Research Topics

Non-biomedical perspectives on pain and its prevention and management

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Editorial: Non-biomedical perspectives on pain and its prevention and management

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Editorial on the Research Topic
Non-biomedical perspectives on pain and its prevention and management

Introduction

Overreliance on the biomedical paradigm has contributed, in part, to overuse of surgery and long-term drug medication with harmful physical, psychological, social, and economic consequences. Research is dominated by a tissue-centric biomedical view of pain at the expense of a holistic first-person *experience* of living with pain in communities of people habiting modern-world settings. Pain practice seems overly consumed with the burden of pain at an individual level (patient-centred pain management) and has neglected exploration of societal level (community-centred) or environmental level (ecologically-centred) solutions.

This Research Topic acknowledges that the biomedical paradigm does not provide a complete understanding of pain by focussing attention upstream towards the role of the environment in fashioning the experience and impact of pain on health. Research methodologies from non-biomedical disciplines can explore social, cultural, economic, political, and environmental conditions that influence the living experience of pain in the modern era. Investigating the phenomenon of pain using socio-ecological frameworks provide opportunities to shift perspectives and open-up new avenues for exploration, including innovative strategies to reduce the burden of pain on society.

The purpose of this Research Topic is to broaden and deepen the conceptual understanding of pain in the modern era by showcasing contributions from non-biomedical disciplines. This includes exploration of the concept of painogenic lifestyles and environments, and non-medical strategies targeting living well with, and recovery from, pain at individual, community, or population levels. Our desire is to catalyse scholarly conversation about the interplay between individuals, society, and ecosystems to gain a better understanding of the phenomenon of pain and to inform future healthcare research, practice, and policy.

The Research Topic is deliberately broad in scope to encourage cross-fertilisation of scholarly disciplines from the humanities and the sciences, e.g., social, natural, formal, and applied. We encouraged articles that offered novel perspectives and invited contributions from Anthropology, Behavioural sciences, Ecology, Evolution, Health promotion, History, Politics, Philosophy, Sociology, Socio-economics, Spirituality, the Arts, and Theology. We accepted seventeen articles, both theoretical and empirical, that cover topics not normally visible in conventional pain science literature including ecology, language, salutogenesis, art, emotional memory, and temporality. Contributions offer viewpoints that curiously and critically explore biomedical dogma to provide a broader and deeper understanding of pain and its persistence within the complex socio-ecological milieu of modern life.

Overview of contributions

A socio-ecological model for pain

Many of the perspectives offered by the contributions are encapsulated in a socio-ecological model of pain presented in the article by Johnson and Woodall and reproduced here in Figure 1.

Johnson and Woodall contend that viewing pain through an evolutionary mismatch lens can reveal insidious "upstream" forces that create painogenic environments (1) and structural barriers to hinder recovery from episodes of pain, i.e., making pain "sticky" [*q.v.* Borsook et al. (2)]. Johnson and Woodall's socio-ecological model reveals how the biomedically dominant explanatory language of pain bonds upstream forces into a cohesive narrative that primes society about the meaning, prevention, treatment, and management of pain; a type of "social glue". The contribution by Paley et al. that appraises critiques of the writings of people living with pain during the mid (high) to late Medieval Period (c. 1,000–1,500 AD) reveals how pain was a "shared experience". Paley et al. argue that sharing of personal stories is a fundamental human attribute to foster social cohesion, and that the dominant biomedical narrative of modern living may be preventing people from connecting with a sense of self and their social world.

Pain and language

The contribution by Van Rysewyk offers perspective on the role of language about pain, motivated by the 20th century Austrian philosopher Wittgenstein (3). Van Rysewyk reveals how the use of the word "pain" is "…linked to participation in a social milieu where specific rules are learnt for the regulation of concepts" and that "pain is not merely a "raw feel"…" but rather a social construct which is learnt and refined throughout life. Consequently, disagreements between health care professionals about the nature (diagnosis) of a person's pain should be recognized as the "indefiniteness" of pain.

