans (31), psychiatric hospital patients (40), school students (37), and bereaved tsunami survivors (32).

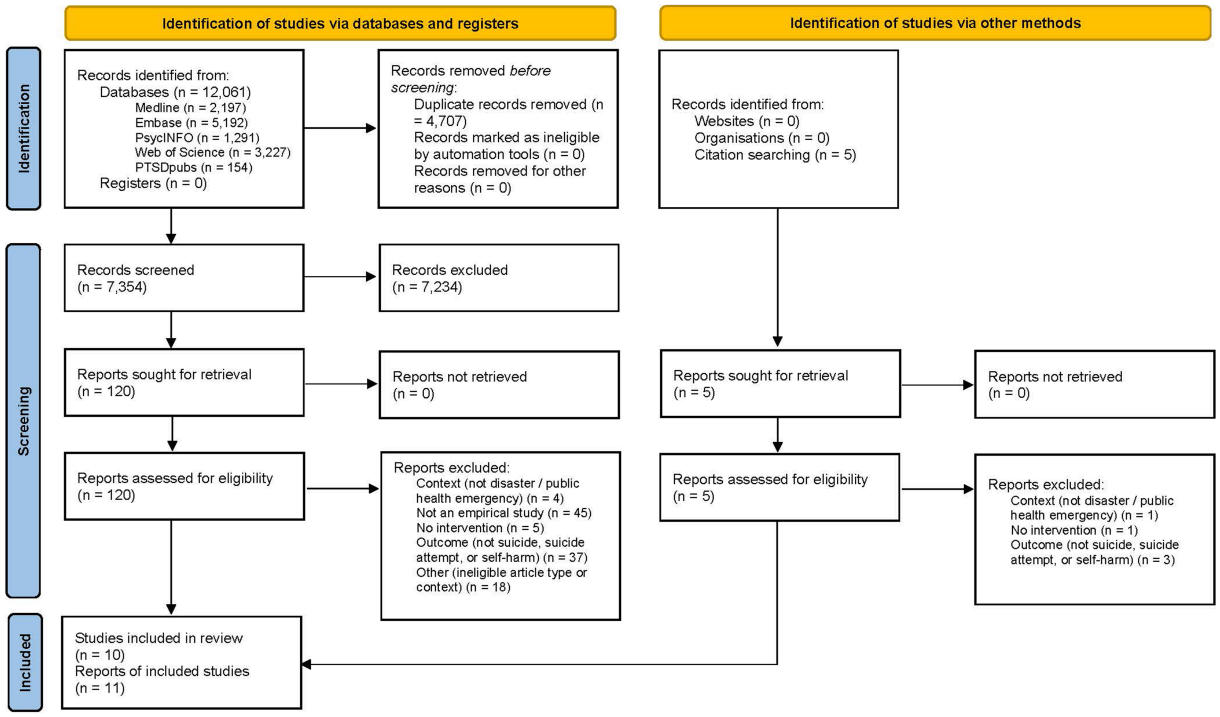

FIGURE 1
PRISMA flow chart for study selection.

Studies reported intervention outcomes in terms of suicide (30, 33–35), firearm suicide (36, 38), suicide attempts (31, 32, 37), and self-harm (40). Study comparators included pre/post comparisons (34, 36, 38), different hospital ward types (40), affected versus non-affected areas (33, 35), control groups not receiving the intervention (31, 32, 37), and variations in per capita park area (30).

3.3 Intervention outcomes

3.3.1 Outcomes by context

Of the five studies examining interventions in public health emergency contexts, three observational studies reported a reduction in suicides and suicide attempts (30, 31, 33), one observational study provided mixed results (40), and one RCT found the intervention not effective in reducing suicide attempts (37). Specifically, the study by Orui et al. (33) examined suicide rates during the Covid-19 pandemic in areas that had previously been affected by the Japanese triple (earthquake, tsunami and nuclear) disaster, and which continued to receive ongoing disaster mental health support, by comparison to unaffected areas not receiving such support. This study found that the suicide related standard mortality ratio rose to 1.20 in unaffected areas during the pandemic and remained relatively stable at 0.98 in intervention areas, indicative of a possible buffering effect of existing support. The study by Kim et al. (30) reported that urban parks functioned as a mitigator of increasing suicide rates in the 2009 H1N1 pandemic in that with every $1m^2$ per person increase in park area, the suicide rate per 100,000 people decreased by 0.38. The study by Gujral et al. (31) found that escalated distribution of video-enabled tablets among rural US veterans during the Covid-19 pandemic was associated with increased mental health service use and a 22% decrease in the likelihood of suicide behavior. Challinor et al. (40) monitored self-harm incidents among patients of different secure psychiatric hospital wards during the Covid-19 pandemic. Study findings indicated that a higher self-harm incidence during the initial pandemic stage particularly on high-dependency personality disorder wards (which coincided with the first lockdown and ward containment measures), subsided thereafter (coinciding with the safe resumption of treatment as usual). Finally, the RCT conducted by Klim-Conforti et al. (37) during the Covid-19 pandemic indicated no benefits of CBT-skills training in reducing suicide attempts among urban school students when compared to a control group not receiving the intervention.

Three of five studies examining interventions in disaster contexts provided encouraging results (32, 35, 38) while two studies provided no evidence of intervention effectiveness (34, 36). The interrupted time series study by Chapman et al. (38) indicated a step change and accelerated decline in annual firearm suicides with the introduction of the national gun laws and buyback scheme in the wake of Australia's worst mass shooting. By contrast, the time series analysis by Lee et al. (36) conducted in the same disaster context provided no evidence of a structural break in firearm suicide growth rates around the time of the intervention. The cohort study by Matsubayashi et al. (35) examined economic security measures and suicide rates in the context of the Japanese triple disaster, finding that a per-capita increase in local government expenditure was associated with a decrease in the suicide rate among men. The interrupted time series study by Nakanishi et al. (34) conducted in the same context provided no evidence that suicide trends were interrupted by the introduction of a national suicide prevention Act. Finally, the cohort-analytical study by

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TABLE 1 Study characteristics and findings.

Author	Country	Context (PHE / disaster)	Study design type	Sample / participants	Intervention	Comparator	Outcome / effect measure	Main findings
Challinor et al. (40)	United Kingdom	PHE (COVID-19 pandemic)	Cohort	Patients at high-secure psychiatric hospital wards ($n = 118$) Gender (female): 0% Study period: 2020–2021	Psychiatric hospital treatment	Ward type (Mental illness vs. personality disorder, and high vs. medium dependency)	Self-harm Monthly incidence (change)	The higher self-harm incidence during the initial pandemic stage (April–June 2020), particularly on high-dependency PD wards (coinciding with 1st lockdown and ward containment measures), subsided thereafter (coinciding with safe resumption of TAU on wards from June 2020).
Gujral et al. (31)	United States	PHE (COVID-19 pandemic)	Cohort	Rural veterans with a history of mental health care use (n = 471,791), including 13,180 tablet recipients Age (mean): 61.2 years Gender (female): 12% Ethnicity: 2% Hispanic, 97% not Hispanic, 1% unknown Study period: 2019–2022	Video-enabled tablets	Control group (not receiving tablets)	VA suicide behavior and overdose reports (SBORs) Difference-in-difference coefficients	Tablets were associated with a 22% decrease in SBORs (monthly coefficient −0.0011; 95% CI −0.0016 to −0.0005), and 168 fewer suicide behavior reports per year. For the subcohort of rural veterans at high risk of suicide, tablets were associated with a 22% decrease in SBORs (monthly coefficient −0.0075; 95% CI −0.125 to −0.0026), and 96 fewer suicide behavior reports per year.
Kim et al. (30)	South Korea	PHE (2009 H1N1 pandemic; 2015 MERS epidemic)	Cohort	Study area population (n = 386,125) Study period: 2003–2018	Urban parks	*Per capita* park area by city-county area	Suicide Rates	Urban parks functioned as a mitigator to prevent increasing suicide rates in the pandemic (especially if associated with economic shocks). With every $1m^2$ per person increase in park area, the suicide rate per 100,000 people decreased by 0.38.
Klim-Conforti et al. (37)	Canada	PHE (Covid-19 pandemic)	RCT	Grade 7–8 students in urban schools (n = 430; 200 intervention, 230 control) Age (range): 11–14 years Gender (female): 61.6% Study period: 2019–2020	Harry Potter-based CBT skills training	Waitlist controls (regular curriculum)	Suicide attempts Pre/post mean difference	There was no significant difference in respective changes in suicide attempts between intervention (Mean 0.06, SD 0.20) and control groups (Mean 0.04, SD 0.18), ($t = 0.90$, df 406, $p = 0.37$).

(Continued)

TABLE 1 (Continued)

Author	Country	Context (PHE / disaster)	Study design type	Sample / participants	Intervention	Comparator	Outcome / effect measure	Main findings
Orui et al. (33)	Japan	PHE (COVID-19 pandemic) Disaster (earthquake, tsunami, nuclear accident)	Cohort	Suicides in affected areas (n = 716), unaffected areas (n = 1,678), and nationally (n = 304,162) during study period Study period: 2009–2020	Disaster mental health interventions	Affected vs. non-affected areas vs. national	Suicide Standard Mortality Ratio (SMR)	The SMR rose to 1.20 (95% CI 1.02–1.47) in unaffected areas in 2020 (during the pandemic) compared to 0.98 (95% CI 0.74–1.29) in intervention areas.
Chapman et al. (38) Chapman et al. (39)	Australia	Disaster (mass shooting)	ITS	National firearm (n = 12,247) and non-firearm (n = 64,623) suicides during study period Study period: 1979–2013	Gun laws and buyback scheme	Pre/post	Firearm suicide Annual rate decline (trend ratio)	The annual rate decline accelerated from 3 to 4.8% following intervention (trend RR 0.981; 95% CI 0.970–0.993); indicating a step change in the level of firearm suicides (RL = 0.652; 95% CI 0.582–0.731); with no indication of substitution to other lethal methods.
Lee et al. (36)	Australia	Disaster (mass shooting)	TSA	National firearm / non-firearm suicides during study period Study period: 1915–2004	Gun laws and buyback scheme	Pre/post	Firearm suicide Structural breaks in growth rates	There was no evidence of a structural break in firearm suicide growth rates around the time of the intervention; and no indication of substitution effects.
Matsubayashi et al. (35)	Japan	Disaster (earthquake, tsunami, nuclear accident)	Cohort	Suicides in study regions during study period Age: ≥ 20 years Study period: 2002–2019	Economic security measures	Severely damaged vs. unaffected prefectures	Suicide Rate change	A 1% increase in per-capita local government expenditure was associated with a 0.104% decrease in the suicide rate among men aged 20–39 years and a 0.073% decrease in men aged 40–64 years.
Nakanishi et al. (34)	Japan	Disaster (earthquake, tsunami, nuclear accident)	ITS	National suicides during study period (n = 597,007) Age (mean): 52.9 years Gender (female): 29.2% Study period: 1996–2016	Suicide prevention act	Pre/post	Suicide Rate change (trend difference)	Overall suicide trends were not interrupted by the Act: change 0.055 [−0.037, 0.147], trend −0.001 [−0.003, 0.001], trend difference − 0.0004 [−0.003, 0.002].
Vijayakumar et al. (32)	India	Disaster (tsunami)	Cohort analytical	Bereaved tsunami survivors (n = 102; 45 intervention, 57 control) Age (mean): 38.2 years Gender (female): 51% Study period: 2004–2006	Trained volunteer delivered mental health support	Bereaved participants from control site (not receiving intervention)	Suicide attempts Pre/post change in counts	Significantly less suicide attempts were observed in the intervention group (FET p = 0.02), reducing from 6 to 0, compared to the control group (7 to 3).

Chapman et al. (38, 39) were regarded as two reports from the same study and only the most recent report was considered. PHE, public health emergency; ITS, interrupted time series; TSA, time series analysis; FET, fisher's exact test; VA, Veteran's affairs; TAU - treatment as usual.

Vijayakumar et al. (32) examined volunteer delivered mental health support among bereaved tsunami survivors, reporting significantly less suicide attempts in the intervention group compared to a control group.

3.3.2 Outcomes by intervention

Only two of five studies examining ongoing existing interventions (i.e., urban parks and video-enabled tablets) (30, 31) and four of five studies of interventions specifically deployed in disaster or public health emergency contexts (i.e., gun laws and buyback scheme, economic security measures, disaster mental health interventions, volunteer delivered mental health support) (32, 33, 35, 38) reported findings indicative of intervention effectiveness. Similarly, three of five studies, respectively, examining suicide prevention focused interventions (31–33) or generic interventions (30, 35, 38) reported reductions in suicidality outcomes. Two studies which examined the same universal intervention (gun laws and buy back scheme), using varying time series designs, provided contradictory results in terms of intervention effectiveness (36, 38).

3.4 Study quality

The study quality assessment is outlined in the Supplementary Material. The overall quality of included studies was variable, with two studies being rated as 'strong' (34, 38), four studies rated as 'moderate' (30, 33, 35, 36), and four studies rated as 'weak' (31, 32, 37, 40). The quality domains rated most strongly across studies were selection bias and data collection methods. Four studies with overall 'weak' quality ratings were each rated 'weak' on two quality domains in terms of blinding (31, 32, 37), confounders (32, 40), selection bias (37), data collection methods (40), or withdrawals and dropouts (31).

4 Discussion

This systematic review identified 10 studies which reported changes in suicidality outcomes associated with interventions conducted in the context of disasters and public health emergencies. Taken together, the limited scope of published evidence, variable study quality, and diversity of interventions and contexts precluded firm assessments of intervention effectiveness. Yet, our review findings provide several valuable insights that can help to inform future suicide prevention practice and research in these increasingly pervasive and challenging contexts (41).

Overall, our findings highlight the breadth of interventions that have been applied and studied in these contexts (including explicit suicide prevention and generic interventions, ongoing existing and specifically deployed interventions, across the full spectrum of universal, selective, and indicated intervention). Notwithstanding evidence limitations, the included studies provided some indication of favorable intervention outcomes in the context of pandemics and disasters.

Two cohort studies of moderate quality provided preliminary evidence of potentially mitigating effects of urban parks (30) and ongoing disaster mental health interventions (33) on suicide rates during pandemics. Yet, neither study design permitted firm causal attribution or fully accounted for relevant confounders. A third cohort study indicated that escalated distribution of video-enabled tablets among veterans during a pandemic improved mental health service engagement and reduced suicidal behavior (31). Whilst rating positively on several quality domains, this study did not account for blinding and dropouts. By contrast to the broader evidence on effective school-based suicide prevention (42, 43), the study adopting the most robust RCT design (but of weak overall quality due to potential selection bias and blinding concerns) found school-based CBT-skills training not to be effective in reducing student suicide attempts during a pandemic (37). Findings of a fourth cohort study remained inconclusive but indicated fluctuations in the self-harm incidence among secure psychiatric hospital patients in alignment with adapted service delivery during pandemic lock down restrictions (40).

Within disaster contexts, two cohort studies (32, 35) highlighted that increased economic security measures in terms of local government spending were associated with decreased suicide rates among men, while volunteer delivered mental health support was associated with decreased suicide attempts among bereaved survivors. Two studies examining the same national gun laws and buy back scheme provided contradictory results, with one study of strong quality (and backed by two reports) indicating positive effects (38), whereas the other study of moderate quality and employing a differing analysis did not (36). Reduced suicide rates previously associated with the introduction of national suicide prevention programs and acts (44, 45), were not observed during disasters (34).

It is noteworthy that studied interventions included hardly any designated suicide prevention interventions specifically designed for disasters or public health emergencies (33). Nevertheless, findings provided some indication of potential suicide prevention co-benefits of generic universal interventions, such as gun laws, economic security measures, and green spaces. While broader disaster mental health intervention frameworks and guidelines exist (46), these currently provide little guidance on suicide prevention. In the absence of an evidence base for designated interventions in such contexts, it therefore remains reasonable to assume that generic evidence-based suicide prevention interventions that have been effective under other circumstances (24, 25) should also have the best chance of unfolding those impacts during disasters and public health emergencies. Yet, the reasons for why their impacts and effectiveness may be hampered in these contexts are manifold, including the destructive and disruptive nature of disasters and pandemics that can simultaneously affect and overwhelm many realms of society, and which may necessitate nimble adaptations in suicide prevention programs or services (23). In fact, four interventions showed some evidence of planned reactive adaptations in these contexts (31, 33, 35, 40) that were either aimed at temporarily decreasing the scale and changing the mode of delivery to reduce virus transmission and ensure health and safety during pandemics (33, 40), or at increasing the overall scale, access and reach of interventions during pandemics and disasters (31, 35). Beyond adaptations to ensure the continuity, access and safety of existing interventions, the timing of designated interventions also deserves consideration within a broader public health approach, as systematic reviews indicate the need for a long-term perspective in view of commonly delayed suicidality increases (12) and protracted secondary stressors in such contexts (47). The integration of designated provisions to recognize and address heightened suicide risks in disaster mental health frameworks (46,

48) and pandemic response plans (49) is key to advancing future preparedness and responses.

Several intervention studies with favorable outcomes addressed known risk and protective factors for suicide of relevance to disasters (10) and public health emergencies (11) through mechanisms aimed at enhancing economic security, health care access, means restriction, psychosocial support, and green space access of affected populations. Research on the effectiveness of ongoing existing or adapted interventions as well as the development of event-specific interventions specifically targeting relevant risk and protective factors of suicide in these contexts therefore provide promising avenues to advance the field.

Research is essential to strengthen the evidence base on effective interventions (26) and inform evidence-based responses (27), but can also be challenging to conduct (50, 51) and itself be disrupted by disasters and pandemics, as was evident in one instance (37). While conducting robust gold standard RCTs may not always be feasible in these circumstances, well-controlled cohort studies and time series analyses provide feasible research methods that afford a level of rigor. When researching the impacts of ongoing interventions, findings can also be harder to interpret, as the onset of a disaster essentially constitutes a new secondary exposure or intervention, which complicates the interpretation of primary intervention effects. It is therefore essential that studies clearly capture the nature and level of disaster exposure among affected target populations and settings. Research on adapted interventions will equally benefit from clearly documenting intervention adaptations (52, 53) and from assessing adaptation outcomes (54) along with overall effectiveness outcomes (55).

4.1 Study limitations

Study findings should be considered in light of certain limitations regarding the available evidence and review process. These include the limited scope of published evidence and variable quality of studies. Importantly, many observational study designs did not permit firm casual attribution of intervention effects. Considerable study heterogeneity (regarding interventions, target groups, and contexts) also precluded formal quantitative synthesis and meta-analysis.

The systematic review process was based on a comprehensive literature search and rigorous study selection strategy but limited to peer-reviewed literature and quantitative empirical studies published in English. It did not consider grey literature, qualitative studies, or non-English language publications. It is further possible that the search strategy may have missed some relevant studies (e.g., of routine interventions continuing throughout disasters and pandemics) if these did not make explicit reference to such contexts. While publication bias was not formally assessed, it is conceivable that intervention studies that were either interrupted by such events or which produced negative or less favorable results in such contexts, were less likely to be published, and were therefore not available for this review.

5 Conclusion

Notwithstanding the limited scope and variable quality of published evidence, our review findings highlight the breadth of interventions that have been applied in such contexts with some success. There is a need for further research on effective interventions and intervention adaptations to inform evidence-based suicide prevention responses to disasters and public health emergencies.

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

LR: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. KK: Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing. KA: Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing.

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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/fpubh.2024.1338099/full#supplementary-material

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Spatial, geographic, and demographic factors associated with adolescent and youth suicide: a systematic review study

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Background: Suicide is a public health issue and a main cause of mortality among adolescents and the youth worldwide, particularly in developing countries.

Objectives: The present research is a systematic review aiming to investigate the spatial, geographical, and demographic factors related to suicide among adolescents and the youth.

Methods: In this systematic review, two researchers examined PsycINFO, Web of Science, Scopus, and PubMed databases on December 7th, 2022 with no time limits from the beginning of publication until 2022 to identify the primary studies on spatial and geographic analysis on adolescent and youth suicides. Once duplicate studies were identified and removed, the titles and abstracts of studies were examined and irrelevant studies were also removed. Finally, 22 studies were reviewed based on the inclusion criteria.

Results: Our findings show that suicide rates are generally higher among men, residents of rural and less densely populated regions, coastal and mountainous regions, natives, 15-29 age group, less privileged populations with social fragmentation, unemployed, divorced or lonely people, those who live in single parent families, people with mental health issues, and those with low levels of education.

Conclusions: Stronger evidence supports the effects of geographic and demographic variables on youth and adolescent suicide rates as compared with spatial variables. These findings suggest that policy makers take spatial and demographic factors into consideration when health systems allocate

resources for suicide prevention, and that national policymakers integrate demographic and geographic variables into health service programs.

Systematic Review Registration: https://www.crd.york.ac.uk/prospero/, identifier CRD42023430994.

KEYWORDS

spatial analysis, geography, suicide, adolescents, youth, systematic review

Backgrounds

Suicide is defined as a death directly or indirectly caused by intentionally poisoning or injuring oneself (1). As a serious public health issue, suicide constitutes the cause of death of about 800,000 (1.4%) individuals per year in the world (2). Approximately 78% of suicide cases have been reported in low-income countries (3). The annual frequency of suicide in different countries ranges from below 1 per 100,000 deaths in Saudi Arabia and Belize to over 40 per 100,000 deaths in Lithuania and Guyana (4, 5). In 2016, the WHO estimated the annual mortality from suicide at 10.7 per 100,000 (6).

Suicide is a major cause of mortality among the youth and adolescents, especially in developing countries (7). In 2015, suicide was reported as the cause of death among 6% of adolescents (8, 9). After road accidents, suicide constitutes the second leading cause of death among individual aged 10-24 years (10, 11). Research suggests 1-10% of adolescents commit suicide at least once in their life given the social stigma of suicide and its misclassification (12–14), the suicide frequency is underestimated at 164,000 in individuals aged below 25 years (15, 16).

Pesticide poisoning, hanging and use of firearms globally constitute the cause of 30% of suicides. The means of suicide used by the victims largely depends on their accessibility to lethal objects (17, 18). Suicide exerts severe and long-lasting effects on the family and friends as suicide survivors. Research suggests positive relationships between degree of depression in the bereaved and their closeness with those committing suicide (19, 20). "Suicide and self-inflicted injuries" was the 14th and 18th (21) leading cause of disability-adjusted life years in 2013 and 2016, respectively (22).

Given the significant social and individual effects of suicide, acquiring awareness of its temporal and spatial patterns in different demographic groups by age, gender and ethnicity and identifying the causes of changes in these patterns are essential for designing effective suicide control and prevention plans. Identifying both risk factors and socio-geographical background is also integral to an effective suicide prevention strategy (23, 24).

Spatial analysis can help investigate the geographic pattern of suicide (25), identify areas with greater risk of suicide, explore the potential relationship between local factors and suicide risk (26), and assess the rates across geographic units (27).

Multiple factors are associated with suicide as the outcome of complex interactions of individuals with family members and their community (28). Research suggests suicide relates to genetic, social and family factors (29) and psychological factors such as depression and anxiety (29–31) as well as adverse childhood experiences, neglect by parents (32), age, gender, sexual orientation, socioeconomic status (33, 34), academic achievement and absenteeism (35, 36), and substance abuse (2). Suicide protective factors also include having a large number of children, family support, coping skills and religiousness (37–39).

Despite the importance of these studies, their limitations include failure to explain suicide and its distribution in different locations. National and global initiatives based on early risk detection and management play a key role in saving lives and suicide prevention as a public health priority. As a suicide monitoring method, spatial and geographic analyses have been conducted to identify high suicide-risk areas (40). These analyses can assist policymakers in determining the causes of suicide, predicating local suicide patterns based on suicide-related data and developing suicide prevention strategies and appropriate interventions in high-risk regions. The present research was therefore conducted to systematically review the spatial and geographic analysis of suicide and its demographic factors in adolescents and the youth.

Methods

Study design

This systematic review was performed to investigate the spatial, geographic and demographic factors of suicide in adolescents and the youth based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (41), as a guideline for appropriate and accurate information sources. After formulating the research question, the search strategy was designed and the systematic review was conducted by screening for eligible articles. Afterwards, two researchers independently employed the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) (42) to qualitatively evaluate the articles

and extract data. A third person resolved potential conflicts in the interpretation of data. This systematic review has been registered on the International Prospective Register of Systematic Reviews (PROSPERO, Registration number: CRD42023430994).