The contribution by Johnson et al. explores pain through the perspective of linguistic relativity, as described by Lakoff and Johnson in the 1980s (4). Johnson et al. describe how metaphor is a tool to shape conceptual understanding of phenomena, such as pain, and that the tissue-centric, neuromechanistic explanatory model of pain creates fallacies and misnomers (5) and an unhealthy focus on biomedical research (6). Moreover, Johnson et al. contend that damage-loaded warmongering pain metaphor shapes a person's lived reality to the detriment of their health and well-

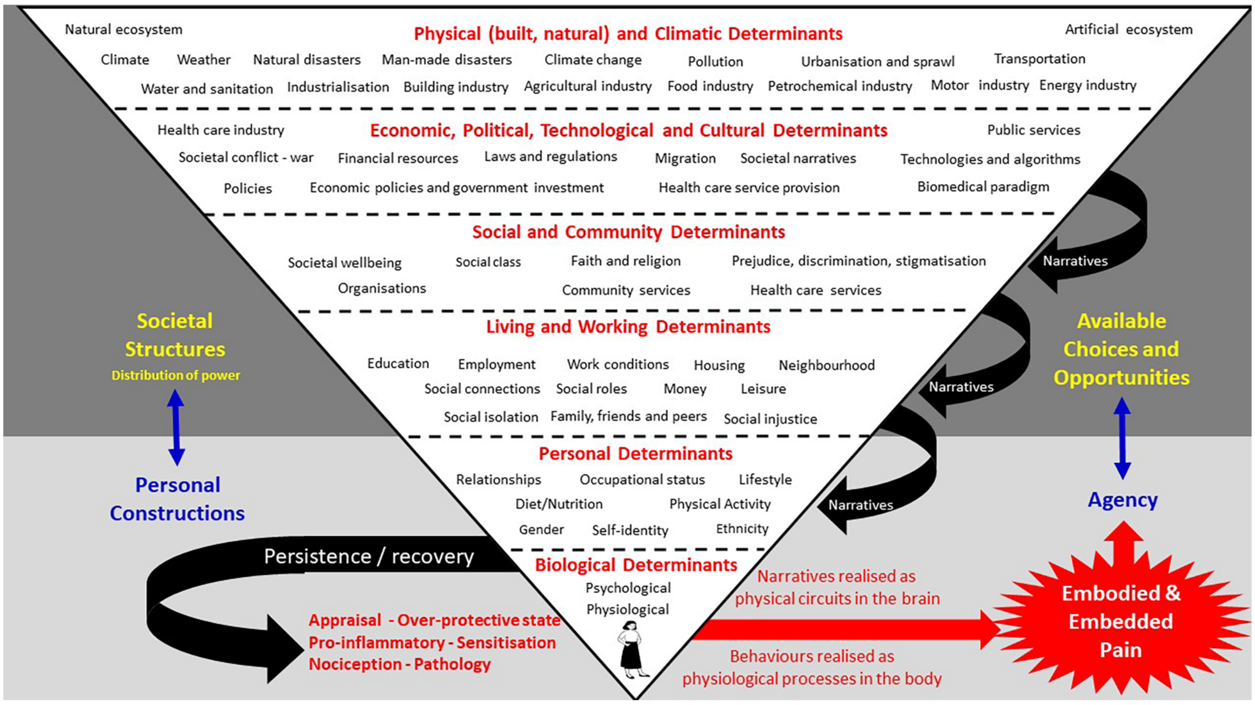

FIGURE 1
See Johnson and Woodall for an explanation of their socio-ecological model of pain.

being, ultimately making pain sticky. Johnson et al. argue that to move people towards a positive life with or without pain, we "literally" need to change our metaphors and narrative to align with the principles of salutogenesis, i.e., fostering health.

Pain and salutogenesis

Various contributions explore pain through a salutogenic lens. Salutogenesis is a whole-person approach to grow health, grounded in a person's unique life story and current situation, encompassing physical, mental, social, and spiritual aspects that are meaningful to the individual (7–9). Johnson and Woodall suggest that healthy settings approaches based on the principles of salutogenesis are likely to alleviate painogenicity and the stickiness of pain. Paley and Johnson offer perspective on salutogenic approaches and how mindfulness interventions can be integrated into daily living to improve a person's comprehension, meaningfulness, and manageability of living well in the modern world, i.e., a sense of coherence. Georgiadis and Johnson position positive psychology within a whole-person salutogenic approach to care, and they discuss how incorporation of personal narration could foster an agentic form of positive psychology, conferring synergistic benefits. Georgiadis and Johnson discuss how personal narration combined with positive psychology could lead to advances in policy and professional practice.