Research question

The research question was formulated based on the population (P), exposure (E), comparator (C), and outcome of interest (O) in the review (PECO) for spatial and geographic analysis of completed suicide in teenagers and young adults (Studies and findings related to suicidal idea and suicidal thoughts, suicidal intention, unsuccessful attempts to commit suicide were excluded). PECO helps researchers create research questions (43). Three main dimensions of spatial, geographic, and demographic factors (E, exposure, interest), suicide (O, outcome based on the study interest) of adolescent and young boys and girls, and (P, population) were investigated by the researchers. Accordingly, what is the research question, and spatial, geographic, and demographic factors related to suicide in adolescents and the youth? It must be noted that the study was not context-specific (C).

Systematic search

Table 1 presents the strategy of systematic search before identification and screening. The keyword search was enriched in the identification stage using synonyms and based on MeSH in PubMed, and was modified for other databases. Boolean operators were also used along with keywords. We retrieved 3001 articles in the systematic literature search conducted in PubMed, Scopus, Web of Science and PsycINFO on 7 December 2022. These four databases were selected due to their academic nature and accessibility in Iran. The retrieved data were entered into EndNote and 1040 duplicate articles were identified and eliminated.

Screening and inclusion and exclusion criteria

Two researchers separately assessed the titles and abstracts of 1961 studies for relevance. The search was run from database inception till December 7th, 2022 with no time limits with the inclusion criteria of being an original study in the English language, and focused on the spatial and geographic analysis of suicide in adolescents and the youth. Only studies on completed suicides were included. Studies and findings for suicidal ideation, suicide attempts, and failed suicides were excluded. Thus, qualitative studies, case reports, systematic reviews, meta-analyses, review studies, conference papers, book chapters, letters to editors, and intervention studies were excluded. Finally, 82 studies remained for full text evaluation.

TABLE 1 Keyword search used in the identification process.

PubMed	(Suicide*[tiab] OR "Attempted Suicide*"[tiab] OR "Suicide Attempt"[tiab] OR Parasuicide*[tiab] OR "Completed Suicide*"[tiab] OR "Fatal Attempt*"[tiab] OR "Fatal Suicide*"[tiab]) AND (spatial[tiab] OR "Spatial Analyses"[tiab] OR "Spacial Analysis"[tiab] OR "Spacial Analyses"[tiab] OR Kriging*[tiab] OR "Spatial Interpolation*"[tiab] OR "Spatial Autocorrelation*"[tiab] OR "Spatial Dependenc*"[tiab] OR "Kernel Density Estimation*"[tiab] OR "spatial regression"[tiab] OR "Geographically Weighted Regression*"[tiab] OR "Geographic Mapping*"[tiab] OR "Geographic Cartography"[tiab] OR "Dasymetric Mapping*"[tiab] OR Geocoding[tiab] OR "Choropleth Mapping*"[tiab] OR Georeferencing[tiab] OR spacial[tiab] OR geographic*[tiab] OR cluster*[tiab]) AND (child*[tiab] OR adolescence[tiab] OR adolescent*[tiab] OR youth*[tiab] OR teen*[tiab] OR teenager*[tiab])
Scopus	TITLE-ABS-KEY(suicide* OR "Attempted Suicide*" OR "Suicide Attempt" OR Parasuicide* OR "Completed Suicide*" OR "Fatal Attempt*" OR "Fatal Suicide*") AND TITLE-ABS-KEY(spatial OR "Spatial Analyses" OR "Spacial Analysis" OR "Spacial Analyses" OR Kriging* OR "Spatial Interpolation*" OR "Spatial Autocorrelation*" OR "Spatial Dependenc*" OR "Kernel Density Estimation*" OR "spatial regression" OR "Geographically Weighted Regression*" OR "geographic mapping*" OR "Geographic Cartography" OR "Dasymetric Mapping*" OR Geocoding OR "Choropleth Mapping*" OR Georeferencing OR spacial OR geographic* OR cluster*) AND TITLE-ABS-KEY (child* OR adolescence OR adolescent* OR youth* OR teen* OR teenager*)
Web Of Science	TS=(suicide* OR "Attempted Suicide*" OR "Suicide Attempt" OR Parasuicide* OR "Completed Suicide*" OR "Fatal Attempt*" OR "Fatal Suicide*") AND TS=(spatial OR "Spatial Analyses" OR "Spacial Analysis" OR "Spacial Analyses" OR Kriging* OR "Spatial Interpolation*" OR "Spatial Autocorrelation*" OR "Spatial Dependenc*" OR "Kernel Density Estimation*" OR "spatial regression" OR "Geographically Weighted Regression*" OR "geographic mapping*" OR "Geographic Cartography" OR "Dasymetric Mapping*" OR Geocoding OR "Choropleth Mapping*" OR Georeferencing OR spacial OR geographic* OR cluster*) AND TS=(child* OR adolescence OR adolescent* OR youth* OR teen* OR teenager*)
PhsycINFO	(suicide* OR "Attempted Suicide*" OR "Suicide Attempt" OR Parasuicide* OR "Completed Suicide*" OR "Fatal Attempt*" OR "Fatal Suicide*") AND (spatial OR "Spatial Analyses" OR "Spacial Analysis" OR "Spacial Analyses" OR Kriging* OR "Spatial Interpolation*" OR "Spatial Autocorrelation*" OR "Spatial Dependenc*" OR "Kernel Density Estimation*" OR "spatial regression" OR "Geographically Weighted Regression*" OR "geographic mapping*" OR "Geographic Cartography" OR "Dasymetric Mapping*" OR Geocoding OR "Choropleth Mapping*" OR Georeferencing OR spacial OR geographic* OR cluster*) AND (child* OR adolescence OR adolescent* OR youth* OR teen* OR teenager*)

Eligibility

Two of the authors independently evaluated the full texts of 82 studies, which resulted in the exclusion of 60 studies for reasons stated in Figure 1. The remaining studies were entered into the quality evaluation and data extraction process.

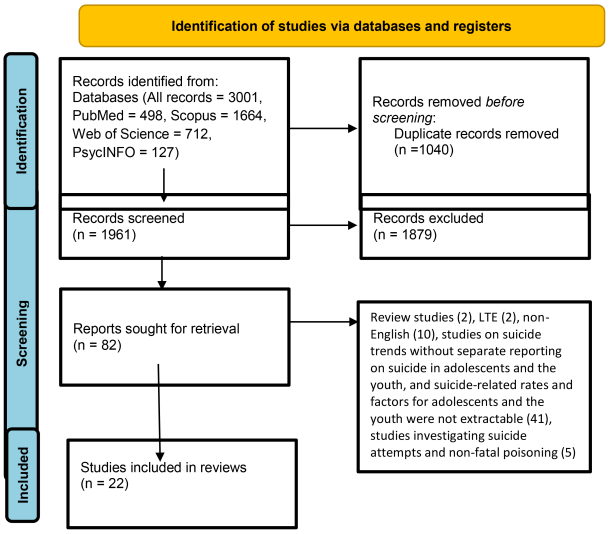

FIGURE 1
PRISMA flow diagram.

Quality assessment

The remaining articles were examined after the full-text reading stage and determining the eligibility in terms of the risk of bias assessment to ensure the quality of the studies (44). The quality of the studies was evaluated based on the STROBE checklist, and finally 22 articles were included for review in the present study. Quality assessment was performed by two people independently. The articles that scored between 11-16 were evaluated as appropriate and the articles that scored more than 16 were evaluated as good (45, 46). Each study was evaluated to check the potential risk of biases through the key areas of study design, sample size justification, target population, sampling strategy, sample selection, validity and reliability of measurement, methodological limitations, and discussion. Any differences between the two authors were resolved through discussion until an agreement was reached.

The two researchers independently extracted the following data from the studies: author's name, publication date, country, study objective, study design, sample volume, statistical test, and findings. Disputes were resolved by talking and help from a third person. In the next stage, the researchers systematically merged the findings based on the use of words, text, and study findings to explain relationships between the extracted data (47). Discussions between the researchers about the relationship of similar data led to classification of the data into different categories. This technique was repeated until logical findings were formed for interpretation. Table 2 presents the results of the study review.

Data synthesis

Considering the method of systematic review for examining a spatial, geographic, and demographic analysis of factors associated with adolescent and youth suicide, a narrative synthesis was considered to be the most appropriate method of data analysis.

Results

Eight studies from Europe, seven from America, six from Asia, and one from Oceania were reviewed in the present study. No studies from Africa were retrieved in the review. The lowest suicide rate was reported at 0.97 per 100,000 in Hong Kong and the highest at 65.2 per 100,000 in Brazil. Most studies were longitudinal and retrospective. Regression and Poisson analyses were the most frequently used statistical tests in the studies. The largest sample size pertained to a study from the US with 71,306 people and the smallest sample size was 118 people in a study from Greece.

Age

Review of literature revealed lower suicide rates for the age group under 15 as compared with the age group 15-29 in most studies. As age increased in the 15-29 age group, suicide rates also increased (49, 54, 58, 60).

Gender

In most of the reviewed studies, men had higher suicide rates than women (8, 49–51, 54, 59, 60, 63, 65), but some studies reported higher death rates due to self-burning in women aged 15-24 (64), and completed suicide rates as higher in girls living in rural areas (8, 59). Also, despite the higher suicide rates for men, certain studies showed no difference between men and women (57), especially in the under-14 age bracket (53). In one study, however, suicide rates for men and women in rural areas were about twice as high as those for men and women in urban areas (55).

Depression

Higher suicide rates have been reported in regions with high numbers of patients with treated depression or under treatment for mental disorders (57).

Education level

Studies reported a significant relationship between low levels of education and self-burning (63). Only one study reported a significant relationship between high levels of education in mothers and higher suicide rates in adolescents and the youth (57).

Social isolation

Certain studies reported a low population density (60) with a high proportion of one-member and single-parent households as a suicide predictor (53, 54, 57, 65). One study showed lower suicide rates for people living in families than for those living alone (59).

TABLE 2 Data extraction and evaluation of study quality.

No	Author (Year), Country	Objective	Study Design	Data source	Sample size	Suicide rate	Statistical test	Findings	Quality assessment score
1	Hajebi, et al, 2016, Iran, data from 2009-2012 (48)	To study the trend, correlations and discrepancy of registered suicide incidents in Iran	Descriptive	Universities of medical sciences and health services (UMSs) via their health network centers in each district, city or town	4879	5-14 = 2.7, 15-25 = 2, 25-34 = 2.7	Logistic regression analysis	Attempted suicides showed more fatality in males, older adults, widows/widowers, divorced and unemployed subjects as well as in residents of rural areas.	16
2	Ivey-Stephenson, et al, 2017, USA, data from 2001-2015 (49)	To examine annual county level trends in suicide rates during 2001–2015 among and within urbanization levels by select demographics and mechanisms of death	Retrospective	National Vital Statistics System	71306	10-14 = 1.36, 15-24 = 10.42	Joinpoint regression analyses	Suicide rates increased across the three urbanization levels, with higher rates in nonmetropolitan/rural counties than in medium/small or large metropolitan counties. Across urbanization levels, suicide rates were consistently highest for men and non-Hispanic American Indian/Alaskan natives compared with rates for women and other racial/ethnic groups; however, rates were highest for non-Hispanic whites' person, in more metropolitan counties. Trends indicate that suicide rates for non-Hispanic black person were lowest in nonmetropolitan/rural counties and highest in more urban counties.	17
3	Diego Salmero´ n, et al, 2013, Spain, data from, 1991-2008 (50)	To analyze the trends, geographical variations, seasonal patterns and methods of mortality due to the combination of suicide and causes of undetermined intent in Spain	Retrospective	The National Statistics Institute	13985	0-14=.18, 15-24 = 4.51, 25-34 = 7.21	Poisson models	Spring and summer were the seasons with the highest suicide rates.	17
4	IB O'Farrell, et al, 2016, Ireland, data from 2009-2011 (23)	To examine the small area level association between suicide and the following three area level factors, deprivation, social fragmentation and population density	Retrospective	The Irish Central Statistics Office	781	All=15, males=25, females= 5	Negative binomial regression	The most deprived areas showing the greatest risk of suicide. Low population density (rurality) was associated with an increased risk suicide in males. A weak association between high population density (urbanicity) and increased suicide risk was found among females in the 15–39-year age group.	16
5	Xin Qi, et al, Australia, 2014, data from, 1986-2005 (51)	This study explores the spatiotemporal variations of suicide across Australia	Retrospective	Australian Bureau of Statistics	18301	15-34 male=28.29, female=6.12	Descriptive and mapping approaches	Differences in suicide rates across genders were found across geographical areas.	17

(Continued)

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TABLE 2 Continued

No	Author (Year), Country	Objective	Study Design	Data source	Sample size	Suicide rate	Statistical test	Findings	Quality assessment score
6	Pompili, et al, 2008, Italy, data from 19970-2002 (52)	To analyze gender and regional differences in the suicide rate of adolescents	Retrospective	Italian Mortality Database, which is collected by the Italian National Census Bureau	3069	2.35	Poisson regression	Analyses of these suicides identified significant differences by region of residence and gender.	16
7	Song, et al, 2019, South Korea, data from2005-2015 (53)	To investigate the influence of area-level factors on adolescent suicide and to determine which variables differ according to age and gender	Retrospective	Korean Statistical Information Service and the Korea Labor Institute		10-14 = 1.41, 15-19 = 8.19	A panel data model using Generalized Least Squares	Economic problems were shown to be more associated with suicide in male adolescents than in female adolescents. On the other hand, social fragmentation and health services were shown to be more associated with suicides in females	17
8	Middleton, et al, 2006, England and Wales, data from 1988-1994 (54)	To investigate the spatial patterning and possible contributors to the geographical distribution of suicide among 15–44- year-old men	Small-area analysis and mapping of geo-coded	Suicide and undetermined deaths (International Classification of Diseases	15821		Random-effects Poisson regression models	Suicide rates were highest in the inner-city areas, coastal areas, particularly those in more remote regions. Social fragmentation, such as the proportion of single-person households, is associated with rates of suicide in both urban and rural areas. Levels of unemployment and long-term illness accounted for some of the coastal patterning.	17
9	Cynthia A. Fontanella, et al, 2015, USA, data from 1996-2010 (55)	To examine trends in the US suicide mortality for adolescents and young adults across the rural-urban continuum	Retrospective	The National Center for Health Statistics National Vital Statistics System	66595	Urban=10.31, rural= 19.93	Negative binomial regression models	Youths died by suicide and rural suicide rates were nearly double those of urban areas for both males and females, rural place of residence.	17
10	Fong Ans yip, 2003, Hong Kong, data from, 1991-1996 (56)	To study the geographical distribution of suicides in Hong Kong and examine the influence of socioeconomic variables on suicides and delineate the etiological factors	Retrospective	All deaths in Hong Kong where the underlying cause was determined as being suicidal or self-inflicted injury (E950-E959)		.97	Pearson's correlation coefficient	High population density and proportion of Cantonese residents	15
11	Gyung-Mee Kim, et al, south Korea, 2019, data	To determine the trends and the regional risk factors of youth	Retrospective	National Statistical Office of South Korea (NSO)	2167	2001 = 18, 2010 = 47.04	T -tests, Chi squared test	No significant gender difference in suicide rates; there was a significantly higher ratio of adolescents aged 15-18 versus adolescents aged 12-14 and higher number of single-parent households than those in the low SMR regions,	17

(Continued)

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TABLE 2 Continued

No	Author (Year), Country	Objective	Study Design	Data source	Sample size	Suicide rate	Statistical test	Findings	Quality assessment score
	from, 2001-2010 (57)	suicide in South Korea from 2001 to 2010						higher number of adolescents who were treated with depression were related to elevated suicide rates of adolescents. Total sleep time of adolescents and regional unemployment rates were negatively associated with the suicide risk of respective regions.	
12	Núñez-González, et al, 2018, Ecuador data from 1997-2016 (8)	To describe the temporal trend of suicide in adolescents between 10-19 years old	Ecological study	National Institute of Statistics and Census (INEC) database	3824	1997 = 12.7, 2016 = 23.3	Pearson's Chi squared test, the Fisher Exact test	No significant differences between the monthly distribution of suicides and gender, indigenous people in the Amazon region and the Southern Highlands.	17
13	BERATIS, 1991, Greece, data from 1980-1987 (58)	To examine epidemiological characteristics among these youngsters, and identify subgroups which appear to be at higher risk for suicide	Retrospective	The data were collected directly from the records of the police headquarters	118	.98	chi-square test	Girls and boys demonstrated the greatest suicide rate at 16 and 19 years, respectively. The combined suicide rate was significantly higher in the rural areas (1.48) than in Athens (0.48) and the other urban areas (0.98). Boys committed suicide more frequently than girls in Athens and other urban areas, whereas girls did so in the rural areas.	17
14	Guus Berkelmans, et al, 2020, Netherlands, data from 2013-2017 (59)	To understand socio-demographic risk factors in youth suicides	Retrospective	Micro-data of Statistics Netherlands	501	3.6	Chi-square test	Higher suicide rates among male youths, older youths, those of Dutch descent and youths living alone. Substantial geographical differences between provinces and healthcare regions (suicide rates among in-patients of psychiatric institutions are many times higher than average suicide rates). Background, living with their parents; months, age	16
15	RICHARD H, et al, 1984, United States, data from 1964-1978 (60)	To analyze the geographic pattern of this youthful suicide epidemic,	Retrospective	The 1970 US Bureau of the Census		9.6	A national interstate analysis	A strong inverse relationship between youthful suicide and population density	14
16	Emma Hofstra, et al,2018, Netherlands, data from 1995-2015 (61)	Trends in suicide incidence and to explore if any associations differ in relation to gender, age, and province of residence	Retrospective longitudinal population-based study	he national register of natural and unnatural deaths data, as registered by Statistics Netherlands	4658	0–19 = 1.2and 20–29 = 8.3	Poisson regression analysis	Suicide rates peak in the spring, up to 8% higher than in the summer. Suicides occurred more than twice as often in men than in women; no evidence was found of a differential effect by season in the age groups.	17
17	Orellana, et al, 2016, Brazil, data from 2000-2012 (62)	To examine the spatial-temporal distribution and risk of suicide in the indigenous and	Descriptive ecological study	Information Department of the Brazilian Unified	181	Non-indigenous=8.1 indigenous= 65.2	kernel analysis	The suicide risk among the indigenous population, males and villages residents was higher than in the non-indigenous population, female and rural residents.	16

(Continued)

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TABLE 2 Continued

No	Author (Year), Country	Objective	Study Design	Data source	Sample size	Suicide rate	Statistical test	Findings	Quality assessment score
		non-indigenous population of the Brazil		Health System					
18	Taghaddosinejad, et al, 2010, Tehran, iran, data from 2002-2006 (63)	To identify the characteristics of completed suicide by burning in Tehran	Retrospective analysis	Tehran's Legal Medicine Organization and judiciary system	15-24 = 145	1.6	Pearson's chi-square test, and Fisher exact test	Most victims were residents of suburban areas. Self-burning was more frequent in females than in males and was noted mainly in young age groups' residents of suburban areas with low level of education.	17
19	Bradford D. Gessner, Alaska, 1997, data from 1979-1993 (64)	Geographic variations in suicide rates are associated with marriage rates, unemployment rates, per capita income, and education rates, in the youth of Alaska.	Statewide Analysis	Alaska Bureau of Vital Statistics	14-19 = 216	14-19 = 31.5 Male 14-19 = 47.5 Female 14-19 = 13.6	Knox pair method	Suicide rates varied by race, gender, and local census area of residence. Within census areas, suicide rates correlated inversely with the percentage of all households headed by a married couple.	18
20	Katherine Hempstead, New Jersey, 2006, data from,1999–2001 (65),	To investigate whether fatal and non-fatal self-injury exhibit similar geographic patterns	Secondary analysis	Hospital discharge data, death certificates and medical examiner data	10-24year=199	6.6	Negative binomial regression	Completed suicides have a somewhat different geographical pattern. Isolation such as low population density and high proportions of households with only one member were predictive of completed suicides, male divorce rate, percent non-Hispanic whites person, county density, municipality density, rural center, percent of households with one member, unemployment rate	16
21	Chia-Yueh Hsu, et al, Hong Kong, 2015, data from 2005-2010 (66),	To investigate the spatial patterning of suicide and the association of suicide rates with a broad range of area socioeconomic characteristics	Secondary analysis	Coroner's Court	10-44 = 1639	14 male, 8 female	Moran's I statistics, Bayesian hierarchical models	In general, suicide rates were higher in areas with higher levels of social fragmentation (except population mobility) and socioeconomic deprivation. Areas with more households living in public housing and a higher population density also showed higher suicide rates.	17
22	Farrell, et al, Ireland, 2015, data frome2009-2011 (23),	To examine the small area level association between suicide and the following three area level factors, deprivation, social fragmentation and population density	Secondary analysis	Irish Central Statistics Office	15-39 = 781	15	Negative binomial regression	Overall deprivation had the strongest independent effect on small-area rates of suicide, with the most deprived areas showing the greatest risk of suicide. Low population density (rurality) was associated with an increased suicide risk in males	18

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Race and ethnicity

In two studies conducted in urban areas, minority people suffered higher suicide rates than other ethnic and racial groups (49, 65). However, the majority of studies showed higher suicide rates for natives of Alaska, Brazil, the Netherlands, Hong Kong, and Ecuador than non-natives, immigrants, and white individuals (8, 49, 56, 59, 62, 64).

Marital status

Some studies have confirmed the relationship between divorce and suicide [66]. Suicide rates also showed an inverse relationship with the percentage of households headed by married couples (65). Suicide rates were higher among widowed and divorced people than among married couples (64). Married women showed a higher rate of suicide and death by self-burning than married men (48).

Employment status

Several studies have confirmed the relationship between unemployment and suicide (48, 54, 65). Only one study showed a higher suicide rate in regions with low unemployment (57).

Deprivation and social fragmentation

Higher suicide rates were observed in underprivileged regions with social fragmentation (23, 66). Studies have shown higher suicide rates in men than in women in underprivileged regions (23).

Urban and rural area and the suburbs

The majority of studies reported higher suicide rates in regions classified as rural (23, 23, 48, 49, 54, 58, 62, 62, 65). Higher suicide rates were also reported in the suburbs relative to urban areas (49, 63). Other studies reported higher suicide rates in cities with psychiatric hospitals (59). Certain studies reported higher suicide rates for rural girls and urban boys (58). Other studies reported higher suicide rates for urban girls and rural boys (23). One study on the urban areas of the US reported a higher suicide rate among men and natives compared to women and non-natives (49).

Socioeconomic status

Higher suicide rates were observed in areas with a lower socioeconomic status (23, 66).

Highlands, mountainous, and coastal areas

A study in Ecuador reported a high suicide rate in the highlands and mountainous areas of the Amazon (8). A higher suicide rate was also observed in the Welsh and English coastal areas (54). Higher suicide rates were observed for the youths of northern Italy and Australia compared to other regions (51, 52).

Population density and housing

Areas with a larger number of families living in more populated public housing (66) had higher suicide rates (23, 53, 56, 66). Some studies also report higher suicide rates in low density populations (54, 60), or lower risk of suicide in high density populations (23).

Seasons of the year

Some studies reported that suicide rates were higher in the spring (50, 61) and summer (50). Other studies, however, showed no relationship between suicide and days and seasons of the year (8, 59, 63).

Miscellaneous

One study showed a relationship between the poverty rate, GDP per capita, employment rate, foreign married women's rate, crime rate, number of psychiatrists, and social welfare costs, with suicide rates in 15-19-year-old adolescents (53).

Discussion

A classical study by Durkheim found geographical and temporal variations effective in mortality from suicide and community effective in the tendency of individuals to commit suicide. This study found suicide frequency in a population to reflect its geographical and socioeconomic features, and suicide risk factors at a community level not to simply constitute the sum of individual risk factors. The limitations of the studies conducted on individual risk factors were also highlighted in this study in terms of investigating the fundamental causes and preventive measures of suicide (67). The present research aimed at exploring the spatial, geographical and demographic factors related to suicide in adolescents and the youth. Numerous studies on spatial and temporal variations in suicide reported mortality from suicide as a function of geographical location (19, 40). In contrast, Fowler and Caley reported insignificant differences in the frequency and risk of suicide in 1.3 million individuals in England and Wales among different populations and geographical locations. They explained their findings by the scarcity of suicide as an outcome and found collecting data on suicide to rarely lead to discovering local groups and targeted interventions (68).

The present systematic review showed a higher suicide frequency for the age group of 15-29 years old than that for the age group of below 15 years. Similarly, numerous studies suggest the growing suicide frequency at the age of below 29 years than in other age groups (69, 70). Research indicates positive relationships between age and suicide frequency such that 6% of suicides were reported in adolescents aged below fifteen, 34% in those aged 15-19 and 60% in the 20-24 age group (55). These findings are a global alarm to urgently adopt appropriate preventive measures. Research also relates the higher risk of suicide at lower ages to receiving decreased support, poor religious activities, living alone or in single-parent families, alcohol abuse, unemployment and facing new stressful responsibilities such as financially or vocationally supporting oneself or one's family (69, 71–73).

In line with literature, the present systematic review found increased suicide frequencies in males than those in females of the adolescent and young age group (74, 75), which can be explained by the heavier burden of economic loads carried by men (66). Gender-based social expectations of men, their higher exposure to risk and their lower tendency to seek help during depression or on the verge of suicidal behaviors can be attributed to an emphasis on their commitment to be strong, independent and capable (8, 76). The present review rarely observed a higher suicide frequency in women than that in men; e.g. the higher suicide rate in Iranian women was attributed to their cultural background and means of suicide (63).

The present research observed a higher suicide frequency in the patients with psychological disorders, including depression. Previous studies also reported more suicidal ideation and attempts in adolescents with depression or living in areas with high suicide rates. These adolescents felt a lack of access to medical services in their neighborhood (77, 78). Promoting access to health services thus appears essential for evaluating health and preventing suicide in adolescents (57). Depression might have lowered the tendency to receive psychological services. It is therefore recommended that preventive services be actively provided for patients with depression, especially in high-risk areas.

The present research found negative relationships between education levels and suicide frequency. Low levels of literacy have also been found to relate to suicide rates in literature (79). The lower suicide frequency in educated individuals can be explained by their higher perception of the damage caused by suicide (80).

The present study found the total suicide frequency to be higher in native, racial and ethnic groups. Similarly, a higher suicide frequency was reported in the native Taiwanese (81). Research explains this finding by easy access to pesticides, especially in rural areas (81); nevertheless, the small proportion of minority populations should be included in the analysis of ethnic and racial data. The data should also be cautiously interpreted due to failure to report suicides (65).

The present research observed positive relationships between social isolation and suicide frequency. Similarly, previous studies suggest shrinking peer-to-peer networks and social isolation can increase suicide rates (74). Research also demonstrates higher suicide rates in areas with more single-parent families (81). Studies on differences in suicide rates between rural and urban areas have found environmental factors such as transition from an agricultural economy, decline in population, marital instability and growing rates of living in isolation to increase social fragmentation.

In line with the present study, research suggests positive associations between divorce and suicide rates (75, 79, 82). The risk of suicide was also found to increase in singles and divorced individuals (83). Marriage can exert its protective effects through improving socio-emotional stability and conformity to social norms. The significant and positive relationship observed between divorce and suicide, even in high-income strata, reflects the effects of social welfare on suicide (75, 84). Marriage at young ages can increase suicide frequency in women by increasing their family and social stresses (63). According to Durkheim, divorce rates, number of children, indicators of social integrity, and family ties play a key role in suicide rates. In fact, the higher the divorce rate and the fewer the children, the weaker the social integrity of the family and thus the higher the suicide rate (85).

The present findings showed relationships between suicide and unemployment. A review of the studies mostly conducted in Western countries showed that unemployment is a socioeconomic factor associated with suicide rates (83, 86). Despite the reported negative relationships of the socioeconomic status and unemployment with suicide (75, 86), these relationships have not been confirmed in the youth (57, 87). These findings appear rational given that individuals aged below 18 are not employed or allowed to be employed in most countries. Certain studies also observed no significant relationships between unemployment and suicide rates (79).

According to Durkheim, increased suicide caused by weakened social norms can be associated with rapid economic and demographic changes. Social displacement caused by population and economic expansion and contraction can create an environment for suicide in the absence of social workforce that serves to reduce suicidal tendencies. In line with this argument by Durkheim, the present and previous research suggests social solidarity constitutes a major predictor of cross-sectional and temporal changes in suicide rates (75). Research also suggests positive relationships between socioeconomic deprivation and suicide (75, 86). Furthermore, socioeconomic growth has been found to prevent or reduce suicide (88).

This study observed the positive relationships of deprivation and social disintegration with suicide in the youth and adolescents (89). Some studies have found deprivation more effective than social disintegration in suicide, whereas certain researchers reported social disintegration as the dominant factor (54, 83); nevertheless, these two variables were also found not to affect suicide elsewhere (90).

The present study found a higher suicide rate in adolescents and the youth living in rural areas and on the outskirts than in those living in urban areas; nevertheless some studies reported higher suicide frequencies in urban areas (91, 92). According to previous studies, the risk and frequency of suicide is higher in rural than in urban areas (74, 75, 81, 93) This finding can be explained by higher development, better socioeconomic status and access to psychiatric services in urban areas as compared to villages (55, 94). The limited economic infrastructure and jobs coupled with high unemployment, low education levels and economic deprivation in rural areas can adversely affect mental health. Climatic conditions,

social isolation, lack of intimate friends and jobs and more firearms can be associated with higher suicide rates in rural areas (55, 94). Research suggests a spatial inequality in suicide rates between rural and urban residents (91, 92).

According to previous studies, the risk factors of suicide include social isolation, stigma of psychological disorders, easy access to poisonous pesticides, economic problems and concentration of ethnic minority groups (81, 95). In line with the present research, previous studies demonstrated a higher suicide frequency in rural than urban men (94). The higher prevalence of mortality in urban areas can be explained by the extent of deprivation, low socioeconomic status and large ethnic population in the neighborhood where suicide occurs (92, 96).

This study found higher suicide rates in areas with a low population density and coastal and mountainous regions. Similarly, research suggests negative relationships between population density and suicide rates (81). In low-density population areas, individuals at risk may receive inadequate outpatient care and treatment for psychological disorders and drug abuse compared to the services provided in urban areas. The residents of low density population areas also tend to keep and use firearms, and some studies revealed relationships between higher suicide rates and using firearms (65).

The present study observed no regular patterns of suicide; nevertheless, previous studies reported the highest suicide frequency in the spring, early summer and fall (61, 97, 98). Certain researchers have also confirmed the relationship between season and suicide in young age groups (99, 100). It appears that seasonal patterns constitute a popular factor in suicide risk and seasonal variations in mortality from suicide can help identify factors affecting or preventing suicide.

Limitations

Inappropriate age classifications in previous studies prevented a favorable comparison and meta-analysis in some cases. The limitations of primary studies, such as the possibility of inaccurate recording of suicide statistics in some years or underreporting could have also affected the results of this study. Alongside these limitations, however, the present study also has strongpoints including that, to our knowledge, this is the first study on the systematic evaluation of spatial, geographic, and other factors related to suicide in adolescents and the youth; and its findings can serve as a guide for qualitative and quantitative research which may identify potential preventive interventions.

Policy making implications

Developing training courses and implementing suicide prevention strategies in schools with the help of local leaders, influencers and peers; developing suicide prevention strategies in villages and low-density areas; reducing access to firearms in villages; allocating funds to geographical areas with a high prevalence of suicide among the native people; increasing access to mental health services, especially for men, individuals of 15-29 years, people living in rural areas and suburbs; socio-economic development (policies to reduce divorce, increase the level of education, reduce unemployment), and informing psychologists and social workers about spatial and geographic factors related to suicide in teenagers and young adults.

Conclusions

Geographic and demographic variables were found more effective than spatial variables on suicide in the youth and adolescents. Mortality from suicide was higher in men, residents of rural and low population density areas, natives, 15-29 age group, individuals suffering deprivation, social disintegration and unemployment, divorced individuals and singles, single-parent families, patients with psychological disorders and individuals with low education levels. These findings suggest that policy makers take spatial and demographic factors into consideration when health systems allocate resources for suicide prevention, and that national policymakers integrate demographic and geographic variables into health service programs. Finally, future intervention studies should seriously address the role of the variables in this study in reducing the prevalence of suicide in teenagers and young adults.

Data availability statement

All data generated or analyzed during this study are included in this published article, and the datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Author contributions

MG: Conceptualization, Writing – review & editing. RT: Conceptualization, Methodology, Writing – review & editing. ZM: Conceptualization, Methodology, Writing – review & editing. SK: Conceptualization, Methodology, Project administration, Writing – original draft. MF: Conceptualization, Writing – review & editing. MM: Data curation, Writing – review & editing. SAM: Conceptualization, Methodology, Writing – review & editing. SSM: Investigation, Supervision, Writing – review & editing. SA: Conceptualization, Writing – review & editing. RK: Investigation, Writing – review & editing. ND: Conceptualization, Methodology, Writing – original draft.

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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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A call to action: informing research and practice in suicide prevention among individuals with psychosis

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Although it is well established that individuals living with psychosis are at increased risk for suicidal ideation, attempts, and death by suicide, several gaps in the literature need to be addressed to advance research and improve clinical practice. This Call-to-Action highlights three major gaps in our understanding of the intersection of psychosis and suicide as determined by expert consensus. The three gaps include research methods, suicide risk screening and assessment tools used with persons with psychosis, and psychosocial interventions and therapies. Specific action steps to address these gaps are outlined to inform research and practice, and thus, improve care and prognoses among persons with psychosis at risk for suicide.

KEYWORDS

suicide, psychosis, suicide behavior, psychotic symptoms, schizophrenia

1 Introduction

Persons with schizophrenia spectrum disorders have an increased risk of suicide, up to 20 times that of the general population (1–3). While the risk of suicide is particularly elevated in the first episode and early stages of psychosis, it remains a major concern throughout the course of illness (4), with the lifetime rate of death by suicide estimated to

range between 4 to 13% (5–7). According to a recent meta-analysis, individuals in the general population who self-report psychotic experiences are twice as likely to present with subsequent suicide ideation than the general population, three times as likely to attempt suicide, and four times as likely to die by suicide (8). Relatedly, approximatively 30-50% of individuals with schizophrenia spectrum disorders or affective disorders with psychotic features will have suicide ideation in their lifetime (9–11) and 20-50% will attempt suicide (7, 12, 13) highlighting the impact of suicide risk among those with psychosis.

While there has been substantial progress in research and clinical care for individuals experiencing psychosis with suicide risk, gaps remain. Notably, there are three major gaps identified determined by expert consensus (14) that deserve attention: 1) lack of research design standards, 2) unknown reliability and validity of suicide risk screening and assessment tools in a psychosis population, and 3) insufficient evidence of efficacious suicide-focused psychosocial interventions and therapies for those experiencing psychosis. We outlined several action steps that we believe will help researchers and providers fill these gaps.

2 Implement research design standards that consider the heterogeneity of both psychosis and suicide thoughts and behaviors to support data aggregation

Both suicide risk and psychosis encompass a wide range of definitions and broad continuum of severity (Table 1), contributing to unresolved variability in findings across studies. For example, a recent meta-analysis showed that the prevalence of suicide attempts varies according to the specific diagnosis of the schizophrenia spectrum disorder, the setting (outpatient vs. inpatient), and geographical region (23). A better understanding of these consistencies and inconsistencies is an important step in further the translation of this research into effective clinical intervention. Furthermore, in every stage of the research process possible, including research design, delivery, and implementation, researchers should include individuals with lived experience of psychosis and suicide risk (24–26). This may also include the acknowledgement that many researchers have lived experience themselves. The inclusion of people with lived experience will improve the quality and relevance of research to those who are most impacted: those seeking services. Finally, it is important to acknowledge the challenges of recruiting and retain participants with psychosis in research and how these challenges impact data ascertainment, e.g., (27). We therefore present recommendations for implementing research design standards on suicide risk in psychosis, while considering their heterogeneity and the aforementioned factors.

TABLE 1 Term Definitions.

Suicide	A death caused by a self-directed injurious behavior with some intent to die from that behavior (15)
Passive suicide thoughts	Referring to a desire to be dead (16)
Active suicide ideation	Referring to having a thought of wanting to kill oneself with or without a plan (15)
Suicide attempt	Defined as non-fatal, self-directed, and potentially injurious behavior with a degree of intent to die from that behavior, which may or may not involve injury (15)
Psychosis symptoms	Positive symptoms, i.e., hallucinations, delusions, and disorganized behavior, and negative symptoms, e.g., affective flattening, alogia, avolition, anhedonia, and asociality (17)
Schizophrenia spectrum or other psychotic disorder diagnosis	Diagnoses of schizophrenia spectrum or other psychotic disorders, e.g., diagnoses of schizophrenia, schizoaffective disorder, schizophreniform disorder, brief psychotic disorder, delusional disorder, schizotypal personality disorder (17)
Affective psychosis	Psychosis symptoms occur as part of a mood disorder with psychotic features, i.e., bipolar I disorder with psychotic features or major depressive episode with psychotic features (17)
Clinical-high risk for psychosis, also called ultra-high-risk, at-risk, prodromal phase	Persons at clinical high-risk for psychosis are deemed at risk of transitioning to overt psychosis, and typically present with attenuated symptoms of psychosis, brief and limited intermittent episodes of psychosis, disturbing experiences in different domains, e.g., perceptions, thought processing, attention, or a decline in their general functioning with a history of psychosis in the family (18–21)
First-episode psychosis	The onset of the first episode of psychosis is usually marked by the presentation of frank symptoms of psychosis and the fulfillment of diagnostic criteria for a schizophrenia spectrum disorder or an affective disorder with psychotic features (22)

2.1 Recruit diverse samples across the psychosis spectrum

2.1.1 Include individuals experiencing varying levels of psychosis severity and diagnoses

Researchers should aim to recruit samples of people along a spectrum of psychosis symptom severity. This would include those with self-reported psychotic experiences in the general population who meet ultra or clinical high-risk criteria or who have experienced a first episode of psychosis, to those who have had a chronic schizophrenia spectrum disorder or disorder with psychotic features for many years. The needs and characteristics of young adults with a first episode of psychosis are different from those of people who have been living with the illness for several years, including in terms of stage of development and expectations of treatment (28, 29). It is therefore possible that suicide risk factors, as well as effective suicide prevention treatments, differ across people at different stages of illness.

2.1.2 Recruit participants from a variety of community and clinical settings

The clinical profile of patients may vary depending on the community or clinical setting (e.g., inpatient units, outpatient services, specialized services for psychosis, such as early intervention services), and certain protective factors may also influence suicidal behaviors (e.g., safety measures during hospitalization (23). Studies should recruit participants from a variety of settings to ensure that samples include varying levels of suicide risk and psychosis symptom severity.

2.1.3 Recruit and include diverse samples from differing racial and ethnic backgrounds, developing nations, and LGBTQ+ groups

This is especially important given racial and ethnic disparities in psychosis risk across the continuum (30–32) and that risk factors may vary across racial and ethnic groups (33–35). For example, in first generation immigrants and Hispanic/Latinx persons with a schizophrenia spectrum disorder, maintaining cultural traditions from their country of origin, religious beliefs, and practices, and having a positive ethnic identity may be protective against suicide ideation (36, 37). This could translate into specific targets for assessment and suicide prevention interventions in these groups. Ethnicity and race should be carefully assessed (e.g., based on self-identification, multiple data sources, migratory status (35)). Increased culturally sensitive and inclusive research will contribute to the development of culturally sensitive suicide prevention interventions.

Knowledge and evidence on prevalence, risk factors, theoretical models (38, 39) and suicide prevention interventions (40, 41) come predominantly from high-income countries. However, there have been reports of different rates and risk factors for suicide thoughts and behaviors in persons with schizophrenia spectrum disorders between low- and middle-income countries and high-income countries (42–45). A cross-national comparative study revealed that self-reported psychotic experiences were less distressing for adults living in low- and middle-income countries than for those in high-income countries (46). However, it is possible that the cross-cultural validity of current measures of psychotic experiences is limited, that psychotic experiences of equal severity are less clinically relevant in some low- and middle-income countries due to certain social and cultural protective factors (e.g., collectivist communities), or that the association between psychotic experiences and distress, and possibly suicide thoughts and behaviors, differs between countries due to cultural differences (47). Measures of psychotic experiences need to be validated across countries to minimize intra-category variability and refined to focus more on distress to better identify individuals with greater needs among different cultures, notably in terms of suicide screening and prevention (47).

LGBTQ+ groups have a higher risk of suicidal ideation and behavior, owing in part to the unique challenges they may face and minority stressors (48–50), and may be a greater risk for experiencing psychosis (51, 52). It is crucial to better understand the unknown role of LGBTQ+ identities on suicide risk in psychosis as well as providing a broader understanding of the intersection of LGBTQ+ identities and psychosis. Including affirming questions include asking one's gender identity as well as sex (e.g., 53, 54), can be a step forward to address these questions in future research.

2.2 Conduct longitudinal observational studies

Many studies of psychosis and suicide in the literature are cross-sectional (55–57), limiting the conclusions that can be drawn to impact the assessment of suicide risk, suicide prevention interventions, and understanding of mechanisms underlying the association between psychosis and suicide risk (55). While many studies have reported that psychosis is a risk factor for suicide (8, 10), recent evidence suggests a bidirectional relationship between psychosis-like experiences and suicide thoughts and behaviors (58, 59). Further longitudinal studies designed specifically to address these questions of clinical relevance are needed to inform suicide prevention practices. Study designs that combine short-term high intensity measurement and long-term panel type designs (i.e., measurement burst) may be useful to uncover the dynamics of psychosis-like experiences on suicide thoughts and behaviors.

2.3 Conduct largescale, multisite research that supports data sharing

Although the risk of suicide is high in persons with psychosis, the lifetime prevalence of all schizophrenia spectrum disorders and affective disorders with psychotic features is estimated at 3.06% (60), and up to half will experience suicide ideation or attempts in their lifetime (7, 9–13). Thus, to conduct studies with sufficient statistical power, largescale, multisite research studies are needed, with large sample sizes to provide a more robust evidence base. Pooling resources from different sites together may be one approach. Fortunately, large data sets already exist across a range of general and clinical populations and countries; more effort can be dedicated to merging these data sets for cross-site analyses. Future research should establish consistent measurement harmonization, which is needed for these analyses. Initiatives, such as the National Institutes of Health (NIH) Data Management and Sharing policy (61), the NIH Data Archive (62), and the National Institute of Mental Health MAP-PRO (Meaningful Assessment Protocol-Patient-reported outcomes) platform (63, 64), are also needed to improve our understanding of relatively rare phenomenon, such as suicide in people with psychosis.

3 Determine the reliability and validity of suicide risk screening and assessment tools in psychosis populations

Suicide screeners are used to identify those at risk for suicide (e.g., recent suicide thoughts or behaviors) while assessment tools

develop a more comprehensive understanding of that suicide risk (e.g., severity and frequency of suicide thoughts, risk and protective factors). Both are crucial for early identification and prognosis of care. Moreover, using valid and reliable tools are necessary to develop an accurate understanding of suicide risk (65, 66) and an understanding of the unique phenomenology of suicide risk in those experiencing psychosis.

3.1 Test the use of established suicide risk screening and assessment tools among those with psychosis

Overall, it is important to be screening and assessing for suicide risk in all populations and studies in the general population have consistently demonstrated that asking about suicide does not increase the risk of suicide (67, 68). In fact, there may be a benefit to asking about suicide (69). Given the increased suicide risk in a psychosis population it may be that much more crucial.

It is possible that existing current suicide risk screening tools are appropriate for individuals with psychosis, but this has yet to be established. Establishing the validity, reliability and utility of existing validated screeners or measures of suicide risk (e.g., the Ask Suicide-Screening Questions (ASQ) Toolkit (70–72)), the Beck Scale for Suicide Ideation (BSS (73, 74)), the Columbia – Suicide Severity Rating Scale (C-SSRS (75, 76)); in people with psychosis will help foster the harmonization and use of gold-standard measures of suicide thoughts and behaviors in this population. Notably, one study found that both the BSS and the C-SSRS were able to collect suicide attempt history for patients with schizophrenia spectrum disorders (77). Measures of suicide thoughts and behaviors, as well as psychosis experiences, should be harmonized across studies, building off broader efforts to standardize assessments to allow direct comparison across research studies. Additionally, future cross-sectional and longitudinal studies should carefully consider the timing of assessments. Many studies assess risk factors long before the suicide outcome occurs or use lifetime measures, which while useful may miss nuance captured by measures that incorporate questions about current suicide ideation (56). Future studies should examine lifetime and current suicide risk-related symptoms to better capture chronic risk factors (e.g., demographics) versus acute risk factors.

3.2 Consider the unique aspects of psychosis that may influence the assessment of suicide risk

There are several unique aspects of psychosis and schizophrenia spectrum disorders that may influence the assessment of suicide risk. For some people with psychosis symptoms, psychiatric treatment or involuntary hospitalization can be unpleasant and potentially traumatic (78, 79). Therefore, it is possible that people with psychosis may hesitate to disclose suicide ideation to a provider for fear of further hospitalization. Second, there is some evidence that people with psychosis have impairments in metacognition and awareness of their thoughts (80, 81), which may impact their ability to report on suicide risk. This may be particularly relevant for details of such thoughts (e.g., recency, content). Third, people with psychosis experience both public and internalized stigma related to their mental health diagnoses or symptoms (82–84), which may increase risk of suicide (85, 86). It is possible that the stigma that people with psychosis experience compounds with stigma about suicide risk, further impacting their willingness to disclose suicidal thoughts.

Psychosis impacts the phenomenology of suicide. There is some evidence for greater medically lethal means used in psychosis populations (e.g., firearms (87)) and a longer duration of untreated psychosis is associated with an increased risk of suicide behavior (88). For some individuals with a schizophrenia spectrum disorder, suicide behaviors represent a direct response to command auditory hallucinations (e.g., 89). However, in one study, the rate of suicide attempts did not differ between those who experienced command hallucinations and those who did not, suggesting that other factors are important in identifying individuals at risk of suicide behavior among those with schizophrenia spectrum disorders (89).

3.3 Differentiate and assess specific symptoms of psychosis (both positive and negative) in relation to suicide risk, including whether symptoms of psychosis alter the phenomenology of this suicide risk

Given inconsistent findings regarding the relationship between psychosis experiences and suicide thoughts and behaviors, a fine-grained analysis of specific psychosis symptoms (and their severity) with subtypes of suicide thoughts and behaviors (i.e., ideation, plans, attempts, death) could help better understand whether, for example, the association between psychosis and suicide thoughts and behaviors is due to the presence of psychosis symptoms, to specific symptoms (e.g., auditory versus visual hallucinations (90), to the frequency or intensity of these (90), to the associated distress (91), or is mediated by another variable (55). Relatedly, considerations of unique risk factors and protective factors and sources of strengths for this population should be determined and routinely assessed. For example, negative symptoms may be related to reduced suicidal behavior (10, 92) and defeatist attitudes may further be protective from suicide (93).

3.4 Understand mechanisms and unique aspects of living with psychosis related to suicide risk

To fully assess for suicide risk in psychosis, understanding specific suicide risk factors and the phenomenology of suicide in this population, and whether these constructs differ from the general population, is crucial. Literature to date suggest the presence of various demographic characteristics (e.g., age, gender, history of suicide attempt), psychiatric symptom experiences (e.g., depression, hopelessness, psychosis symptoms), clinical insight, and

substance use disorders contribute to suicide risk in the psychosis population (1, 8, 56, 57, 94–100). There is variability across studies in terms of whether risk factors (1) statistically explain the association between psychotic symptoms and suicide behavior or (2) whether psychotic symptoms themselves are an independent risk factor for suicide risk, adjusting for these factors (55, 101).

4 Determine effective psychosocial interventions and treatments that directly target suicide risk among persons with psychosis

Psychosocial interventions and treatments to address suicide outcomes among psychosis populations are limited. (Note. We do not address pharmacologic treatments in this review but acknowledge that many gaps exist in that treatment domain as well.) A recent systematic review and meta-analysis examined 11 studies of psychosocial interventions among participants with psychosis with measurement of suicide outcomes and found a significant treatment effect that pooled across suicide ideation, attempt, and death (7). Interventions of the 11 studies included various approaches (i.e., supportive treatment, cognitive-behavioral, cognitive, case management) compared to treatment as usual or a waitlist, with cognitive-behavioral therapy (CBT) being the most prevalent approach (7). While the meta-analytic study by Bornheimer and colleagues (2020) had potential methodological limitations associated with selection bias due to the requirement of suicide-related outcomes being measured in the studies examined, the study provides preliminary support for psychosocial interventions in psychosis that captured suicide ideation, attempt, and death. Importantly, it also highlights the lack of empirical studies investigating their effect and the lack of consensus on best practices due to the wide variety of intervention characteristics in the included studies (7). Further gaps remain as there is little understanding of interventions directly targeting suicide thoughts and behaviors in psychosis. Moreover, and relatedly, the potential moderators of treatment uptake and retention are unknown, which may include more severe psychosis (e.g., 27).

4.1 Test the use of suicide prevention interventions across the psychosis spectrum

Aside from studies who focus on suicide and psychosis within their research, many trials investigating suicide-related outcomes often exclude psychosis populations, and vice-versa (e.g., 102–107). For example, a recent systematic review of psychotherapy trials with suicide-related primary outcomes found that 75% excluded individuals with psychosis (102). Given this exclusion rate, this review highlights that there is a dearth of information on if suicide prevention interventions are effective for those with psychosis. In the review, few studies provided a rationale for excluding people with psychosis (102). Therefore, existing suicide-focused interventions (e.g., Brief Cognitive-Behavioral Therapy for suicide prevention (BCBT (108, 109)), Cognitive Therapy for Suicide Prevention (CT-SP (110)), Collaborative Assessment and Management of Suicidality (CAMS (111)), crisis lifelines (112), lethal means counseling ((113), safety planning type interventions (114)) should be evaluated in psychosis, and if needed, modifications and adaptations should be made to make these interventions more acceptable or effective. Furthermore, trials should provide a rationale for why psychosis is excluded so that interventions could be developed to reduce barriers (e.g., support for decisional capacity to consent to research).

4.2 Test novel suicide prevention intervention adaptations across the psychosis spectrum

It is possible that existing suicide prevention interventions do not require modification for use with people with psychosis, but in the absence of specialized research, licensed practitioners may consider how suicide prevention interventions may need to be adapted due to unique facets of working with this population. For instance, people who have a schizophrenia spectrum disorder may experience cognitive impairments (115–119), so compensatory strategies may help with intervention retention and skill use. Additionally, positive psychosis symptoms such as hallucinations may be indicators of greater risk for suicide thoughts or behaviors (10, 120, 121), and their assessment should be incorporated into interventions if applicable. Furthermore, people with psychosis may have limited social supports (122–125). Lacking social connection may be associated with increased suicidal desire (e.g., thwarted belongingness and perceived burdensomeness (126)) and a higher risk for future suicide attempt or death if social contacts are not listed on their suicide safety plan (127). People with psychosis may be less likely to use crisis lines (128) and interventions exist to practice and gain exposure to crisis line calls and safety planning may need to be augmented (e.g., 129). See examples of interventions that have explicitly been adapted for psychosis in Table 2.

5 Conclusion

Suicide is a critical public health issue among individuals with psychosis. Although progress has been made in research and clinical care for individuals at risk for suicide and experiencing psychosis, important gaps remain. This paper presented three major areas for attention and action, including: 1) implement research design standards that consider the heterogeneity of both psychosis and suicide thoughts and behaviors, 2) determine the impact and utility of suicide risk screening and assessment tools in psychosis populations, and 3) determine effective psychosocial interventions and therapies that directly target suicide risk among persons with psychosis. In addition to the above recommendations, there are two additional points we would like to highlight. First, funding agencies should seek to increase funding opportunities at the intersection of suicide and psychosis to support critically needed research in these

TABLE 2 Examples of suicide-focused interventions that have explicitly been adapted for psychosis.

Intervention Name	Short Description	Research Stage
Acceptance and Commitment Therapy (ACT): Creating a Life Worth Living	A 60 minute, 8-week group therapy utilizing concepts of ACT and safety planning.	A pilot feasibility and acceptability study was completed with promising outcomes with Veterans in a VHA psychosocial rehabilitation program (130).
Cognitive-Behavioral Suicide Prevention for psychosis (CBSPp)	CBSPp uses cognitive and behavioral techniques to identify and modify information processing biases, appraisals, and schemas related to suicide and psychosis.	A pilot randomized controlled trial found CBSPp to be feasible with positive outcomes (131). Adaptations for community mental health are ongoing (132) with promising significant open pilot trial findings (133).
SafeTy And Recovery Treatment (mSTART)	A cognitive behavioral therapy intervention with a mobile device to support in-between session learning to reduce suicide risk among people with schizophrenia and bipolar disorder.	A pilot trial of mSTART found promising feasibility, acceptability, and significant improvement in suicide ideation severity (27, 134)
Suicide Prevention by Peers Offering Recovery Tactics (SUPPORT) Program	A recovery-oriented suicide prevention intervention delivered by Veteran Peer Specialist to a Veteran with serious mental illness at risk for suicide in four, 50-minute individual appointments. Includes standalone suicide prevention training and a training specific to delivering the intervention for Certified Peer Specialists.	An open pilot trial to determine feasibility, acceptability, and fidelity is underway at a VHA medical center (135).
Youth-Nominated Support Team (YST) Intervention	A psychoeducation, support-based intervention for adolescents to nominate an adult who in turn provides support to the adolescent at risk for suicide, typically for three months following hospitalization.	The program is being adapted for clinical-high risk for psychosis with suicidal ideation (136).

VHA, Veterans Health Administration.

areas to impact practice and policy. Second, trainings should be developed, tested, and implement to prepare providers with competency and effectiveness in treating suicide risk and psychosis. Overall, the action steps provided in the areas above aim to provide a framework for addressing these critical gaps in research.

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

SC: Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. RS: Conceptualization, Writing – original draft, Writing – review & editing. LB: Writing – review & editing, Writing – original draft, Conceptualization. EP: Conceptualization, Writing – original draft, Writing – review & editing. HW: Writing – original draft, Writing – review & editing. BE: Writing – review & editing, Writing – original draft. JD: Writing – original draft, Writing – review & editing. CD: Writing – original draft, Writing – review & editing.

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Advancing suicide prevention in Germany, Austria and Switzerland: a qualitative study

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Introduction: Suicide is a significant public health problem, impacting individuals, families and communities worldwide. Effective suicide prevention requires a comprehensive approach with diverse integrated interventions and collaboration across sectors, stakeholders and professions. This study aims to identify challenges, gaps and success factors in current suicide prevention efforts in Germany, Austria and Switzerland, providing specific recommendations for advancement.

Methods: We conducted online, semi-structured interviews with 36 suicide prevention experts from Germany, Austria and Switzerland, incorporating perspectives from policy, science and practice. Interviews were conducted between September 2022 and February 2023, audio-recorded, transcribed verbatim and analyzed using the Framework method.

Results: Despite progress in national strategies and coordinated efforts for suicide prevention, challenges such as resource scarcity, stigma and structural issues in psychiatric and psychotherapeutic care persist. The interviewees identified several areas for advancement, including developing targeted prevention measures for men and older people, strengthening collaboration across sectors, stakeholders and professions, and increasing the involvement of individuals with lived experience. While the COVID-19 pandemic has exacerbated challenges in psychiatric and psychotherapeutic care, it has concurrently strengthened interest in suicide prevention among policymakers and the media.

Discussion: National suicide prevention strategies play a crucial role in setting priorities, raising public awareness, and guiding action. However, since most suicide prevention efforts are still predominantly health sector-driven, a more comprehensive approach is needed to promote the involvement of all relevant actors and address suicidality as a collective societal responsibility. Tailoring prevention programs for risk groups like older people and men is important, as these populations show high suicide rates and face a lack of targeted interventions. Our study underscores the importance to continuously monitor, refine and strengthen collaborative and evidence-based suicide prevention efforts.

KEYWORDS

mental health, suicide prevention, national prevention strategies, prevention programs, multi-level prevention, collaboration, lived experience, qualitative research

1 Introduction

Suicide is a global public health problem, impacting individuals, families and communities around the globe (1). Each year, about 700,000 people die by suicide worldwide, with the number of suicide attempts and individuals suffering from suicidal thoughts being substantially higher (1). In 2021, epidemiological data indicated an average suicide rate of 10.2 per 100,000 population in the European Union (2). Notably, Germany (10.3 per 100,000), Austria (11.9 per 100,000), and Switzerland (11.5 per 100,000) recorded suicide rates surpassing the European average (2).

The reasons for suicidality are complex, involving multi-level interactions among various risk factors (3). Suicidal thoughts are often caused by mental illness, particularly major depressive disorder and bipolar disorder, underscoring the importance of their effective treatment (4). Suicide prevention (SP) requires a coordinated, sustainable approach that integrates diverse measures and multi-level collaboration across sectors, stakeholders and professions (5). No single measure alone is sufficient to prevent suicides (3). The 4-level-intervention concept by the European Alliance against Depression (6) exemplifies a comprehensive, widely implemented and evaluated community-based program designed to improve care for patients with depression and prevent suicidal behavior (7). The concept incorporates 1) interventions for primary and mental health care professionals, 2) interventions for the general public and community, 3) interventions for community facilitators, gatekeepers and stakeholders, and 4) interventions for patients, high-risk groups and their relatives (7).

The range of SP measures is broad. Population-based interventions that can contribute to preventing suicides include, for example, restricting access to suicidal means, suicide preventive media coverage and public awareness campaigns (8). High-risk approaches include SP interventions for specific risk groups, such as prisoners, older, isolated individuals and drug or alcohol dependents as well as improved diagnosis and treatment of psychiatric disorders (8). Understanding the reasons for suicide risk and the barriers to accessing mental health support is crucial to the design of targeted interventions (9, 10). In order to ensure that actual needs are met, the involvement of individuals with suicidal experience and their relatives in the design, implementation and evaluation of SP initiatives is considered invaluable (11, 12).

Over recent decades, the World Health Organization (WHO) has raised global awareness of suicide, leading to the development of comprehensive SP strategies in many countries (5). A national SP strategy is a government-led, nationwide initiative that systematically addresses suicidal behavior through diverse approaches and integrated, countrywide measures (5, 13). While often having similar components, such as public education, crisis intervention and suicide monitoring (3, 5), national strategies may differ, for example, with respect to the level of community involvement or participating agencies (14). According to the assessment of the WHO in 2017, almost 10% of low- and lower middle-income countries and about one-third of upper middle- and high-income countries have implemented a stand-alone government-adopted national SP strategy (15).

In the Central European countries of Germany, Austria and Switzerland, various associations, organizations, foundations and networks are committed to SP at the national or regional level, connecting expertise and political competence from various professions and enhancing collaboration and research in SP. Each of these countries has established distinct national SP initiatives to guide SP efforts. In Germany, the National Suicide Prevention Program (NaSPro) contributes as a nationwide specialist network for exchange and knowledge transfer on suicidality and SP (16). In 2021, a report on the current state and prospects of SP in Germany was compiled by the expertise of NaSPro (17). In May 2024, the suicide prevention strategy for Germany was introduced, comprising measures and recommendations in three overarching areas of action (18). Other organizations that contribute to SP in Germany are, for example, the German Depression Foundation and the German Association for Suicide Prevention.

The Austrian SP strategy, Suicide Prevention Austria (SUPRA), features strategic and operational objectives for national SP along with subordinate measures, including corresponding target values and responsibilities (19). An interim report on the implementation of SUPRA is published annually. In the same year of SUPRA's implementation, an SP coordination office was established at the national public health institute with the responsibilities of implementing the measures proposed by SUPRA, consolidating ongoing SP efforts in the federal states, establishing high-quality national reporting on suicide and coordinating cross-sectoral collaboration (20). Other organizations that contribute to SP in Austria are, for example, the Austrian Association for Suicide Prevention and Pro Mente Austria.

The Swiss national action plan for suicide prevention, developed by the Swiss Federal Office of Public Health, the Swiss Conference of Cantonal Directors of Public Health and the foundation Health Promotion Switzerland, comprises 10 goals with 19 specific measures to advance SP in Switzerland (21). An interim status report on its implementation was published in 2021 (22). Other organizations that contribute to SP in Switzerland are, for example, the Initiative for the Prevention of Suicide in Switzerland and Pro Mente Sana. National efforts in these three countries are complemented by international SP organizations, such as the International Association for Suicide Prevention and the European Alliance against Depression.

In scientific publications, government reports and practice, terms such as *strategy*, *program, action plan* and *project* are not consistently used. To ensure clarity, we use the term *strategy* to refer to national concepts (including national action plan) setting broad goals and direction, the term *program* for long-term, comprehensive efforts aligned with the overarching strategy and encompassing a range of interconnected projects and the term *project* for temporary initiatives targeting specific objectives within a program.

In Germany, Austria and Switzerland, three neighboring countries in Central Europe with similar socio-cultural, economic and political-organizational characteristics, suicide rates have been a topic of concern for several decades. Although these nations boast high standards of living and advanced health care systems, suicidality continues to burden society. This study aims to identify the challenges, gaps and success factors in current SP efforts in Germany, Austria and Switzerland in order to derive specific recommendations for advancing SP in these countries.

Abbreviations: ASSIP, Attempted Suicide Short Intervention Program; COVID-19, Coronavirus disease 2019; NaSPro, National Suicide Prevention Program in Germany; SP, Suicide Prevention; SUPRA, Suicide Prevention Austria; WHO, World Health Organization.

2 Methods

A qualitative study design was chosen to provide in-depth, differentiated descriptions of expert knowledge, experiences and opinions relevant to the research interest.

2.1 Study setting

Our study focuses on the SP landscape in Germany, Austria and Switzerland, three high-income and politically stable countries in Central Europe. In these countries, the planning and decision-making in SP predominantly reside at the level of federal states or cantons. In Germany and Austria, the federal states, as well as the cantons in Switzerland, are subnational entities with their own governments and parliaments, ensuring regional autonomy through decentralized administration within the national framework.

From September 2022 to February 2023, we conducted one-on-one online interviews with SP experts from Germany, Austria and Switzerland to investigate SP measures and strategies employed in these countries.

2.2 Study participants and recruitment

In total, 36 SP experts participated in the study. They are referred to as experts due to their specific knowledge, relevant experience and roles as informants (23). In this study, we were interested in expert knowledge based on professional involvement in SP. Individuals were considered experts if they engaged in SP as part of their professional duties, such as planning, coordinating, implementing or evaluating SP measures. The identification and selection of experts was based on the judgment of the researchers. The first author (SW) screened relevant organizations for potential participants and discussed this approach and the selected individuals with the co-author (KW) and other colleagues working in the field of SP research.

12 experts from each of the three countries – Germany, Austria and Switzerland – were interviewed. The participants were categorized according to their primary engagement in policy, science or practice. To ensure equal representation of the different perspectives, 12 experts from each of the three domains were included. Experts with a policy background include, for example, employees of federal health agencies and members of international, national or regional SP societies, associations, foundations and competence groups. Most scientific experts are researchers at universities or research institutes of university hospitals working in suicide and SP research. Experts from practice include, for example, psychiatrists, psychotherapists, employees from counseling services and others who regularly interact directly with individuals at suicide risk.

Many of the 36 experts involved in our study, despite having a primary affiliation with one of the three domains – policy, science or practice – are actively engaged in several roles across the broader field of SP. For instance, some experts primarily categorized under the policy domain also contribute to scientific research. Similarly, several researchers engage in policy-making processes, and many clinical health professionals conduct scientific studies in suicide and SP research in addition to providing clinical care. The categorization of the interviewees into professional domains is intended not as a strict demarcation but merely to ensure that the different perspectives are equally incorporated.

Study participants were selected through purposive sampling and were approached via e-mail. Of the 68 SP experts approached, 16 did not respond and 16 declined to participate, mostly due to time constraints. No expert dropped out after agreeing to participate in the study.

2.3 Data collection

Online, semi-structured interviews were conducted via Zoom, guided by an interview protocol with open-ended questions (see Supplementary material 1). The instrument was pretested for logic, comprehensibility and completeness with two non-experts. The following topics were covered by the interview guide: 1) aspects on the national SP approach, 2) the evaluation and 3) effectiveness of SP measures, 4) the availability and quality of data and evidence in SP, 5) challenges in SP, 6) the impact of the coronavirus disease 2019 (COVID-19) pandemic and 7) best practice elements and optimization potentials. The emphasis on certain interview topics aligned with the experts' primary perspective. Study participants received the guide via e-mail one week prior to the interview.

The first author (SW, female, Ph.D. candidate at the Swiss Tropical and Public Health Institute, trained and experienced in qualitative research methods) interviewed all experts. Except for the previous collaboration with three Swiss experts from the sample, the interviewer had no contact with the other interviewees prior to this study. To ensure reflexivity, SW regularly engaged in self-reflection to scrutinize personal assumptions and preconceptions about the research topic. In conducting numerous interviews on the same topics with identical questions that repeatedly elicited similar responses from interviewees, assumptions began to form regarding future interviews. To counteract interviewer bias, careful attention was given to ensure that questions in subsequent interviews were posed openly and objectively, without revealing any pre-existing assumptions. The identity of the researcher, namely her female gender, young age and status as a doctoral student, may have influenced the willingness to participate or the interview process. To reduce any possible influence, we used standardized scripts for the recruitment process and practiced neutral questioning. Experiences, thoughts, evolving insights and reflections were documented, discussed with the co-author (KW) and other colleagues, and consulted during the data analysis. The choice of research methodology was influenced by the research objectives and the professional experience of the interviewer.

All interviews were conducted in German (with the exception of one interview in English), audio-recorded using an encrypted voice recorder and transcribed verbatim following the basic transcription system of Dresing and Pehl (24). During transcription, all names and other details that would allow a direct link to an individual were anonymized. Upon request, study participants were provided with a copy of the anonymized transcript of their interview.

2.4 Data analysis

Data were analyzed using the Framework method for a systematic approach to managing and mapping qualitative data (25). Thematic

categories (codes) were deductively derived from the interview guide. These codes were systematically applied to the data using a coding tree, which served as a structured framework for organizing and analyzing qualitative data. The framework facilitated the identification and retrieval of relevant text segments and enabled a systematic examination of the data based on the main themes and associated sub-themes. To ensure consistency, the interviewer, who had good data understanding from conducting and transcribing the interviews, also coded and analyzed the data. Data reduction and analysis was based on a theme matrix "cases x codes", which allowed data comparison across cases as well as within a single case (25). Data management and analysis were conducted using MAXQDA.

This manuscript presents our findings on the perceived role of SP and national SP strategies in the countries of interest, conditions for collaboration in SP, the acceptance of SP measures as well as the impact of the COVID-19 pandemic on SP, along with associated challenges, best practices and areas for enhancement. A forthcoming, complementary manuscript will discuss expert experiences and opinions on the evaluation of SP measures and the availability and quality of suicide data, along with associated challenges, best practices and areas for enhancement.

TABLE 1 Demographic characteristics of study participants and duration of interviews ($N = 36$).

Characteristics	Policy ($n = 12$)	Science ($n = 12$)	Practice ($n = 12$)
Gender [*n*]			
Female	4	6	5
Male	8	6	7
Age [*years*]			
Mean (*SD*)	53 (8.6)	53 (9.1)	53 (10.7)
Range	38–67	43–76	36–67
Country of employment [*n*]			
Switzerland	4	4	4
Germany	4	4	4
Austria	4	4	4
Duration of the interviews [*min*]			
Mean (*SD*)	42.5 (10.4)		
Range	22.2–68.9		

2.5 Ethics statement

Participation was voluntary. All study participants received detailed study information via mail prior to data collection, which explained the objectives and procedures of the research project. The interviews were based on written, informed consent. There was no compensation for study participation. This study, reviewed by the Ethics Committee of Northwestern and Central Switzerland (ID: Req-2022-00881) in August 2022, was determined not to require ethical approval. Reporting was guided by the Consolidated Criteria for Reporting Qualitative Research: 32-item checklist (26).

3 Results

3.1 Sample characteristics

The study comprised a sample of 36 experts, consisting of 15 females (41.7%) and 21 males with an average age of 53 years, both in the total sample and within each professional perspective (see Table 1). Interview duration varied from 22 to 69 minutes, averaging at 42.5 minutes. Study participants were spread across 17 different federal states or cantons in Germany, Austria and Switzerland (see Figure 1).

The duration of professional SP experience ranged from 3 to 45 years, averaging at 19.5 years. 77.8% ($n = 28$) of experts have been professionally engaged in SP for more than 10 years. The proportion of their working time devoted to SP varied from 5 to 100%. Study participants noted difficulties in accurately assessing this percentage due to fluctuating workloads depending on SP projects and events. Additionally, the integration of SP within broader mental health services, particularly in hospital settings, made distinct demarcation challenging. Moreover, a substantial engagement in SP is based on voluntary work, with many experts dedicating a significant portion of their free time to related activities.

3.2 Qualitative findings

The following sections summarize expert statements on the perceived relevance of SP in their country, related cross-sectoral, cross-regional and interprofessional collaboration, the acceptance of SP services and projects, further challenges, gaps and potentials for advancement in current SP efforts and the impact of the COVID-19 pandemic on SP. The main findings from our study, based on the statements of participating experts, are summarized in Table 2.

3.2.1 Perceived relevance of suicide prevention

Most experts from all three countries and professional backgrounds noted that SP in general tends to be a rather low priority in public health compared to other health issues. However, they also pointed out that its significance has grown noticeably in recent years. This positive trend can be exemplified by initiatives such as the substantial funding by the foundation Health Promotion Switzerland of four new suicide prevention projects in Switzerland since 2021. The increase in awareness among society and policymakers is accompanied by the development from sporadic, urban-centric SP measures to more comprehensive and coordinated efforts. According to the study participants, national SP strategies have played a pivotal role in this context, providing a structured framework, demonstrating political commitment, fostering collaboration and encouraging all federal states or cantons to address SP.

> "There are two success factors that are important for us. One of them is that the suicide prevention program is an official program of the Austrian Ministry of Health, which […] somehow gives it much higher importance, and in a way, gently encourages, to put it carefully, the individual federal states to participate. […] The second [success factor] is the setting. That there is this coordination office […] and that it is located at the Austrian

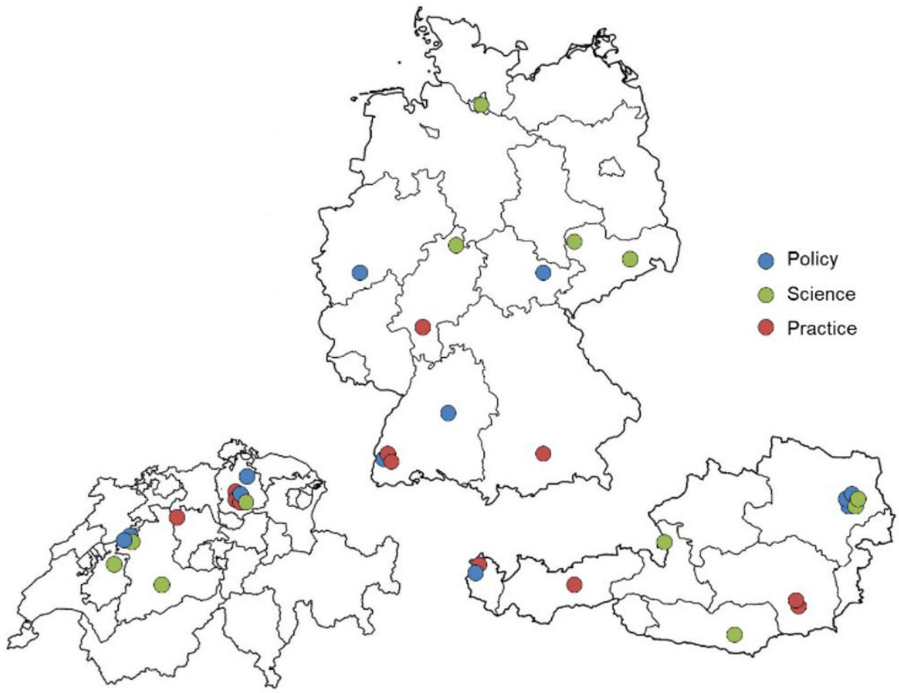

FIGURE 1
Geographic distribution of study participants with their main professional perspective (adjusted country size), own illustration.

> Public Health Institute results in so many synergy effects." (Participant 5, male, policy, Austria)

Experts from Germany and Austria noted that recent debates on assisted suicide legislation have enhanced the prominence and recognition of SP in public and political spheres.

> "This year in Germany, we are talking a lot about assisted suicide and its legal regulation. Whenever there is some political occasion – now in November, the legislation will be discussed again – then it [suicide prevention] has a relatively high significance. On occasions like the World Suicide Prevention Day, it has a relatively high relevance. In the general discussion, however, it has rather little prominence." (Participant 14, female, practice, Germany)

Despite advancements and individual funding measures, many experts from all three countries mentioned the inadequacy of financial investments in SP and related research. The comparatively small number of engaged professionals and the substantial reliance on voluntary work, particularly in policy, underscore the need for more human and financial resources. Many experts indicated that increasing resources for SP and associated research are key opportunities for advancement.

> "When you compare the investment in road accident prevention and how many deaths occur by road accidents – it is about as frequent as suicides [in adolescents]. […] Ten to fifteen times more money is invested in road accident prevention than in suicide prevention. This is actually a disgrace. The same applies for cancer research, where the factor is even higher. When it is about research, when it is about understanding how a young person becomes suicidal, it is grotesque how much money is spent on rare diseases in research and how little money is allocated to youth suicide [prevention]." (Participant 36, male, practice, Switzerland)

According to several experts, persistent stigma and misconceptions around suicidality and mental health continue to pose challenges for preventing suicides. Resistance to SP efforts, for example in educational, criminal justice and community settings, indicates a need for more comprehensive public awareness and engagement campaigns.

> "There are still instances where we encounter resistance with the topic. […] When we advertise an event with the title 'Suicide Prevention – Knowledge Helps,' almost no one comes. But if we rephrase it as 'Resilience – Strong for Everyday Life,' we have many participants. This means that it is still the best not to address the topic of suicide and suicidality directly. […] There is still a devaluation, an association with weakness. And those of us who address it [suicide prevention] are sometimes seen as missionaries, trying to convert or help everyone. 'This is not possible. Because people who want to take their own life will do it anyway.' We do encounter resistance from time to time, LESS now, but still." (Participant 30, female, practice, Austria)

According to many experts from all three countries, regional SP commitment differs. The federal structures of Germany, Austria and Switzerland result in varying levels of SP engagement and resource allocation across federal states or cantons as well as urban and rural areas. In these countries, most regulatory authority in the area of

TABLE 2 Summary of the main findings based on the statements of the participating experts.

Topic	Main findings
Perceived relevance of suicide prevention	The perceived significance of suicide prevention has grown in recent years, accompanied by an increase in related efforts and awareness.
	National suicide prevention strategies hold an important role, providing a concerted framework for action and underlining political commitment to suicide prevention.
	Suicide prevention and related research are perceived as underfunded compared to other public health areas.
	Stigma and misconceptions around suicidality persist, requiring comprehensive public awareness campaigns.
	In Germany, Austria and Switzerland, engagement and resource allocation for suicide prevention vary significantly across federal states or cantons.
Collaboration in suicide prevention	National strategies, networks, initiatives and organizations for suicide prevention foster collaboration, networking and learning.
	Personal contacts and awareness among relevant stakeholders and political decision-makers are crucial for effective collaboration.
	Decentralized regulatory authority, stigmatization of suicidality, lack of awareness and insufficient resources hamper collaboration in suicide prevention.
	In Switzerland, language barriers between cantons with different national languages hamper cross-regional collaboration.
	There is a need for stronger collaboration and networking across sectors, stakeholders and professionals.
Acceptance of suicide prevention services and projects	The accessibility of suicide prevention services largely influences their acceptance and utilization by the target group.
	Interventions need to be tailored to meet the target group's specific needs and characteristics.
	Incorporating the perspectives of individuals with lived experience and their relatives in suicide prevention measures enhances their relevance, feasibility and effectiveness. In practice, however, the involvement of these perspectives is often limited.
Further challenges, gaps and potentials for advancement in suicide prevention efforts	There is a need to strengthen psychiatric and psychotherapeutic care, including suicide risk assessment and care for individuals after a suicide attempt, as well as support for relatives after a suicide.
	Limited availability and accessibility of mental health and psychosocial care in rural areas can contribute to higher suicide rates.
	Targeted suicide prevention measures are needed for men and older adults, who experience high suicide rates.
	Experts from Germany and Austria advocate for the establishment of a national 24/7 telephone hotline that offers support in crisis situations.
Impact of the COVID-19 pandemic on suicide prevention	Experts in all three countries reported a surge in demand for mental health support during the COVID-19 pandemic, particularly among children and adolescents.
	The COVID-19 pandemic exacerbated existing structural challenges in mental health care, such as long waiting times and insufficient treatment resources.
	The COVID-19 pandemic increased awareness of mental health and suicidality among the public, the media and policymakers.

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public health is at decentralized level, while responsibilities at national level are limited.

> "The federal government's hands are tied and the constitution does not allow it to take action in this area. […] Unlike other countries, the federal government in Switzerland primarily has a coordinating role [in suicide prevention]. And this is the major dilemma in Switzerland, especially for the smaller cantons, as they often struggle due to their limited resources." (Participant 33, male, practice, Switzerland)

3.2.2 Collaboration in suicide prevention

A comprehensive SP approach requires several levels of collaboration. This section first summarizes the experts' experiences in cross-sectoral collaboration followed by reflections on cross-regional collaboration and interprofessional collaboration in mental health care.

3.2.2.1 Cross-sectoral collaboration

In the past, cross-sectoral collaboration in SP was rather fragmented and sporadic but many experts from Germany, Austria and Switzerland noted a shift toward more systematic interconnectedness. The study participants primarily attributed this improvement to the implementation of national SP strategies and the involvement of various stakeholders in SP societies, associations and other initiatives. Besides health care, collaboration with sectors such as education, media and criminal justice as well as social services is key. Personal contacts and awareness among relevant stakeholders and political decision-makers were deemed crucial for cross-sectoral collaboration.

Experts from several regions, like Carinthia in Austria or Zurich in Switzerland, showcased successful sector and stakeholder collaboration at the regional level.

> "The cooperation in Carinthia has actually become very good since we founded SUPRA in 2018/19. The stakeholders involved are the executive branch because they are often confronted with suicides, the Red Cross with the crisis intervention team […] The department of psychiatry in Klagenfurt is very intensively involved, as is the department in Villach. We work very closely with the media, talking about reporting guidelines." (Participant 20, male, science, Austria)

> "What we always try to do is to conduct these so-called suicide reports in Zurich. These are regional exchange forums held over lunch, twice a year. And we try to make them quite accessible. The main goal there is to connect people who are professionally in contact with suicidal individuals. These can be quite diverse, including, for example, the police, hospitals and someone from social work in schools, for instance. We really aim to improve this networking." (Participant 11, female, policy, Switzerland)

Several experts from all three countries considered collaboration with the media to be comparatively good. In particular, study participants from Austria highlighted strong and long-standing media cooperation, exemplified by initiatives like the Papageno Media Award, an annually awarded media prize for suicide preventive reporting. However, several interviewees from Germany, Austria and Switzerland identified shortcomings and gaps in collaboration, for example with sectors such as education and the criminal justice system.

3.2.2.2 Cross-regional collaboration

The level of cross-regional collaboration between relevant actors was described differently, largely depending on existing networks, initiatives and the commitment of regional stakeholders. Again, many experts considered national SP strategies to be of great value in promoting collaboration across regions. For example, Austrian experts highlighted that SUPRA facilitates nationwide networking and learning, connecting stakeholders across federal states.

> "It is good that we have this overarching entity, namely SUPRA, that connects ALL federal states. And we do not have to reinvent the wheel but can really see how such projects as GO-ON [suicide prevention program in Styria] develop in all federal states. And then we can learn from each other, from the experiences of other federal states. And through SUPRA top-level networking takes place." (Participant 30, female, practice, Austria)

Similarly, organizations such as the German Society for Suicide Prevention and the working groups of NaSPro were described to foster collaboration and best practice development in Germany.

> "The German Society for Suicide Prevention offers a very high-quality exchange during its conferences, in my opinion. But what I would like to emphasize even more are the working groups of NaSPro. They have come together in various areas to ensure that every professional working in the field should actually participate and contribute here [in suicide prevention]. So that we do NOT work in parallel in many places. Instead, we consolidate the expertise and also develop a certain political pressure, professional pressure and work toward best practices. This is actually something that is quite well developed." (Participant 1, male, policy, Germany)

Some experts from Austria and Switzerland pointed out that cross-regional collaboration and the establishment of personal contacts is comparatively easier in these countries due to their smaller size. In Switzerland, however, challenges in cross-regional collaboration exist due to language barriers between cantons with different national languages.

Apart from cross-regional networks, numerous initiatives and projects run in a rather uncoordinated manner, according to several experts. To avoid parallel structures and unify efforts, some experts from Germany advocated for a national SP coordination office, which would streamline initiatives and foster more cohesive approaches and interventions. Furthermore, enhancing information about available services and projects through means like a national information website was recommended.

> "I always notice that there are already a lot of good offers. That is true. It is important to really appreciate that. […] In my opinion, though, it all happens in a very uncoordinated manner. […] And

> that is also one of the core demands of various associations, including NaSPro, DGS [German Society for Suicide Prevention] and others: we need something like a central coordination office […] We now have several networks in Germany: in Dresden, in Berlin, in Cologne, in Frankfurt, in Thuringia. […] But there is not really a concerted effort among them to develop a common strategy." (Participant 13, female, science, Germany)

3.2.2.3 Interprofessional collaboration in mental health care

Most experts in our study deemed the interconnectedness and collaboration among mental health care professionals insufficient. Initiatives such as the connection service in Styria (Austria) and so-called bridging conferences in Zurich (Switzerland) illustrate regional efforts to improve the transition from inpatient to outpatient care.

> "We are currently in the process of implementing an enhanced connection service, so that people are connected with the counseling services in the region before they are discharged. When they go to the hospital, they are introduced to these services and an initial appointment is scheduled before their discharge. This has been in place for about a year and a half now and it has been very successful. It is better than it has ever been before." (Participant 32, male, practice, Austria)

Apart from such scattered initiatives, the gap between inpatient and outpatient treatment settings for suicidal individuals remains, according to most study participants.

> "There is a gap, I would say. And it does not exist because they [the health care professionals] do not want to collaborate, but often because they lack the time and financial resources. […] Because the inpatient health care providers often find themselves in a situation where they have very little time for a large number of patients. And the outpatient therapists are not compensated for the services they provide when they participate in roundtable discussions or visit someone in a hospital setting. There is a real lack of both time and financial resources, which creates a gap in between." (Participant 22, female, practice, Switzerland)

Long waiting times for psychotherapeutic outpatient treatment highlight the need for more intensive post-discharge support. In some regions in Germany, Austria and Switzerland, projects like the Attempted Suicide Short Intervention Program (ASSIP) were therefore implemented.

> "Psychotherapists have a waiting period of at least three months here in the urban area. Getting a psychotherapy appointment more quickly is rarely possible. I think it is appropriate to assume that the post-discharge care following inpatient treatment for a suicide attempt is not adequate. This was the reason and motivation for us to focus on the ASSIP project […] Now, we are offering it here with hoping that we can contribute to an improvement." (Participant 28, female, practice, Germany)

Overall, despite advances in SP collaboration, most experts from all three countries highlighted the need for stronger collaboration and networking among professionals, stakeholders and sectors. The hindering factors identified, including decentralized regulatory authority, stigmatization of suicidality, lack of awareness and limited resources, underscore the complexity of collaboration in SP.

3.2.3 Acceptance of suicide prevention services and projects

The majority of experts mentioned knowledge and accessibility of services and projects as most critical determinants of their acceptance and utilization. SP interventions should be designed to match the needs and characteristics of the target group, for example, in terms of content, language and imagery.

> "The most successful interventions are those that start from the people's needs […] and that are carried out with a vision that takes into account structural aspects and also established knowledge. And sometimes that lacks. Either they are bottom-up initiatives but not taking into account enough evidence and structural aspects. Or they are top-down measures which are very well thought sometimes but not rooted in the ground and not well prepared with regard to the inclusion and participation of the actors at several levels. We should try to find a middle way between bottom-up and top-down." (Participant 24, female, science, Switzerland)

According to many interviewees, services and projects tailored to address the unique needs and characteristics of specific risk groups increase their acceptance and use. Low-threshold access is essential, encompassing aspects like online availability, anonymity and immediate availability. Services should cater to the different preferences of different target groups, such as the common preference for digital services among younger individuals or the preference for face-to-face contacts among older people.

> "For these services, it is always relevant that they have low-threshold access, meaning low barriers. That means that it does not cost anything, that I can get help quickly and that I can also reach it easily in terms of physical distance." (Participant 6, male, policy, Austria)

Many experts highlighted the value of including individuals with lived experience and their relatives in designing and implementing SP measures, thus enhancing their relevance, feasibility and effectiveness. Despite its acknowledged importance, actual involvement of these perspectives is often limited and insufficient in practice, according to most interviewees.

> "As has been repeatedly highlighted by the World Health Organization, there is an ongoing demand for greater involvement of those affected in determining what is developed and subsequently implemented in suicide prevention. And, of course, another important group in this context is the relatives who have lost someone to suicide. This is certainly crucial. But there is still a significant need for catching up in this area as well." (Participant 17, male, science, Austria)

The representation of affected individuals and relatives in SP associations was highlighted as a positive advancement.

> "There is an umbrella organization of associations for those affected. And there are associations for those affected in almost every federal state. We collaborate very closely with them. In the SUPRA expert panel, two individuals from this umbrella organization and three relatives representatives are involved […] this is very important to us. It was missing in the beginning. For the first two or three years, no one was involved. Then we included them. And honestly, without that, it would not work at all." (Participant 5, male, policy, Austria)

Several experts highlighted the importance of an encouraging, open and non-judgmental discourse on suicidality in both health care settings and the general population. Destigmatizing mental health issues and promoting personal, trusting relationships can substantially enhance participation in preventive measures. Furthermore, sharing first-hand experiences of overcoming personal crises and helpful coping strategies at public information events and in the media were described as a powerful tool for increasing acceptance and participation in SP services and projects.

> "It is very important to destigmatize. […] that people get the feeling that it is okay and good and important that they get help when they are not well. That people talk about it. Public relations and media coverage are certainly important in this respect. […] With the Papageno effect, it is very impressive how important it is to include reports from individuals who have overcome suicidal crises themselves in the media and what a good role model effect that has." (Participant 29, male, policy, Austria)

> "In the realm of media, for example, we know that it is extremely effective when those who have experienced suicidal thoughts speak about their struggles and how they deal with them. Our evaluations show that this is much more effective than when experts, like you or me or someone else, talk about this topic." (Participant 17, male, science, Austria)

3.2.4 Further challenges, gaps and potentials for advancement in suicide prevention efforts

Providing adequate psychiatric and psychotherapeutic care to individuals with mental disorders is key to preventing suicides. However, several interviewees noted structural challenges within psychiatric and psychotherapeutic care, such as a shortage of specialists, long waiting times and the scarcity of suicide-specific therapeutic approaches. Experts from all three countries highlighted the necessity for strengthening psychiatric and psychotherapeutic care, including suicide risk assessment in these settings. In particular, care for individuals after a suicide attempt and support for relatives after a suicide should be enhanced.

In this context, disparities in mental health care between urban areas, including suburban agglomerations, and rural areas were highlighted. According to experts from all three countries, rural areas tend to have weaker health care coverage and stronger stigmatization of mental health problems. Access to mental health support is particularly difficult in cases of immobility and a lack of digital skills.

> "In rural regions, the health care provision is still significantly poorer than in urban areas. This is why, in some rural regions, the suicide rates are indeed significantly higher than in cities. There is certainly a need for improvement." (Participant 29, male, policy, Austria)

Some interviewees noted that lower suicide rates in urban areas are largely due to better psychosocial care and a stronger social safety net.

> "Our areas of concern with the highest suicide rates are rural regions. We know which areas those are. And yes, it is true that suicide rates are generally lower in urban areas. This is quite noticeable. However, it does not necessarily correlate directly with the existing suicide prevention measures but rather with an overall better psychosocial care and a generally stronger social safety net." (Participant 5, male, policy, Austria)

One of the most frequently mentioned gaps and potentials for optimization was the design and implementation of targeted SP programs and projects specifically designed for certain risk groups, such as men and older adults. Experts from all three countries pointed out that despite the considerably higher suicide rates observed in these two subpopulations, there are insufficient initiatives that aim to address their specific needs.

Furthermore, study participants from Germany and Austria emphasized the need to establish a national 24/7 telephone hotline that offers support in times of need and crisis.

3.2.5 Impact of the COVID-19 pandemic on suicide prevention

Most interviewees from Germany, Austria and Switzerland reported a surge in demand for mental health services during the COVID-19 pandemic, particularly among children and adolescents. Many experts noted an increase in inquiries for mental health support and incidences of suicide attempts, especially among vulnerable groups, such as individuals with mental disorders.

> "Now I am focusing once again on children and young people. There has been a massive increase in utilization [of clinical services]. And this applies throughout Switzerland. The inquiries, the registrations, especially with stress-associated problems – depression, eating disorders, compulsions, truancy – have gone up massively. And at the same time, the number of suicide attempts, from where we know it, has increased considerably." (Participant 12, male, policy, Switzerland)

> "Several child and adolescent psychiatry hospitals have seen an increase in suicidal behavior among their patients. […] already vulnerable children and adolescents were strongly affected and suffered a lot from the pandemic. […] These were vulnerable people, people who already had mental illnesses, people who

> worked in the health sector, people who were sitting at home in lockdown with school-aged children and were working from home. They had this double burden. These were basically our risk groups. And we saw that suicidality, depressiveness and such factors were higher [in these groups], as was anxiety." (Participant 19, male, science, Austria)

According to several interviewees, individuals with pre-existing suicidal ideation seemed to experience the pandemic particularly stressful, which was reflected in more acute presentations of suicidality and an increased number of emergency admissions.

> "We are counseling clients [adolescents and young adults] longer, more intensively. It feels like the clients come at a later stage in the crisis. They are already in a really bad state, that is really, really bad and not just bad or really bad. They come to us in a different state and then somehow need more and closer accompaniment. There was a lot of loneliness as an issue. And of course, the only way to prevent this is to get into contact and to maintain this contact for a while. Of course, we could not counsel more clients, because the capacity has remained the same. But the intensity has changed." (Participant 14, female, practice, Germany)

Several experts from all three countries mentioned that the higher demand for psychiatric and psychotherapeutic support exceeded the health care system's capacity. The existing challenges in mental health care, such as long waiting times and insufficient treatment resources, were further exacerbated by the pandemic. At the same time, measures for controlling COVID-19 transmission complicated care provision. In some facilities, for example, physical contact was temporarily restricted or even stopped completely.

> "In the meantime, we know and it is also well documented that, for example, the number of young people who need help because they have fallen into depressive and suicidal crises has gone up quite a bit. And that the corresponding support services that are available are unfortunately not sufficient." (Participant 31, female, practice, Austria)

Despite initial concerns and the perception of increased psychological distress, according to the interviewees, no significant increase in overall suicide rates was recorded during the first year of the COVID-19 pandemic in Germany, Austria and Switzerland. However, several experts cautioned about potential delayed effects on mental health and suicide rates, emphasizing the link between economic recessions and increased suicidality.

> "What has not increased so far are suicides. Here, we need to focus very strongly on the recession. Because there is very good evidence that economic recessions with their effects, especially on the labor market, and here the keyword is unemployment, have an influence on suicides. […] We also know from other crises that the psychological, the mental health component always takes longer to heal. And when the medical aspects [of the pandemic] are no longer in the foreground, the danger that suicides will increase is actually greatest." (Participant 17, male, science, Austria)

Besides the negative effects, several experts highlighted that the COVID-19 pandemic increased awareness of mental health and suicidality in society. This improvement was reflected, for example, in increased media coverage, public interest and political engagement in SP issues, leading to more support for mental health initiatives.

> "I would say that to a certain extent, the COVID-19 pandemic has somehow played into our hands thematically. Things actually improved during the Corona period in that the topic of mental health and mental stress became more discussable. The stigma has, in my opinion, decreased to a certain extent. That is, because all people are burdened." (Participant 5, male, policy, Austria)

> "We definitely felt a stronger interest in the topic. Because before, generally the topic mental health was not discussed in parliament or in the media or anything like that. […] We have really received MANY parliamentary inquiries: what is the federal government doing to strengthen the population psychologically? […] It has given the issue a boost, also the topic of suicidality, from the population to the media and parliamentarians." (Participant 9, female, policy, Switzerland)

According to the experts, the COVID-19 pandemic necessitated several adjustments to many SP measures. Interviewees reported a shift to telephone, video and online formats, for example in counseling centers. While face-to-face contact was temporarily restricted in all three countries, virtual events were introduced and in many cases broader audiences could be reached. Some public information events and research projects were put on hold. In other settings, services could be expanded. Furthermore, new projects and awareness campaigns emerged, some of which focusing on supporting mental health during the COVID-19 pandemic.

4 Discussion

An important finding of our study is that the experts' statements on most topics did not differ considerably or systematically by country (Germany, Austria and Switzerland) or professional perspective (policy, science and practice). Overall, the interviewees identified similar hindering and enabling factors in SP measures and strategies.

This paper discusses our main findings within the broader context of existing scientific literature. Since experts have highlighted the value of national SP strategies in various contexts, we begin by examining the role of these initiatives. Following this, we discuss our findings on cross-sectoral and multi-stakeholder collaboration, as crucial components of an effective SP approach. We conclude with further specific recommendations to advance SP in Germany, Austria and Switzerland. Given the abundance of research dedicated to evaluating the impact of the COVID-19 pandemic on mental health, suicide rates and health care systems, we chose not to discuss our findings in this context.

4.1 Role of national suicide prevention strategies

According to SP experts from Germany, Austria and Switzerland, national SP strategies in these countries have been pivotal in increasing awareness and prioritizing SP efforts. Interviewees emphasized that these initiatives provide a structured framework to foster networking, collaboration and learning, while improving the visibility of SP issues and boosting political commitment to related efforts. This observation aligns with research indicating that political advocacy and policy change can help to address current and future public health issues and advancing public health initiatives (27). Furthermore, Platt et al. (5) confirm that national SP strategies improve the visibility of SP in policy agendas.

While scientific evidence on the effectiveness of individual SP interventions is available, reliable studies on the impact of national SP strategies as a whole are scarce (5). Due to factor such as their complexity and multi-component nature, the organic and non-linear development in strategy implementation, and difficulties to control for confounders and covariates, little is known about the effect of national SP strategies on suicide rates (5, 28). As reported by the WHO, some national strategies, for example in England, Scotland and Sweden, have contributed to reducing the suicide rate and increasing the awareness within society and among relevant stakeholders (29). According to Matsubayashi and Ueda (13) as well as Lewitzka et al. (28), national SP strategies can have a positive impact on reducing suicides. However, there are also studies that have reported no or even a negative effect of an implemented SP strategy (30–32). In addition to the many potential benefits of SP strategies and interventions, potential unanticipated negative consequences must be considered (33). Potential adverse events, such as increased maladaptive attitudes toward suicide and reduced help-seeking behavior, require thorough investigation to facilitate informed decision-making in SP programming and implementation (33).

Although national SP strategies usually have the overarching aim to reduce the suicide rate, we advocate that this outcome criterion alone is not sufficient. In addition to effectiveness and impact, criteria such as relevance, coherence, feasibility, adaptability and sustainability should be key indicators to evaluate the usefulness and successful implementation of an SP strategy (34). The International Association for Suicide Prevention highlight that in addition to the mere existence of a national strategy, its appropriate implementation and monitoring are important aspects that are lacking in many countries (30).

National SP strategies should be monitored and refined over time, informed by current scientific evidence on suicide characteristics and SP measures (30). Pirkis et al. (35) suggest that these initiatives could be enhanced by a stronger focus on the social determinants of suicidality. A whole-of-government approach, involving cross-sectoral collaboration and shared societal and governmental responsibility to SP as well as the involvement of individuals with lived experience, could address these determinants more effectively (35).

4.2 Cross-sectoral and multi-stakeholder collaboration in suicide prevention

According to the interviewees, there has been a positive trend toward enhanced interconnectedness and collaboration across various sectors and stakeholders pertinent to SP. Many experts attributed this improvement primarily to the implementation of national SP strategies and the increased awareness of mental health among stakeholders from, for example, politics, media and the health care sector. However, despite advancements, several experts indicated a persistent need for more robust collaboration at different levels. Existing regional efforts and networks should be leveraged as good practice models to strengthen collaboration among sectors, stakeholders and professions on a larger scale.

Previous research indicates that decisions in sectors outside the health system largely impact SP (27). Thus, cross-sectoral collaboration and action must be part of any SP strategy (27, 35). Whole-of-government approaches involve multiple government sectors such as health, media, criminal justice, transport, agriculture and education (12). Moreover, multi-stakeholder collaboration, which includes partnerships with non-governmental organizations and community stakeholders, is important for a comprehensive SP approach (12). Engaging stakeholders throughout the SP project and research cycle (co-ideation, co-design, co-implementation, and co-evaluation) can enhance SP outcomes (11). Cross-sectoral and multi-stakeholder collaboration facilitates the sharing of knowledge, best practices and lessons learned, provides opportunities for integrating SP into other initiatives and strengthens transparency and accountability among involved partners (12).

Despite progress in collaborative action, most national SP strategies and programs are predominantly developed, led and monitored by professionals anchored in the health sector (35). A more holistic approach, leveraging broad expertise from various sectors and stakeholders, could lead to more robust and coordinated SP efforts, thereby enhancing outcomes and elevating the societal prioritization of suicide (35).

To further streamline national and regional SP efforts, some experts highlighted the need for a central, national coordination center dedicated to SP. In Austria, such a coordination center was implemented in 2012 and is located at the national public health institute (36). Among other things, this institution is responsible for implementing SP measures and coordinating cross-sectoral and cross-regional efforts and collaboration (20). In Germany and Switzerland, the establishment of a central coordinating center is a promising avenue for advancing SP.

4.3 Further recommendations to advance suicide prevention in Germany, Austria and Switzerland

One of the most frequently mentioned gaps in SP efforts was the design and implementation of SP measures tailored to specific risk groups, particularly older people and men. In most developed countries, individuals aged 65 and older are considered 'older adults' (37), a group particularly vulnerable to mental disorders due to factors like limited mobility, chronic pain, social isolation and life-changing events like the loss of a spouse (38–40). In most countries worldwide, the suicide rate increases with age (1). However, research on old-age suicide and SP programs and projects for older adults are lacking (40, 41). In general, promoting healthy aging through supportive physical and social environments is crucial in preventing suicides in old age (38). Since many older individuals may favor personal, face-to-face

interactions, providing in-person interventions should be prioritized (42). Furthermore, measures that address psychosocial adverse events (39) and training community members in identifying older individuals at suicide risk can contribute to prevent old-age suicides (43). Since many older individuals visit the primary care physician in the months preceding their suicide (44), training primary care providers to recognize suicidal thoughts is vital (39, 42). The currently scattered efforts and projects that aim to address old-age suicides should be comprehensively evaluated and, if proven effective, expanded to benefit more individuals.

The disparity in suicide rates between genders is striking, with men committing suicide more frequently than women. In 2019, the global age-standardized suicide rate for men was 12.6 per 100,000, compared to 5.4 per 100,000 for women (1). Such a pattern can also be observed in Germany, Austria and Switzerland, where the male-to-female suicide rate ratios are even higher (45–47). One possible reason for this disparity is that men are less likely to seek mental health support, for example, due to gender stereotypes and normative masculinities (48–50). Targeted SP measures tailored to men's needs are scarce (10, 51). Related success factors include support from trusted individuals in informal settings, emotional regulation techniques and reframing help-seeking as masculine (51). Gender-sensitized approaches and peer-support can enhance the acceptance and effectiveness of SP measures (50, 52). Furthermore, strengthening social networks and destigmatizing mental illness are key in preventing suicides, especially among men (49, 50). Successful initiatives include, for example, an online SP campaign in Belgium (53), a peer-based SP campaign in Canada (54) and a multimodal workplace-based SP project in Australia (55). These measures have shown effectiveness in increasing help-seeking intentions among men with suicidal thoughts and fostering open discussions about mental health and suicidality. Again, such proven efforts should be scaled up and adapted in other regions and countries to reach more individuals in need.

Many experts emphasized the importance of tailoring SP measures to the specific characteristics and needs of the target group. In this context, they advocated for more substantial involvement of individuals with lived experience and their relatives in the design, implementation and evaluation of SP measures to enhance their relevance, feasibility and effectiveness. An increasing body of evidence supports the value of such engagement (11, 12, 35). This involvement can not only amplify the effectiveness but also bolster the sustainability of programs and projects (35). Beyond optimizing mental health care elements and the design and delivery of SP measures, individuals with lived experience should also have a greater role in SP policymaking (35).

Specific counseling services, for example in crisis intervention centers or via telephone, show promising results in contributing to decreasing suicide rates (56, 57). In this context, several experts from Germany and Austria highlighted the need for a national 24/7 telephone hotline for people in suicidal crises. Currently, both countries provide hotlines for counseling people with mental health problems, but these are either region-specific and/or are operated by religious organizations. Despite the fact that the services of religious organizations may offer denomination-independent counseling, an official, non-religious SP hotline would eventually be more widely accepted and utilized by the general population. Switzerland can be seen as a role model in this context. Two national hotlines, one for adults and another for children and adolescents, provide 24/7 free and anonymous psychosocial support to the general population in times of need and crisis. Both hotlines offer consultations in Switzerland's three official languages (German, French, Italian) and partly also in English.

4.4 Limitations

Some limitations must be considered when interpreting our findings. This study presents the opinions, experiences and viewpoints of 36 individuals, which may not be generalizable to all SP experts in Germany, Austria and Switzerland. The selection of experts was based on the researchers' judgment, and different experts might have highlighted alternative issues or brought different experiences to light. This condition is typical in qualitative research designs and limits the representativeness of our findings. We have carefully summarized the experts' statements and included only the main results corroborated by a substantial proportion of the experts in our manuscript. Consequently, we assume that the likelihood of bias influenced by unfounded beliefs or emotions is minimal.

Given that the interviews were primarily conducted in German, with one interview in English, this represents a limitation, especially in the context of Switzerland's multilingual landscape. Due to the federal structure of Switzerland, variations in SP activities and related experiences across different cantons should be anticipated. As a result, this research project does not adequately represent perspectives from French- and Italian-speaking cantons. Additionally, the viewpoints of individuals directly affected by suicidality and their relatives were not included, which would have provided deeper insights into the effectiveness, acceptance and key success factors of SP initiatives.

Investigating SP measures and strategies in Germany, Austria and Switzerland limits the applicability of many findings primarily to these countries and potentially others with comparable socio-cultural, economic and political-organizational characteristics. The findings might have varied if countries with different political systems, such as those featuring centralized planning and decision-making in public health, had been included in the analysis.

5 Conclusion

This qualitative study explores the challenges, gaps and success factors of SP in Germany, Austria and Switzerland, drawing on expert opinions. Although each country employs its own strategy, our study reveals many common threads in their SP landscape. The findings provide actionable guidance for advancing SP in Germany, Austria, Switzerland and potentially other countries with similar socio-cultural, economic and political-organizational characteristics. While considerable progress has been made, there remains a need to refine and strengthen collaborative and evidence-based SP efforts. The awareness and commitment of all relevant sectors and stakeholders are crucial in ensuring that SP is a prioritized, well-resourced and effective societal initiative.

Data availability statement

The datasets presented in this article are not readily available because they contain information that could compromise the privacy of the

interviewees. Requests to access parts of the datasets should be directed to the corresponding author (SW, sophia.werdin@swisstph.ch).

Ethics statement

The studies involving humans were approved by the Ethics Committee of Northwestern and Central Switzerland (ID Req-2022-00881). 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

SW: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. KW: Conceptualization, Funding acquisition, Resources, Supervision, Writing – review & editing.

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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/fpubh.2024.1378481/full#supplementary-material

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The use of CAMS and DBT to effectively treat patients who are suicidal

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Around the world, suicide ideation, attempts, and deaths pose a major public and mental health challenge for patients (and their loved ones). Accordingly, there is a clear need for effective clinical treatments that reliably reduce suicidal thoughts and behaviors. In this article, we review the Collaborative Assessment and Management of Suicidality (CAMS) and Dialectical Behavior Therapy (DBT), two clinical treatments that rise to the highest levels of empirical rigor. Both CAMS and DBT are now supported by randomized controlled trials (RCTs), with independent replications, and meta-analyses. There are also supportive data related to training clinical providers to use CAMS and DBT with adherence. RCTs that investigate the use of both interventions within clinical trial research designs and the increasing use of these complementary approaches within routine clinical practice are discussed. Future directions for research and clinical use of CAMS and DBT are explored as means to effectively treat suicidal risk.

KEYWORDS

treatment, suicidal ideation, suicidal behaviors, CAMS, DBT

Introduction

Suicide is a worldwide public health challenge with over 700,000 deaths per year. Suicide rates around the world are fairly comparable with the highest rates in Africa and the lowest rates in Eastern Mediterranean countries (1). In the United States, suicide is the 11th leading cause of death with over 49,000 Americans dying by suicide and an additional 2,553,000 attempting suicide in 2022 (2). Moreover, an additional 16,600,000 American adults and teenagers struggled with *serious thoughts of suicide* in 2022. By definition, suicidal ideation is present for any self-inflicted death to be certified as a suicide, but only a scant fraction of those with suicide ideation ever go on to make suicide attempts or die by suicide. With the exception of a brief reduction in 2019 and 2020, suicides in the U.S. have steadily increased over the past five decades, while other causes of death have steadily decreased (e.g., infant mortality, influenza, tuberculosis, and HIV). The modal suicide death in the U.S. is a middle-aged white male who ends his life with a gun. The modal suicide attempter is a young adult female who overdoses. In recent years, there have been

increases in suicide attempts among female adolescents and more generally among young people of color in the U.S (2). The emotional toll of suicide is profound as up to 30 "suicide loss survivors" are impacted by each suicide (3). The economic costs of suicide are considerable; in the U.S., suicide and non-fatal self-harm in 2020 cost the nation over $500 billion in medical costs, work loss costs, value of statistical life, and quality of life costs (4).

For decades, the standard clinical response for someone with suicidal thoughts and/or behaviors has been an inpatient admission to a psychiatric unit and the routine prescribing of psychotropic medications. Ironically, neither of these common clinical interventions have clear or robust empirical support. Indeed, there is evidence that inpatient hospital stays can actually be non-therapeutic (5, 6) [with a possible exception for inpatients who made a suicide attempt immediately prior to their admission (7)] and the efficacy of medications for suicidality is modest, mixed, and can even increase the risk of suicidal behaviors (8).

Fortunately, years of ongoing rigorous randomized controlled trial (RCT) clinical research has seen the development and support of a handful of psychological treatments with proven treatment efficacy and effectiveness for reducing suicidal ideation and behaviors in patients who are suicidal across different samples and clinical settings. Within any clinical trial research, the highest standard level of experimental rigor establishes a *causal* impact of a treatment (i.e., that using a treatment reliably addresses conditions reducing targeted symptoms and behaviors, leading to clinical recovery). Empirical validation thus includes the following criteria: 1) treatment studies that employ randomized controlled trial experimental designs, 2) the reliable replication of similarly supportive RCT findings, c) the replication of supportive RCT findings by *independent* researchers (i.e., investigators who did not develop the intervention with no publication bias or allegiance effects), and d) reliable empirical support of clinical trial treatment findings by at least one meta-analysis. These criteria will serve as an organizing focus for the clinical trial research studies highlighted in the present discussion.

When this level of scientific rigor is considered in relation to suicidal risk, two clinical interventions rise to the top as the most empirically supported treatments for suicidal ideation and behavior. The first treatment we will consider is the Collaborative Assessment and Management of Suicidality (CAMS) developed by Jobes (9–11). The second treatment we will discuss is Dialectical Behavior Therapy (DBT) developed by Linehan (12). While CAMS and DBT are clinically compatible, they are distinctly different psychological treatments. CAMS is provided as an individual psychotherapy modality wherein different interventions are used within ongoing care to target patient-defined "drivers" of suicide (i.e., those issues that make the patient suicidal) over 4-12 sessions of care. In contrast, comprehensive DBT is a team-based treatment emphasizing four modes of treatment delivery: 1) skills training, 2) individual psychotherapy, 3) phone coaching, and 4) team consultation. These modes are in the service of helping patients develop "a life worth living" within a behaviorally-focused treatment with care generally ranging from 6 months to more than a year. It is important to note the complementarity of these two proven treatments because they straddle the full spectrum of suicidal risk, from patients with acute suicidal ideation to patients who are chronically suicidal and have a history of multiple suicide attempts.

Both of these clinical interventions are supported by published non-randomized and randomized clinical trials as well as meta-analyses confirming their efficacy and effectiveness. To this end, based on extensive and rigorous clinical trial data, CAMS is one of the best treatments for reliably reducing suicidal ideation and overall symptom distress while increasing hope/decreasing hopelessness among outpatients and inpatients who are suicidal. In turn, there are *dozens* of RCTs as well as meta-analyses that clearly show the efficacy of DBT with data that are specific to its ability to reliably reduce suicide attempts and self-harm behaviors.

The goal of the present discussion is to review and highlight key empirical support for each intervention before turning our attention to how these treatments have increasingly been used together in clinical trial studies and also within contemporary clinical practice for reliably decreasing suicidal ideation, self-harm, and suicide attempts (among other positive secondary outcomes). Importantly, these proven clinical interventions can be provided on an outpatient basis which can obviate the need for costly emergency department (ED) and inpatient care that too often may be ineffective and are quite expensive. Moreover, effective training models for both interventions are available around the world that can help ensure their adherent clinical use for patients who suffer from suicidal thoughts and self-destructive behaviors.

Before delving into the clinical trial highlights supporting these approaches, it is important to note the outcome variables used in randomized controlled trials for suicidality can vary widely. Most studies focus on suicidal ideation and behaviors as primary outcome variables. Secondary variables may include overall symptom distress, patient satisfaction, retention to care, hopelessness, clinician satisfaction/confidence, and other "markers" related to suicide risk and treatment (e.g., depression, treatment recidivism, and cost-effectiveness). In our integrative review, we highlight the key clinical trial investigations and endeavor to report on similar outcome variables across clinical trials of CAMS and DBT.

The Collaborative Assessment and Management of Suicidality

CAMS is an evidence-based suicide-focused therapeutic framework (11). Central to CAMS is the use of a multipurpose assessment, stabilization, treatment planning, and clinical outcome tool called the "Suicide Status Form" (SSF) that provides structured guidance and extensive clinical documentation for all CAMS suicide-focused assessment and treatment planning. There are three distinct phases to CAMS: a) the all-important first session, b) an interim phase of suicide-focused care, and c) the final outcome disposition session of CAMS. In the first session of "standard" CAMS, clinicians ask permission to take a seat next to the patient to have the patient complete an initial quantitative and qualitative assessment pertaining to the patient's suicidality. Still sitting side-by-side, the clinician takes over assessing key risk variables and warning signs. This assessment process then leads to a

collaboratively developed treatment plan that is designed to keep a patient out of the hospital, if possible. This is accomplished by collaboratively completing the CAMS Stabilization Plan (13) before shifting attention to two patient-identified problems—or "drivers"—that compel the patient to consider suicide which will be targeted and treated across the course of CAMS. Drivers identified in CAMS RCTs focus on relationships, intrasubjective misery, vocational concerns, and self-oriented issues (14). After the first session, an interim version of the SSF is used which begins with the patient rating the "SSF Core Assessment" (psychological pain, stress, agitation, hopelessness, self-hate, and overall behavior risk of suicide). All interim CAMS sessions end with an update of the CAMS Treatment Plan. For example, is the CAMS Stabilization Plan working or does it require modification? Have patient-identified suicidal drivers evolved or changed since the previous session? Is there a need to modify the driver-focused interventions? Treatment planning within CAMS is thus always suicide-focused with an overarching goal that centers on the patient learning to reliably manage their suicidal thoughts and feelings while establishing behavioral stability for three consecutive sessions. When these resolution criteria are met, there is an outcome disposition version of the SSF that is used in the final session of CAMS which brings the treatment to a close.

Beyond this general overview of CAMS, it is important to note that every session of CAMS begins with the SSF Core Assessment and ends with an update to the CAMS Treatment Plan. CAMS clinicians are free to use whatever interventions they deem appropriate to treat patient-identified drivers (CBT, behavioral activation, medication, couple's therapy, elements of DBT or ACT, insight-oriented therapy, etc.). Patients always receive copies of their SSFs after each session over the course of care. CAMS can be administered in person or via telehealth using fillable PDF versions of the SSF (11, 15). While CAMS is typically an outpatient-oriented intervention, there has been notable success using the model in inpatient settings as well (16–19).

Empirical support for CAMS

What follows is a review of seven randomized controlled trials of CAMS, two meta-analytic studies, and training-related research. As discussed by Jobes (11), there are 11 published non-randomized controlled trials of CAMS that consistently show positive correlational outcomes. Within the present review, we will focus on the *causal* impact of CAMS based on RCT findings (refer to Table 1 for the included CAMS RCTs).

Randomized controlled trials of CAMS

The published RCTs supporting CAMS provide both replicated experimental results but also independently validated results by investigations that did not include the developer (DAJ). Independent validation of RCTs means that there is no "publication bias" or "allegiance effects" that may occur when a treatment developer is involved in a clinical trial.

The next-day appointment RCT

The first RCT of CAMS was a small feasibility study comparing CAMS to "enhanced care as usual" (E-CAU) with 32 outpatients who were suicidal (20). Despite limited statistical power, there were significant between-group experimental findings on the primary assessment measure of suicidal ideation and secondary measures of overall symptom distress and optimism/hope. Patients receiving

TABLE 1 The included CAMS RCTs.

Authors	*N*	Sample/setting	Study inclusion	Main outcomes
Comtois et al., 2011 (20)	32	CMH outpatients, Harborview, Seattle, WA	Significant SI (i.e., >13 on BSSI-C), recent SA, or imminent risk	Reduced SI and symptom distress, increased hope, patients preferred CAMS
Andreasson et al., 2016 (21)	108	CMH outpatients, Copenhagen, DK	≥2 BPD criteria, SA in the past 5 years	Mixed findings: CAMS was as effective as DBT for NSSI and SAs
Jobes et al., 2017 (22)	148	Soldier outpatients, Ft. Stewart, GA	Significant SI (i.e., >13 on BSSI-C)	Reduced SI in six to eight sessions; moderator findings: resiliency, symptom distress, decreased ED visits; cost-effective
Ryberg et al., 2019 (18)	78	Inpatients/outpatients, Oslo, NO	Significant SI (>13 on BSSI-C), positive response on questions of current SI	Reduced SI and symptom distress; moderator finding: CAMS improves poor working alliance
Pistorello et al., 2021 (23)	62	College student outpatients, University of Nevada, Reno	Rating ≥2 on question "I have thoughts of ending my life" (on a 0–4 scale)	Reductions in SI and depression; moderator finding: reductions in hopelessness
Comtois et al., 2022 (24)	150	CMH outpatients (SME)	≥1 lifetime, actual, or interrupted SA for recently discharged inpatients	Mixed findings: TAU worked better early, CAMS worked better later in terms of SI and symptom distress; clinicians were more satisfied with CAMS
Santel et al., 2023 (19)	88	Psychiatric inpatients, Bielefeld University, GE	Admitted for acute SI or recent SA	Decreased SI, symptom distress, and SA's post D/C; stronger alliance

CAMS reported significantly higher satisfaction ratings than patients in E-CAU, and CAMS patients had significantly better treatment retention in comparison to patients receiving control care.

The DiaS RCT

A second CAMS RCT was conducted by researchers in Copenhagen, Denmark. The "DiaS" trial was a parallel-group superiority design in which 108 patients who attempted suicide with borderline personality disorder features were randomly assigned to either 16 weeks of DBT or up to 16 weeks of CAMS (21). This RCT found no statistically significant between-group differences between DBT and CAMS for the primary outcome variables of self-harm and suicide attempts at 28 weeks of follow-up (21). This RCT was underpowered, and while data were favorable toward CAMS, the differences did not reach statistical significance.

Norwegian RCT

A Norwegian research team conducted an independent RCT of CAMS (18) comparing 78 patients who were randomized to CAMS versus treatment as usual (TAU) who were recruited from seven inpatient and outpatient clinical settings (i.e., standard inpatient settings, crisis clinics, and outpatient settings). CAMS had a significantly better impact on the primary outcome variable of suicidal ideation and on the secondary outcome of overall symptom distress at 3 months of follow-up, and sustained reduction in overall symptom distress was seen among patients receiving CAMS in comparison to TAU at 12 months of follow-up (18).

Operation Worth Living RCT

The "Operation Worth Living" (OWL) RCT randomized 148 U.S. Infantry Army Soldiers with high levels of suicidal ideation to CAMS or E-CAU (22). At a year of follow-up, Soldiers receiving CAMS reduced their suicidal ideation (in 6-8 sessions) significantly more quickly than E-CAU (primary outcome). Soldiers in both arms of the trial generally improved on all assessment measures at the 12-month follow-up. Within a secondary analysis of possible moderators, CAMS was found to be superior to E-CAU on six of eight significant moderator findings (25). For example, married Soldiers who received CAMS had significantly more resiliency and significantly less symptom distress than Soldiers in E-CAU. There have been additional extensive secondary analyses using OWL RCT data leading to some valuable contributions [e.g (14, 26–31)].

SMART design study

A small clinical trial feasibility study was funded by the National Institute of Mental Health (NIMH) for an investigation that was conducted at the University of Nevada–Reno Counseling Center. This study was funded to explore the prospect of conducting a "sequential multiple assignment, randomized trial"—otherwise known as a "SMART" research design (32). The idea of a SMART is that clients can be initially randomized to one of two treatments in stage 1, which in this study meant counseling center clients would receive up to eight sessions of CAMS or TAU. Clients who insufficiently responded to stage 1 care were randomized once again in stage 2, in which they received up to 16 sessions of CAMS or DBT. The beauty of this elegant design is that researchers can investigate both within- and between-group effects along with sequencing of clinical care, the dosing of care, and how different treatments may have a differential impact on certain subtypes of clients. In this way, a SMART can help us understand for whom different treatments, at different doses, will be best suited to achieve optimal treatment outcomes.

Within the feasibility RCT, 62 counseling center students with serious suicidal ideation were randomly assigned to stage 1 care receiving either CAMS or TAU (23). Most of these students responded positively to both arms of care, and relatively few needed to be randomized to stage 2 (and this sample was too small to analyze). However, for stage 1 care, it was observed that CAMS was significantly better than TAU for reducing the primary outcome variable of suicidal ideation and a secondary outcome variable of depression. Moderator analyses from stage 1 were noteworthy since clients with no multiple attempt history or borderline features had significant reductions in a secondary variable of hopelessness when receiving CAMS when compared to TAU care. In other words, those clients with multiple suicide attempts and borderline features actually responded better to TAU care. It is important to note that all study treatments were provided by the *same clinicians* rendering whichever treatment their client had been randomly assigned to receive (either CAMS or TAU in stage 1; CAMS or DBT in stage 2). In other words, clinicians served as their own controls as their clients received different treatments provided by the exact same clinician (i.e., between-group variance that comes with different clinicians providing treatments was thus eliminated). Moreover, digital recordings of sessions were watched (using the CAMS Rating Scale to assess fidelity) which ensured that study treatments were faithfully provided as randomly assigned (23). Secondary analysis using data from this RCT showed that better adherence to the CAMS model resulted in better treatment outcomes (33).

Aftercare Focus Study RCT

A sixth RCT of CAMS had mixed results. The "Aftercare Focus Study" was designed to intentionally recruit extremely high-risk people—namely, patients who had made suicide attempts and were recently discharged from inpatient psychiatric care (24). In the study, 150 patients were randomly assigned to CAMS or TAU. As seen in other RCTs of CAMS, the control comparison care was actually quite strong, which perhaps eliminated some potential between-group findings. Patients in both arms of the treatment improved from baseline to 12 months of follow-up. For the primary outcome variable of suicidal ideation, there was a decrease for TAU patients at 3 months, whereas CAMS had more impact on suicidal ideation at 12 months. In addition, on a secondary outcome variable, CAMS patients had less psychological distress at 12 months when compared to baseline. One between-group secondary finding of note was that CAMS clinicians were significantly more satisfied with their treatment than TAU clinicians. The study also provided persuasive support for the notion of having outpatient clinics that specialize in clinical care that specifically focuses on suicidal risk, similar to suicide-focused clinics that exist across geographic regions in Denmark (34).

Inpatient CAMS RCT in Germany

Finally, a seventh published RCT of CAMS by Santel and colleagues (19) was conducted as a feasibility RCT comparing the inpatient use of CAMS to enhanced treatment as usual (E-TAU). The RCT included 88 inpatients who were acutely suicidal and admitted to a psychiatric inpatient hospital setting in Bielefeld, Germany. Results showed that both groups improved over time across all primary and secondary outcome measures. Patients receiving CAMS showed notably larger effect sizes across all measures. For treatment completers, CAMS patients showed significant improvement on the primary outcome measure of suicidal ideation ($p = 0.01$) in comparison to control patients; CAMS patients also rated the therapeutic relationship significantly better ($p < 0.02$) than E-TAU patients as a secondary outcome. Importantly, in terms of another primary outcome measure, patients treated by CAMS were significantly less likely to make a suicide attempt compared to control patients within the high-risk post-discharge period 4 weeks after they were discharged ($p = 0.05$). While encouraging, this preliminary finding needs to be further studied and replicated. Thus, within this inpatient feasibility RCT, the pattern of results was generally supportive of CAMS, suggesting that the inpatient use of CAMS is both feasible and promising. However, given the limited sample size, these preliminary findings nevertheless require further replication ideally within well-powered multisite RCT designs.

Meta-analyses of CAMS

Therapeutic assessment meta-analysis

Poston and Hanson (35) empirically demonstrated that the CAMS-based SSF assessment functions as a "therapeutic assessment" (i.e., a clinical assessment experience that contributes to both improved treatment process and outcomes). The authors conducted a rigorous meta-analysis of effect sizes from 17 published studies of different psychological assessments (e.g., assessments of self-evaluation or alcohol use among others). Similar to other assessments in the study that met the criteria to be considered a "therapeutic assessment," this meta-analysis indicated that CAMS assessment is indeed therapeutic in that it provides personalized, collaborative, and highly involving test feedback which contributes to positive clinically meaningful treatment effects. By definition, therapeutic assessments have positive and clinically meaningful effects on treatment, including the improvement of the treatment process. This meta-analysis provides a different sort of validation of CAMS with a strong effect size for CAMS as a therapeutic assessment.

Meta-analysis of nine CAMS trials

A significant development related to CAMS clinical trial research occurred when Swift and colleagues (36) conducted a meta-analysis of nine CAMS clinical trials (16, 18, 20–23, 37–39). In comparison to control treatments, results showed that CAMS significantly reduced the primary outcome measure of suicidal ideation and secondary outcome measures showed positive and significant CAMS effects on overall symptom distress, hope/hopelessness, and treatment acceptability. There was a non-significant impact in terms of CAMS on the primary outcome measures of suicide attempts/self-harm and for secondary measures of cost-effectiveness and other suicide-related correlates (e.g., self-esteem and resilience). While overall all outcomes in this meta-analysis favored CAMS when compared to control care, more data are needed to see if non-significant trending findings might reach significance. Beyond the noted primary and secondary outcomes, there were no significant differences between the use of CAMS with White versus non-White samples. Moreover, there was no apparent "publication bias" or "allegiance effect" linked to the developer of CAMS (DAJ). Given these results, Swift et al. concluded that CAMS is "well supported" as a clinical intervention for suicidal ideation as per the criteria of the Centers for Disease Control and Prevention (which is the designation for the highest level of empirical support). It should be noted that five of the previously discussed CAMS RCTs were used in the Swift et al. study and four additional non-randomized clinical trials of CAMS were also included in the nine-study meta-analysis.

CAMS training research

Pisani and colleagues (40) noted that training in CAMS has been recognized as one of only a handful of suicide-specific professional training approaches at the national level. Schuberg and colleagues (41) conducted an unpublished study of 165 CAMS-trained Veterans Affairs mental health providers and found significant ($p < 0.05$) before and after training differences related to decreasing clinician anxiety about working with suicidal risk and that training increased clinician confidence in the skills of assessing and treating suicidal risk. There were significant pre–post positive training findings related to clinicians' perceptions about increasing their skills related to forming an alliance with a suicidal patient, increasing patient motivation, and conducting safety planning. Most of these significant CAMS training pre–post effects were sustained in a 3-month follow-up assessment with a subset of the original sample ($n = 36$).

LoParo, Florez, Valentine, and Lamis (42) investigated a handful of suicide-focused trainings in the U.S. state of Georgia. The team studied 137 mental health providers who were varyingly trained in four suicide-focused approaches, namely, CAMS, DBT, Assessing and Managing Suicide Risk (AMSR), and Question, Persuade, Refer (QPR). The results of this investigation showed that the CAMS training—in comparison to other trainings—was significantly more impactful in terms of the outcome variable of "clinical confidence" to work with suicidal risk (i.e., CAMS instilled more confidence in providers than other trainings).

An online survey of 120 mental health practitioners conducted by Crowley, Arnkoff, Glass, and Jobes (43) found moderate to high self-reported adherence to the CAMS therapeutic philosophy, which was comparable to other studies gauging the impact of suicide-focused training. Participants further self-reported relatively high adherence to CAMS practice, which was higher than the findings on adherence to interventions for other issues.

Finally, there is an unpublished doctoral dissertation that investigated the "CAMS Integrated Training Model" (ITM) offered to 116 mental health professionals (44). The ITM

included a) didactic training using a 3-hour online clinical demonstration course, b) 1 day of experiential role-play training of the model, and c) six to eight consultation phone or video coaching sessions. The study showed good support for the ITM approach to professional training in CAMS. Statistical analyses of self-report assessments showed statistically significant improvements in clinician attitude, knowledge about CAMS and suicide, and the acquisition of clinical skills to use CAMS effectively to assess and treat suicidal risk following the training.

Dialectical Behavior Therapy

DBT was originally developed for chronically suicidal and/or self-injuring women meeting the criteria for borderline personality disorder (BPD). At the time of development in the 1970s and 1980s, Linehan reports being most interested in addressing the chronic suicidality found in individuals with severe problems regulating their emotional experiences (45). However, she also reports that she was told that in order to get funding from the National Institutes of Health, she needed to study chronic suicidality within a specific psychological disorder. She chose the condition of BPD because it is woefully underfunded and misunderstood. Since the original trial of DBT was published (46), it quickly became used and studied with a much broader target population than BPD and is often considered a transdiagnostic treatment.

Standard comprehensive outpatient DBT involves four modes of treatment delivered by a treatment team. These modes are individual therapy, skills training (usually conducted in a group format), as-needed intersession consultation between therapist and client, and therapist consultation team. These modes of treatment are delivered following a guiding set of assumptions and principles. Examples of assumptions that guide DBT delivery are as follows: "Clients are doing the best they can," "The lives of suicidal clients with borderline personality disorder are unbearable as they are currently being lived," and "Therapists treating suicidal clients need support." Examples of principles that inform DBT delivery are a set target hierarchy that guides therapists on what to address in any given session, the need to dialectically balance acceptance and change in strategies and problem solutions, and the importance of behavioral specificity in problem definition and solution. Individual therapy sessions are delivered by the primary therapist who is also responsible for suicide risk management, with assistance from consultation team members. Skills training sessions focus on teaching skills in four domains (mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance). Intersession phone coaching calls are designed to assist with skills generalization though are often also utilized to address suicide crisis. Therapist consultation team meetings function to improve therapist adherence to the DBT model, provide support, and reduce burnout.

One reason that DBT is often now considered a transdiagnostic treatment for individuals at risk for suicide is because its target hierarchy is informed by behaviors, in order of importance, rather than diagnostic "symptoms." The target hierarchy that informs DBT prioritizes "life-threatening behaviors." Life-threatening behaviors include suicide urges and crisis behaviors, suicide attempts, non-suicidal self-injury, and suicide ideation. This target hierarchy guides the therapist to focus on life-threatening behaviors as the top priority even if there is a myriad of other problems that the client is experiencing or prefers to discuss. The therapist applies behavioral principles (e.g., behavioral assessment and problem-solving), acceptance principles (via validation strategies and mindfulness practice), and dialectical principles (via modeling of a dialectical worldview which encourages "both and" thinking and use of dialectical strategies when polarization occurs) to affect change in target behaviors. Throughout the treatment, there is additional emphasis on getting an active commitment to not kill oneself and to stay in treatment.

Empirical support for DBT

There have been dozens of RCTs and quasi-experimental studies on DBT over the past 30+ years. Many of these studies have been focused on populations with suicide risk or behavior, but many have focused on other populations/target problems. For this review, there will be a focus on key RCTs that study the full model (all four modes) of DBT, meta-analyses, and training research and only include studies for which suicidal behavior was a primary focus. An exhaustive review of all DBT studies is beyond the scope and focus of our integrative discussion.

Key randomized controlled trials of DBT

Original DBT trial

Linehan et al. (46) conducted the first RCT of DBT. In this study, 44 women with borderline personality disorder and "parasuicidal[1]" behavior were randomized to receive 1 year of either DBT or TAU. The primary outcomes were self-harm behaviors [suicide attempts and non-suicidal self-injury (NSSI)], the severity of those behaviors, and the frequency and duration of psychiatric hospitalizations. Results indicated that DBT had greater decreases in all these outcomes compared to TAU (refer to Table 2 for the included DBT RCTs).

First DBT trial with an independent investigator

Early trials of DBT included Linehan as the investigator as well as trial therapist. In order to establish the effects of DBT as wide ranging, positive effects of the treatment must be determined by at least two different investigators [e.g (52)]. The first published RCT of DBT by an investigator other than Linehan was by Koons and colleagues (47). In this study, 28 women seen through the Durham VA Medical Center and who met the criteria for BPD were randomized to either DBT or TAU. Although history of suicidal

1 At the time of Linehan's original study and book publication, the term "parasuicidal" was used as an umbrella term to include behaviors with suicidal intent (e.g., suicide attempts) and behaviors with non-suicidal intent (e.g., NSSI). This term has since fallen out of favor.

TABLE 2 The included DBT RCTs.

Authors	*N*	Sample/setting	Study inclusion	Main outcomes
Linehan et al., 1991 (46)	44	Community sample, Seattle, WA	≥2 SA or NSSI behaviors in the past 2 years	Greater reductions in SA and NSSI severity, reductions in frequency and duration of psychiatric hospitalizations
Koons et al., 2001 (47)	28	Durham VA Medical Center outpatients, Durham, NC	Women veterans meeting the criteria for BPD[1]	Decreased SI, hopelessness, depression, and anger expression
Linehan et al., 2006 (48)	101	University of Washington clinic and community practice outpatients, Seattle, WA	Women meeting criteria for BPD, ≥2 SA/NSSI behaviors in the past 5 years (≥1 in 8 weeks prior to enrollment)	Reductions in SA, fewer psychiatric hospitalizations, fewer days of psychiatric hospitalization for SI, lower medical risk for NSSI behaviors
Linehan et al., 2015 (49)	99	University of Washington clinic and community practice outpatients, Seattle, WA	Women meeting criteria for BPD, ≥2 SA/NSSI behaviors in the past 5 years (≥1 in 8 weeks prior to enrollment), SA in the past year	Reductions in frequency and medical severity of SAs, reduced SI, increased use of crisis services; conditions with DBT skills training components saw more improvements in NSSI frequency
McCauley et al., 2018 (50)	173	Adolescent outpatients from four academic medical centers across Seattle, WA and Los Angeles, CA	≥1 lifetime SA, elevated past month SI, ≥3 NSSI episodes (≥1 in 12 weeks prior to enrollment)	Reductions in SAs, NSSI episodes, and self-harm episodes during and after treatment; decreased rates of self-harm episodes through 1 year of follow-up
McMain et al., 2009 (51)	180	Outpatients at the Centre for Addiction and Mental Health and St. Michael's Hospital, Toronto, CA	Meeting criteria for BPD, ≥2 SA/NSSI behaviors in the past 5 years (≥1 in 8 weeks prior to enrollment)	Both GPM and DBT saw reductions in frequency and severity of SAs, NSSI, ED visits, and psychiatric hospital stays; however, there was no difference between conditions

[1]Suicidal behavior was not an inclusion criterion; however, 75% endorsed ≥1 instance of self-injury.

behavior was not an inclusion criterion for this study, 75% of the participants endorsed at least one intentional self-injury episode. Results indicated that participants randomized to DBT had significantly greater decreases in suicidal ideation, hopelessness, depression, and anger expression. In addition, there was a trend for a statistically significant reduction in the number of intentional self-injury behaviors and hospitalizations for participants in the DBT condition; however, these were not statistically different from individuals in the TAU condition. Both of these earlier trials, while important in the initial establishment of DBT's potential, had small sample sizes and limited statistical power to detect differences. More studies with larger samples were then conducted.

DBT compared to treatment-by-experts

In order to demonstrate DBT's efficacy compared to a more stringent control condition and with a larger sample, Linehan et al. (48) randomized 101 women who met the criteria for BPD and were considered high risk for the suicide group. This was operationalized as inclusion criteria of at least two suicide attempts or self-injuries in the past 5 years, with at least one episode in the 8 weeks prior to enrolling. The treatment conditions were either DBT or "Community Treatment by Experts" (CTBE) which was developed specifically for this study. CTBE was conducted by clinicians who had been nominated by their community as experts in treating clients with difficult behaviors. CTBE was also designed to match DBT in terms of availability of treatment and supervision. Participants were provided up to 1 year of treatment and then assessed for 1 year of follow-up.

Results from this study indicated that DBT outperformed CTBE on most primary outcomes, including the number of suicide attempts (individuals in DBT were half as likely to make an attempt than in CTBE), fewer psychiatric hospitalizations, fewer days of hospitalization for suicide ideation, and lower medical risk for self-injurious episodes. This study was designed to overcome limitations of prior research on DBT as well as criticisms that DBT's effects were based solely on general factors of expert psychotherapy.

Component analysis study

In an effort to determine whether the full model of DBT is necessary or whether a less intensive (and therefore less expensive) treatment would be as efficacious, Linehan and colleagues conducted a component analysis study (49). The three treatment conditions were full model DBT, DBT skills training "only" which included weekly skills training plus non-DBT individual therapy, and DBT individual therapy "only" which included weekly individual therapy and non-DBT activity-based support group. All three treatments were designed to control for the amount of therapy received as well as for peer supervision/consultation. In addition, therapists in all three conditions were trained in the DBT crisis management protocol, given the high-risk sample. Participants included 99 women who met the criteria for BPD and had similar suicide risk inclusion criteria to Linehan et al. (48).

Results from the component analysis study indicated that all conditions result in similar improvements in frequency and medical severity of suicide attempts, suicide ideation, and use of crisis services. The two conditions with DBT skills training had statistically greater improvements in frequency of NSSI acts compared to the DBT individual therapy only condition. These results suggested that a variety of DBT interventions could be useful for reducing suicidal behavior. Complementing prior research that indicated that skills use is an important mediator of outcomes in DBT trials (53), interventions that included DBT skills training may be more effective than interventions without.

DBT for adolescents at risk for suicide

DBT for adolescents (DBT-A) had been developed by Miller, Rathus, and Linehan (54) and studied in a series of uncontrolled trials with generally positive effects. This multisite study (50), conducted in Seattle and Los Angeles, randomized 173 adolescents ages 12–18 (95% female subjects) to DBT or individual and group supportive therapy. Inclusion criteria were at least one lifetime suicide attempt; elevated past-month suicidal ideation; at least three self-injury episodes, with 1 in the 12 weeks before enrollment; and three or more borderline personality disorder criteria. In the DBT-A condition, as per the manual, skills training sessions included at least one parent/caretaker for each child with the purpose of teaching parents the skills as well.

The primary outcomes for this 6-month treatment trial were suicide attempts, NSSI episodes, and total self-harm episodes. Results indicated that DBT had significantly better outcomes on all of these variables at post-treatment. Specifically, adolescents in DBT were less likely to have a suicide attempt, NSSI episode, or self-harm behavior during treatment, and rates of self-harm decreased through a 1-year follow-up period. However, these treatment differences disappeared by 12 months as both groups improved over time. This was the first adolescent RCT of DBT that demonstrated DBT's efficacy at reducing suicide attempts in this high-risk group.

Largest RCT of DBT

To date, the largest RCT of DBT has been conducted by McMain and colleagues (51) in Canada with 180 participants randomly assigned to treatment. This study was largely designed as a replication study of Linehan (48) with similar inclusion criteria. One exception is that the study included men and women, though men comprised just 14% of the sample. The control condition in this study was General Psychiatric Management (GPM) which was based on the APA Practice Guideline for the Treatment of Patients with Borderline Personality Disorder (2001) and was comprised of case management, psychodynamically informed therapy, and medication management delivered by expert psychiatrists.

In contrast to the other RCTs reviewed here, the McMain et al. (51) study did not find differences between the two conditions on primary outcomes. Both groups demonstrated significant reductions on frequency and severity of suicide attempts and non-suicidal self-injury as well as reductions in emergency room visits and psychiatric hospital days. This study indicated that individuals with BPD and suicidal behavior can benefit from structured, well-specified treatment.

Meta-analyses of DBT

A number of meta-analyses have been conducted on DBT. Included here is a summary on two that focused on comprehensive DBT's effects on suicidal behavior specifically.

Meta-analysis on 18 DBT trials

DeCou et al. (55) conducted a meta-analysis on 18 trials of DBT that assessed self-injury and suicidality, including suicide attempts, NSSI, suicidal ideation, and access of psychiatric crisis services. The meta-analysis only included studies that compared DBT to TAU or wait-list control, thus removing any studies with more active control conditions. Results indicated that DBT reduced self-directed violence (suicide attempts and NSSI) and reduced the frequency of psychiatric crisis services. This meta-analysis did not find an effect of DBT with regard to suicide ideation.

Meta-analysis on DBT for adolescents in 21 studies

Kothgassner et al. (56) included 21 studies in this meta-analysis of DBT outcomes for adolescents ages 12–19. The meta-analysis included only studies that reported outcomes for self-injury and/or suicide ideation and included individuals with a history of at least one suicide attempt or self-injury episode. The sample of studies was comprised of five RCTs, three controlled clinical trials, and 13 pre–post evaluations. Results indicated that DBT demonstrated small to moderate effects for reducing self-injury and suicide ideation, compared to control conditions.

DBT training research

Given the inherent complexity of DBT, there has also been interest in the development and evaluation of training methods. The gold standard method of training clinicians in DBT is the "Intensive" model which typically takes the form of two 5-day trainings spaced approximately 6 months apart that is attended by teams of clinicians (as opposed to clinicians attending on their own). A study on the adoption of DBT following intensive training with 52 teams found that 75% of the teams adopted all four DBT modes by 8 months after training (57). The adoption of more modes of DBT was predicted by lower training needs and program needs, fewer bachelor's-level clinicians, and greater prior DBT experience. This study suggests that programs/teams with more resources and fewer stressors can more readily adopt the full model of DBT.

Another method of training that has received some attention is the training of clinicians while still in graduate programs. Given that DBT is a complex treatment that requires significant knowledge with principles of behaviorism, it could be that teaching clinicians early in training through their university training clinics may be an optimal time to learn the treatment. Indeed, in a study conducted at the Dialectical Behavior Therapy Clinic at Rutgers University (DBT-RU), it was found that therapist trainees delivering DBT could achieve similar outcomes to a benchmarked gold-standard RCT (58). The growing demands for a workforce that can deliver DBT with competence and adherence to the model suggest that targeting individuals while still in graduate school may be effective for increasing access to DBT.

Clinical trials using both CAMS and DBT

As noted, there have been RCT efforts to investigate CAMS and DBT together. The aforementioned Danish DiaS RCT was an initial effort to compare DBT and CAMS within a superiority RCT with a

population that would be optimally suited for DBT because the patients in the trial had made suicide attempts and had borderline personality disorder features (21). In this study, both treatments were proven effective in decreasing primary outcome variables of suicide attempts and self-harm with data trending in favor of CAMS (even while the "dose" of CAMS was much less, e.g., 10 sessions once per week vs. 16 sessions of twice per week meetings).

As previously noted, Pistorello and colleagues (32) pursued a feasibility SMART design to explore eight sessions of CAMS vs. eight sessions of TAU in stage 1. For those who insufficiently respond to stage 1, a second stage 2 randomization occurred to either more CAMS (up to 16 weeks) or DBT (up to 16 weeks). Funded by the NIMH, there was not enough grant support to fully populate the SMART design and only 12 clients were randomized to stage 2 which was too small a sample to analyze. Phase 1 results only were thus published showing that CAMS was significantly more effective than TAU in terms of the primary outcome of suicidal ideation and the secondary outcome of depression. However, in an interesting moderator analysis, TAU was generally more effective than CAMS for patients in this trial who had multiple suicide attempt histories and borderline features. This finding is consistent with the extensive evidence base highlighting the therapeutic superiority of DBT with more chronic, dysregulated, multiple attempting individuals [e.g (12, 55, 59)]. An alternative moderator finding was that, in clients who were "newer" to suicidal ideation with no attempt history or borderline features, CAMS significantly decreased a secondary outcome measure of hopelessness when compared to TAU. In other words, the notion "one size does not fit all" seems to emerge from these preliminary RCT findings [refer to (60)].

In an effort to fully test the SMART design, the National Institute of Mental Health funded a multisite study using four university counseling centers in the United States (University of Oregon, University of Nevada–Reno, Duke University, and Rutgers University). At the time of this writing, the "Comprehensive Adaptive Multisite Prevention of University Student Suicide" (CAMPUS trial) is in the final year of data collection in which 480 students will be randomized to stage 1 of eight sessions of CAMS vs. eight sessions of TAU, followed by stage 2 randomization for non-responders to either eight more sessions of CAMS or eight sessions of Counseling Center DBT (CC-DBT). This ambitious trial was directly impacted by the COVID-19 pandemic in 2020 which resulted in two feasibility trials in which training and delivery of all study treatments were performed online with notable success (61).

The use of CAMS and DBT within contemporary clinical practice

Beyond the clinical research focus, there are examples of the routine use of CAMS and DBT within day-to-day contemporary clinical care. At the anecdotal level, we have seen success with the sequencing of care wherein CAMS might be used initially to stabilize a patient in relation to suicide from which they can progress into intensive DBT. Even within the earliest RCT of CAMS, some of the best outcome cases were the ones where patients received eight sessions of CAMS and then referred to intensive DBT within the DBT-rich environment of Seattle, Washington (20).

The Hope Institute

The clearest example of the combined clinical use of CAMS and DBT is The Hope Institute (THI). Founded by Derek Lee in Perrysburg Ohio, THI is an outpatient clinical setting where adults and youth who are suicidal are seen with a singular clinical goal of *stabilization*. Given the known limits of emergency department care and inpatient care (11), THI offers a major and compelling alternative model to the routine use of these more restrictive medically oriented settings. The THI model embraces a next-day-appointment (NDA) approach to clinical care and patients can be seen intensively (up to four times/week). All patient in the THI receive CAMS that might be supplemented by the DBT skills group. In terms of clinical THI outcomes, youth have been stabilized in 5.5 weeks, and adults are typically stabilized in 6 weeks. Patients are able to maintain their stability until they are engaged in ongoing outpatient care (62).

Based on the success of the Perrysburg setting, three new Hope Institutes are in various stages of development and use. One is providing care in the Chandler School District of Arizona (seeing high school and middle school teens who are suicidal), another is seeing patients at a children's hospital in Georgia, and a third clinic is now being initiated in Boulder, Colorado. There is interest in establishing more such clinics offering a major alternative approach to working with suicidal risk on an outpatient basis. Based on the Perrysburg model, the system can be self-sustaining and increased fees can be negotiated with healthcare plans secondary to the savings from not relying on expensive restrictive medical care. Staff morale at THI is high and clinicians receive better salaries than they would otherwise receive in community mental health agencies. Relying on team support and clinical consultation, THI is doing important and innovative evidence-based clinical care with adult and youth patient at risk for suicide.

Discussion

Suicide is a major public health and mental health challenge around the world. There are many costs associated with suicidal suffering for both patients and their loved ones. It is well known that mental health providers are challenged by patients who have suicidal thoughts and behaviors, and in the United States, there is fear of malpractice liability should there be an adverse clinical outcome. Given these considerations, there is a strong need for clinical interventions that will effectively treat suicidal risk, and there has been considerable progress over the past three decades to this end. There are now a handful of suicide-related clinical treatment approaches proven to be effective with the support of randomized clinical trials that reliably replicate therapeutic outcomes (with independent validations). We have thus reviewed two clinical approaches that rise to the highest level of clinical trial

rigor. CAMS and DBT now have extensive RCT and meta-analytic support, and there is also further research support for training in these respective approaches. We have also noted emerging developments in the use of CAMS and DBT within routine clinical practice.

Going forward, the next steps for further increasing the use of CAMS and DBT will be shaped and ultimately defined by current ongoing clinical trial research and ever-evolving clinical practices within contemporary mental healthcare. As discussed by Jobes (11), the advent of the "988 Suicide & Crisis Lifeline" in the United States is now creating an increasing awareness related to emotional crises and suicidal risk. As governments around the world endeavor to enhance crisis services with crisis lines and centers, there is increasing awareness that we must go beyond an acute crisis-only approach with a clear need to *treat* what causes suicidality (63, 64).

Moreover, as discussed by Jobes and Chalker (60), there will likely never be a "one size fits all" treatment approach for suicidal risk across different populations and settings. Accordingly, we contend that the adherent use of CAMS and DBT separately, sequentially, or perhaps even together offers a compelling and complementary approach for clinically addressing suicidal risk. Along these lines, Ronald Kessler's notion of "precision treatment rules" might one day enable us to rely on machine learning-generated algorithms to route appropriate patients to proven evidence-based treatments for whom they are optimally suited for effective care as well as saving treatment costs (65). We would finally note that the best approach to treating suicidal risk—and decreasing liability—is to use proven clinical practices that are shown to effectively treat suicidal risk. Given the proven efficacy of CAMS and DBT, there is considerable promise in being able to provide both of these clinical approaches for effectively treating the spectrum of suicidal risk (from acute suicidal ideation to chronic states with a history of multiple suicide attempts), thereby reducing suicidal suffering and related behaviors across patient populations and clinical settings.

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Conflict of interest

DJ is founder and co-owner of CAMS-care, LLC a professional training and consultation company.

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Suicidal ideation following internet-delivered tailored CBT for depression – a secondary analysis of a factorial design trial

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Introduction: Suicidal ideation is common in major depressive disorder (MDD) and a risk factor for suicidal behavior. Although it can be reduced with psychological treatments, the risks often make clinicians hesitant to offer treatment. This concerns remote treatment options, such as internet-delivered cognitive behavior therapy (ICBT), which may be considered unsafe. Although previous studies indicate that ICBT can reduce self-reported suicidal ideation both as primary and indirect treatment target, questions remain about under what circumstances ICBT can be offered as the primary treatment. In this secondary report, we investigated the importance of different treatment factors in reducing suicidal ideation via ICBT, including different kinds of therapist support.

Methods: We analyzed data from 197 participants from a factorial trial of ICBT for symptoms of MDD. Before inclusion all participants completed a structured clinical interview where obvious suicidal intent lead to exclusion. Suicidal ideation was assessed at pre- and posttreatment using one item of the PHQ-9 and one from BDI-II. The data were analyzed using generalized linear models.

Results: The pre- to posttreatment comparisons showed decreases in the reporting of suicidal ideation. Findings were consistent across the two measures that was used. There was no effect of support format and content tailoring.

Conclusions: The findings suggest that ICBT can help alleviate suicidal ideation even when it is not the focus of the treatment. This was the case regardless of mode of therapist support, who tailored the treatment content, and if case supervision was available or not.

KEYWORDS

iCBT, suicidal ideation, depression, internet intervention, factorial trial

1 Introduction

Suicidal ideation (SI) is a common symptom among those suffering from major depressive disorder (1), and serves as a risk factor for subsequent suicide attempts (2). Because of the risks linked to SI, it has been described as an essential intervention target (3).

Psychological treatments are an option for decreasing SI and suicidal behaviors, both as a direct target and indirectly via treating other forms of psychopathology (e.g., major depressive disorder). Méndez-Bustos et al. (4) noted that a range of different psychotherapeutic approaches have been used to reduce SI and other suicidal outcomes, including Cognitive Behavior Therapy (CBT), Dialectal Behavior Therapy (DBT), and Interpersonal Psychotherapy (IPT). CBT is based on altering behaviors and one's stance towards thoughts and internal sensations as a means of treating psychopathology (5). In the treatment of SI, CBT relies on strategies such as challenging biased thinking and suicidal cognitions, as well as behavioral strategies such as relaxation techniques (6). A later umbrella review (7) reported a significant, albeit small, average reduction in SI following CBT with the authors mentioning scalability as an important advantage. However, some questions remain. For example, Mewton and Andrews (6) noted that there is still insufficient evidence that CBT reduces SI when it serves as an indirect target. Because of the inconclusive evidence up to this point, additional studies are needed.

Another consideration when treating SI is how the treatment can be delivered in an effective, safe, and accessible manner. Internet-delivered cognitive behavioral therapy (ICBT) can be useful for this purpose as it is more easily accessible than alternative contact modes, can be offered anonymously, and can reduce concerns about stigma associated with SI (8). ICBT is a form of self-help, with psychoeducation and practical strategies delivered via a web platform or an app (9). The treatment content is often delivered in a modular fashion, much like how regular CBT sessions cover different topics and assignments over the course of a treatment. It is frequently delivered with asynchronous guidance from a clinician. Among the advantages are that ICBT and internet interventions in general can reduce costs and bridge distances to specialist clinics. However, ICBT also comes with challenges, such as the lack of face-to-face contact with a clinician. Due to this, clinicians may be reluctant to offer ICBT in the presence of SI, despite the support for ICBT when treating several mental and somatic health problems (10). More specifically, internet-delivered cognitive behavioral therapy (ICBT) is effective for reducing symptoms of depression (11), and can be as effective as face-to-face CBT (12). In relation to parasuicidal outcomes, ICBT has been found to produce small but statistically significant reductions in suicidal ideation when it serves as the primary target for the treatment (13). Importantly, results of some trials investigating ICBT for depression have reported reductions in SI, suggesting that the treatment does not need to target SI directly (14, 15). Rather, in cases with less severe and persistent forms of SI, ICBT could be a viable treatment option that addresses both SI and other symptoms of depression. However, not all studies show secondary benefits of ICBT for depression on measures of SI. Helen et al. (16) did not find within-group reductions of SI following ICBT, regardless of whether the participants had received therapist support or not. Additional studies would be helpful to help clarify the effects of ICBT for SI, in particular when SI is not the primary treatment target.

Another consideration is whether there are factors related the treatment that can improve the effects and make it more suitable for certain populations. One example is the presence of weekly therapist support that has been linked to better treatment outcomes and better adherence compared to not having such support available on a weekly basis (17). Another example from an open study and two factorial design trials is the choice of treatment content and allowing participants to choose the content themselves compared against therapists making the choice (18–20). Investigations into factors such as these could be of importance from a decision-making standpoint as they offer information about what kind of treatment structure that offers the best chance of improvement for people seeking help.

The current study sought to expand on previous studies investigating the efficacy of internet-delivered CBT for depression in reducing suicidal ideation. More specifically, the primary aim of this secondary report was to investigate both the general effects of ICBT on SI, but also other factors relevant to the effects of ICBT for SI. These included the kind of therapist-guidance that was offered, decisions on treatment content, and the availability for case supervision for therapists guiding the participants through the treatment. Based on prior studies of similar treatments, it was hypothesized that suicidal ideation would decrease overall during the treatment. For the treatment factors, we wanted to explore whether the on-demand approach to guidance produced similar reductions in SI to the standard way of providing weekly guidance that is often used in regular care settings. Likewise, we were interested in whether participants receiving the option to tailor their own treatment had similar reductions in SI compared to the usual way of having the therapist tailor the content of the intervention. Lastly, we were interested in whether the availability of supervision for the therapists was important for the treatment's ability to reduce SI. The analyses of treatment factors were conducted in an exploratory manner with no directional hypotheses regarding which condition that would perform better.

2 Materials and methods

The current study was a secondary analysis of a trial that has been described in detail in a previous article (19). The project received ethical approval from the regional ethics board. All participants provided informed consent before registering for the study.

2.1 Design

The trial was a randomized factorial trial in which the included participants were randomly assigned to one of eight conditions based on three different factors/independent variables. First, participant could receive either regular, once-weekly therapist support or have the option to request therapist support (referred to as on-demand support). Second, participants could either have the content of the intervention tailored for them by a therapist, or tailor it themselves. Third, the therapist assigned to the participant could either be eligible to receive supervision for the case or not. All participants began

treatment at the same time but had different combinations of the independent variables in a balanced factorial design.

The treatment lasted for 10 weeks. During this time, participants received access to modules covering psychoeducation and strategies for dealing with depression and comorbid anxiety disorders (e.g., panic disorder), and transdiagnostic problems (e.g., perfectionism). The full content of the program is described in the original article (19). Treatment modules included exercises specific to depression (e.g., behavioral activation), more generic and transdiagnostic CBT principles (e.g., cognitive restructuring, gradual exposure, applied relaxation), and problem-specific treatment components (e.g., insomnia, stress). None of the modules dealt with suicidal ideation explicitly. Participants in the therapist-tailored condition received eight modules on average, while those with self-tailored content could select as many or as few modules as they wanted (but were instructed that eight modules was the average pace).

2.2 Recruitment, inclusion, and exclusion criteria

Detailed information about the recruitment procedure is presented elsewhere (19). Briefly, trial recruitment took place via multiple sources, including via social media posts and posters in primary care settings around Sweden. The study information specified that we were looking to recruit participants that experienced low mood and other symptoms of major depressive disorder. Prospective participants would register on the study website and fill in a screening. They would then complete a structured clinical interview (MINI 7.0; 21) before a decision on inclusion/exclusion was made. The inclusion criteria stated that the participant had to 1) be 18 years old or older, 2) meet the criteria for major depressive disorder or unspecified depressive disorder, 3) have elevated symptoms of major depressive disorder on the Patient Health Questionnaire-9 (PHQ-9; a sum score of at least 5) and/or Beck Depression Inventory, version two (BDI-II; a sum score of at least 10), 4) have access to the internet and a device with a web browser, 5) sufficient proficiency in Swedish, 6) no other ongoing psychotherapy and, if using psychotropic medication, a stable dose for the past three months. Participants were excluded if they a) had an active substance use problem, b) had severe psychiatric problems (e.g., anorexia nervosa) that could not be managed within the framework of the study, or c) expressed suicidal plans or preparations. The last criterion was assessed using the questions regarding suicidal ideation and suicide on the MINI 7.0. In total, seven participants were excluded for this reason. A total of 197 participants were included. All included participants were randomized by an independent party not involved in other parts of the project. A complete flowchart of the recruitment process can be seen in Figure 1 of the article reporting on the primary outcomes (19).

2.3 Outcome measures

Two items were used to assess the prevalence and frequency of suicidal ideation. First, we used item nine from the Patient Health Questionnaire (PHQ-9; 22) which asks the respondent to indicate how often they have been bothered by "thoughts that you would be better off dead or of hurting yourself in some way?". Responses are given on a four-point scale with the alternatives being Not at all (scored as 0), Several days (1), More than half of the days (2), and Nearly every day (3). Second, we also used an item from the second iteration of the Beck depression inventory (BDI-II; 23) which asks the participant to indicate the prevalence and severity of suicidal ideation and suicidal intent. The responses given are either I do not have any thoughts of killing myself (scored as 0), I have thoughts of killing myself, but I would not carry them out (1), I would like to kill myself (2), and I would like to kill myself if I had the chance (3). Both measures were administered before and after the active treatment phase.

2.4 Statistical analysis

Statistical analyses were conducted using R (24). The intention-to-treat was used across all analyses. An alpha level of.05 was used for statistical inferences and 95% confidence intervals are reported. A Fisher's exact test was used to test the relationship between the presence of suicidal ideation at the pre-treatment timepoint and the likelihood of having missing data at the posttreatment timepoint.

To assess the change in suicidal ideation during the treatment phase we specified two generalized linear models using the *glm* function in R. For each model, we were interested in the change over time (from pre-treatment to posttreatment), and the interaction between time and each of the three factors outlined above (who tailored the treatment, which kind of support that was provided, and if case supervision was allowed for the specific participant). The factors were coded as: -0.5 = therapist-tailored content, 0.5 = self-tailored content, -0.5 = scheduled therapist support, 0.5 = on-demand support, -0.5 = case supervision available, 0.5 = case supervision not available. The models also estimated the higher order interactions. With the non-normal distribution of responses in mind, we specified a logistical regression using the binomial family argument. For the responses on item 9 of PHQ-9, we recoded the few responses with a score of 2 and 3 as a score of 1, thus creating a dichotomous outcome for use in a logistical regression analysis. For item 9 of the BDI-II, the responses were already exclusively scored as 0 or 1, meaning that no recoding was necessary. Across both outcome measures, a score of 0 indicate no suicidal ideation and 1 indicate the presence of suicidal ideation. In addition to these main analyses, we also explored whether gender moderated the general treatment effect (via a time * gender interaction). For these analyses, gender was coded as -0.5 = woman, 0.5 = man.

3 Results

The demographics of the sample are described in Table 1. Overall outcomes from the trial have been summarized in Andersson et al. (19). Missing data at the posttreatment timepoint was not significantly related to the presence of suicidal

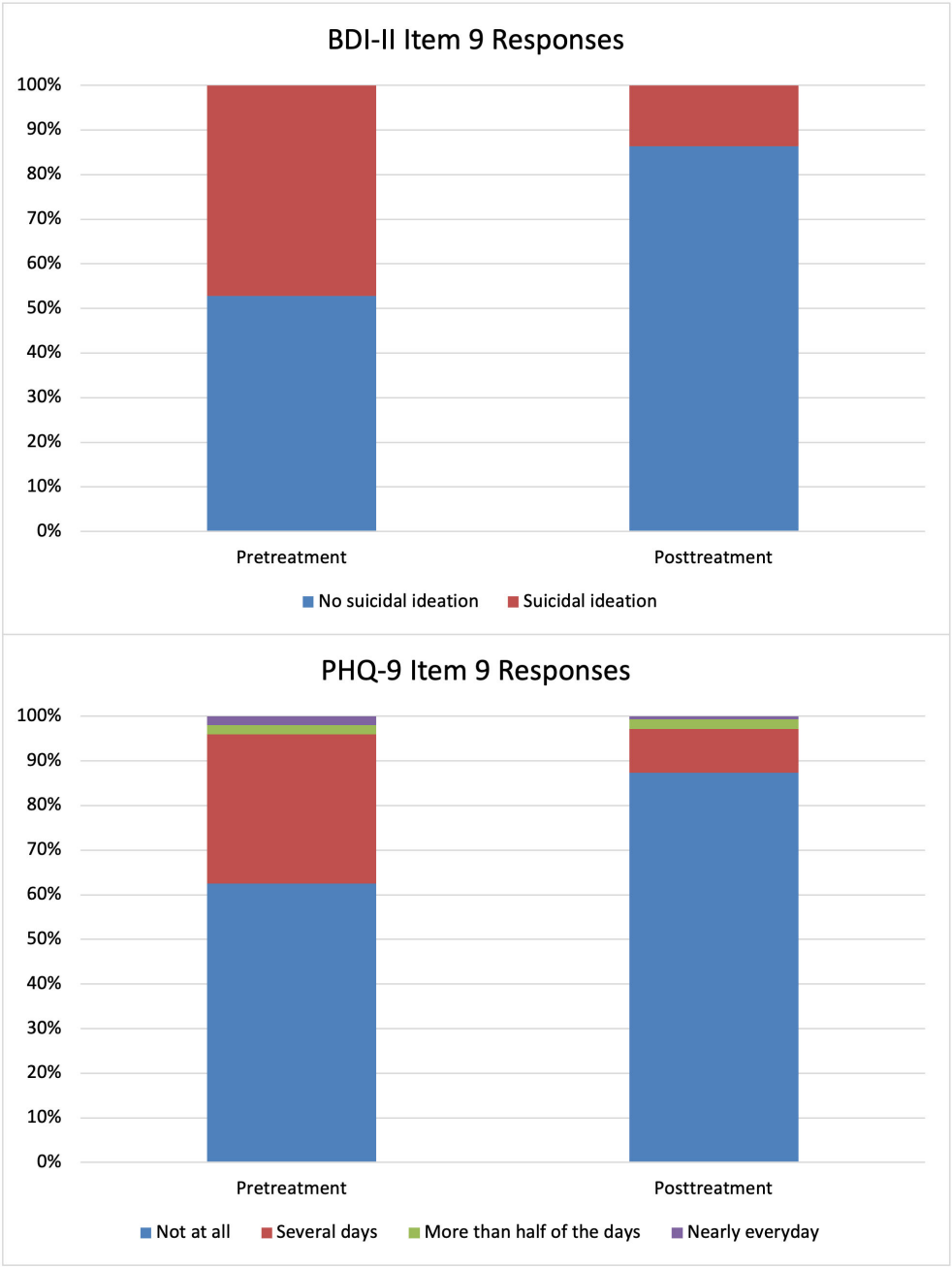

FIGURE 1
Proportion of Participants with Suicidal Ideation Before and After Treatment.

ideation at pre-treatment, Fisher's exact $p = .211$ for item 9 on the BDI-II and .626 for item 9 on the PHQ-9.

3.1 Prevalence and change in suicidal ideation

The percentages of participant indicating that they experienced suicidal ideation according to the items of PHQ-9 and BDI-II can be seen in Table 2. Estimates from the generalized linear models are available in Table 3. The prevalence of suicidal ideation in the sample and the change over time is visualized in Figure 1. Both the observed percentages and the model coefficients indicated a reduction in suicidal ideation during the treatment phase. The odds ratios for both outcome measures showed a significantly reduced risk of experiencing suicidal ideation at the end of the treatment compared to before the start of the study. For both the BDI-II item and the PHQ-9 item, neither of the three factors predicted an increase or decrease in suicidal ideation. None of the higher order interactions were statistically significant.

TABLE 1 Demographic characteristics of the sample (n = 197).

	M	SD
Age	34.59	13.19
Gender	***n***	**%**
Female	152	77.2
Male	44	22.3
Other	1	0.5
Educational level		
Primary school	3	1.5
High school	28	14.2
Vocational education	17	8.6
University (ongoing)	63	32
University (finished)	86	43.7
Current psychotropic medication: *% yes*	30	15.2
Prior psychological treatment: *% yes*	105	53.3
Somatic illness: *% yes*	10	5.1

3.2 Gender differences for changes in suicidal ideation

The results from the exploratory analyses indicated that the change over time in SI did not differ between women and men according to the BDI-II item, estimate = 0.91 [95% CI -0.34, 2.11], SE = 0.62, p = .145, OR = 2.47 [95% CI 0.73, 8.35]. The same was true for the PHQ-9 item, estimate = 0.95 [95% CI -0.35, 2.20], SE = 0.65, p = .141, OR = 2.58 [95% CI 0.73, 9.14].

4 Discussion

The results in this study are in line with previous trials indicating that suicidal ideation decrease following treatment with CBT more generally (25), and ICBT more specifically (14, 15). The findings from this factorial design trial support the idea that less severe SI can be treated within the context of a more generic version of ICBT for depression without the need for elements tailored specifically for SI. This finding is promising as ICBT has been suggested to fit some important needs of people burdened by SI, including the potential for anonymity and widespread availability (8). It also serves as an additional indication of the usefulness of non-SI specific treatments for reducing SI, which is an approach to this problem for which more evidence is needed (6). It should be noted that severe SI did serve as an exclusion criteria, which means that the potential of the treatment to help populations with more severe symptoms remains unknown. However, in populations with less severe depressive symptoms and SI, the findings support the use of ICBT.

TABLE 2 Percentages of participants in the sample with suicidal ideation at the pre- and posttreatment treatment timepoints.

	Pretreatment	Posttreatment
PHQ-9 Item 9	**% (n)**	**% (n)**
Not at all	62.4 (123)	87.3 (124)
Several days	33.5 (66)	9.9 (14)
More than half of the days	2 (4)	2.1 (3)
Nearly everyday	2 (4)	0.7 (1)
BDI-II Item 9	**% (n)**	**%**
I do not have any thoughts of killing myself	52.8 (104)	86.3 (120)
I have thoughts of killing myself, but I would not carry them out	47.2 (93)	13.7 (19)

PHQ-9, Patient Health Questionnaire 9; BDI II, Beck Depression Inventory II.

We found no difference in the reductions between participants who received scheduled support versus those who had support on-demand. This is important as it shows that the efficacy of ICBT in reducing is SI may not be dependent a specific support format and that the treatment can be effective when delivered with less therapist-intense forms of guidance. The latter point is reminiscent of the findings reported by Watts et al. (15), who also reported decreases in SI while not utilizing weekly, regular therapist support. The findings from our present study could also be taken as an additional indication of the utility of the on-demand support format in general, which has also been found in a study on social anxiety disorder (26) and in transdiagnostic treatments for symptoms of anxiety and depression (27). Given the comparable efficacy and the additional time-efficiency relative to weekly, regular scheduled support, support on-demand could be of importance in future efforts of implementing and disseminating similar types of treatment.

The lack of a difference in the efficacy between self-tailored and therapist-tailored module content differs from the small but statistically significant effect reported in the original article on BDI-II ratings (19). Overall, this difference could not be expected to be relevant for SI as a module on SI was not included. The reduction of SI in our sample is comparable to other similar interventions that also primarily focus on reducing depressive symptoms, rather than focusing on SI (15). An aspect to investigate in future studies is whether the addition of a module focused specifically on SI could further improve the effects of the intervention.

4.1 Strengths and limitations

The strengths of the study include the use of two outcome measures for measuring suicidal ideation, which allows for more robust conclusions on the reductions in SI. However, the findings should also be interpreted with the methodological limitations in mind. First, although participants were randomized to different conditions, neither of these served as a no treatment/placebo control group. This limits the causal conclusions about the impact of the treatment. The lack of an untreated group to compare against means that we cannot rule out that the observed

TABLE 3 Coefficients and odds ratios for the generalized linear models.

Outcome	Coeff.	95% CI	SE	*p*-value	OR	OR 95% CI
BDI-II Item 9						
Time	-1.98	-2.71, -1.36	0.34	<.001	0.14	0.01, 0.37
Time X Choice	-0.68	-2.08, 0.63	0.67	.312	0.50	0.12, 1.88
Time X Support	0.00	-1.39, 1.32	0.67	1	1.00	0.25, 3.75
Time X Supervision	0.00	-1.36, 1.36	0.67	1	1.00	0.26, 3.88
PHQ-9 Item 9						
Time	-1.62	-2.35, -1.00	0.34	<.001	0.20	0.10, 0.37
Time X Choice	-0.50	-1.89, 0.81	0.67	.458	0.61	0.15, 2.25
Time X Support	0.29	-1.07, 1.65	0.67	.668	1.34	0.34, 5.18
Time X Supervision	-0.11	-1.47, 1.25	0.67	.874	0.90	0.23, 3.50

change in SI was due to factors that did not relate to the treatment, such as a natural decline over time during the treatment period. Other potential explanations include regression to the mean, where extreme values are less likely to occur with repeated sampling which could cause the illusion of a symptom decrease. Finally, the lack of an active control group that receives access to the general treatment procedure also makes it more difficult to conclude that it was the CBT content that reduced SI, and no other non-treatment factors such as contact with a therapist or the measurements procedures during the study. The fact that we did not observe a difference between those that that received weekly support and those that received support on-demand (which was asked for infrequently) do suggest that the support itself might not have been the important ingredient, but other factors could still have played a role. Second, the exclusion criteria also limit the generalizability of the findings as too severe suicidal ideation would have served as an exclusion criterion. Indeed, seven participants in the original trial were excluded due to suicidal intentions (details provided in 19), and it is unknown whether these individuals would have experienced the same reductions in SI during the treatment that we saw for the included participants. Because of this, the conclusions from the present study may not generalize to populations with more severe forms of SI, including plans for suicide.

5 Conclusions

Overall, the results of the trial are in line with previous studies that suggests that ICBT for depressive symptoms reduces the self-reported prevalence of suicidal ideation. This finding supports the notion that less frequent and severe forms of suicidal ideation can be treated within the context of ICBT and should not serve as an exclusion criterion for this kind of treatment. The study also adds to the field by providing an additional indication that this decrease in suicidal ideation is not contingent on scheduled therapist support, but that reductions also occur when the support is provided on-demand. This is encouraging from an implementation standpoint as this support format requires less time, thus potentially allowing for the rolling out of similar treatments even with a scarcity of trained therapists. Neither of the other treatment factors exhibited a significant difference, further supporting the potential for flexible applications of the treatment format.

Data availability statement

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

Ethics statement

The studies involving humans were approved by the ethics committee at Linköping University. 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

AK: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. GA: Conceptualization, Investigation, Writing – review & editing.

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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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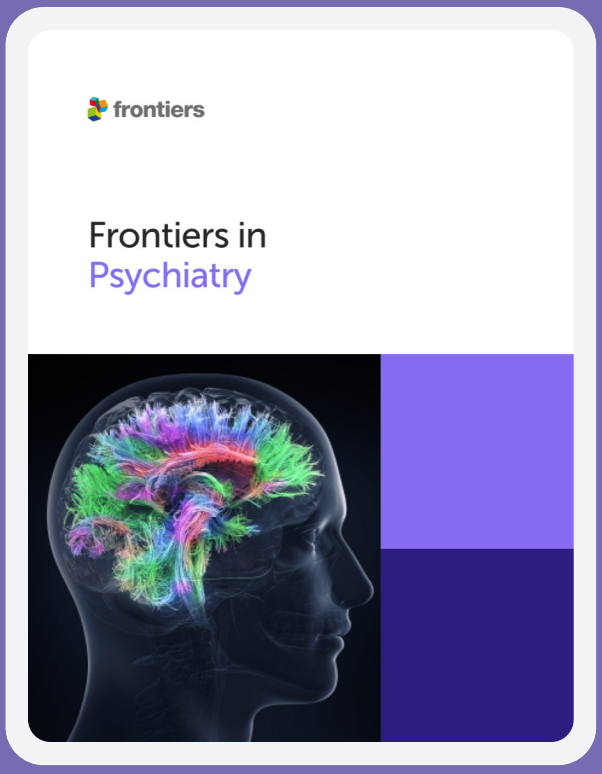

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