Johnson et al. draw upon the principles of salutogenesis in a contribution offering perspective for community-based system change for people living with persistent pain within the context of pain services in the UK. Johnson et al. offer insights from the development and delivery of an innovative pain service called "Rethinking Pain' that is voluntary and community sector-led rather than medical or therapy-led. The Rethinking Pain service utilises health coaches, social prescribers and link workers who proactively engage with culturally-diverse communities of people who experience the biggest health inequalities, reconnecting them with community-support, including engagement with art.

Pain and art

A contribution by Koebner et al. explores the role of museums and artists in the effort to reduce the burden of persistent pain, drawing on perspectives and insights from the Analgesic Museum conference. Three domains of interest emerged: exhibition development, arts experiences and practices, and research and creative scholarship. Koebner et al. advocate opportunities for individuals to author their experience of pain and to engage in dialogue about those experiences. This was the purpose of Unmasking Pain, an artist-led project that explored creative approaches to telling stories of life with pain, discussed in the contribution by Johnson et al. People living with persistent pain described Unmasking Pain as "a new set of rules", providing opportunities for "explorative joy despite pain". This contrasts with clinical encounters and reveals the potential of art to facilitate expression of complex inner experiences and personal stories to help people make-sense of themselves, shifting them from "I can't do, I am not willing to do it", to "Perhaps I can, I'll give it a go, I enjoyed". Engagement with Unmasking Pain also freed-up thinking for pain specialists allowing conceptual thought beyond the biopsychosocial model of pain.

Pain and emotional memory images

A critical aspect of Johnson and Woodall's model of pain is that socio-ecological events affect the structure and function of cells, tissue, organs, and systems, i.e., bioplasticity—the ability of bodily structures and processes to adapt (10), including neuroplasticity that reshapes connectivity associated with learning and memory. Several contributions from Hudson and Johnson explore pain and its stickiness from the perspective of non-conscious emotional memory images (EMIs). Hudson and Johnson introduce the notion of EMIs as "Trauma induced, non-conscious, contiguously formed multimodal mental imagery, which triggers an amnesic, anachronistic, stress response within a split-second." (4) p.1. They contend that encounters in daily living re-trigger EMIs which in turn activate the hypothalamic-pituitary-adrenal (HPA) axis amplifying neural input that may contribute to a debilitating state of psychophysiological dis-ease associated with threat, fear, anxiety, and intractable pain [*q.v.* (11, 12)]. Hudson and Johnson suggest that activities of daily living trigger EMIs and "outdated" stress responses, placing the person in a perpetual state of "alarm", and they offer some case vignettes to demonstrate how a therapeutic approach, which they call Split-Second Unlearning, may "clear" EMIs to "unblock" the "stickiness" of pain. Hudson and Johnson extend their exploration of EMIs in a contribution that draws upon clinical cases and existing literature to explore how a dysfunctional paternalistic family system, often characterised by authoritarian dynamics, emotional neglect, and abuse, is a fertile ground for the creation of EMIs, potentially making pain sticky.

Pain and temporality

Hudson and Johnson further explore how EMIs may make pain sticky through the perspective of temporal language. Hudson and Johnson introduce a framework, called PAIN (Past Adversity Influencing Now), comprising notions of Past Perfect, Past Imperfect, Present, Future Imperfect and Future Perfect. Hudson and Johnson explain how the PAIN framework may be used to guide individuals towards a more positive future (Future Perfect) with or without pain. A contribution by Agarwal explores the management of persistent pain through the perspective of temporality, the subjective perception of the flow of chronological time. Agarwal reveals, through an ontologically grounded thematic exploration of Ayurvedic protocols used by physicians from India, that temporality is conceptualized as spatiotemporal present moment awareness and embodied time. The findings provide evidence that more consideration should be given to spatiotemporality as an organizing principle in the management and conceptualisation of persistent pain.

Psychosocial perspectives

Various contributions advocate the need for greater focus on psychosocial perspectives to support people living with pain. An analysis of data from the 2019 Global Burden of Disease study (13) by Rajkumar provides evidence of the importance of cross-cultural variations in the occurrence of common forms of chronic musculoskeletal pain. Rajkumar reports that the prevalence of chronic neck pain was inversely correlated with Uncertainty Avoidance and the prevalence of chronic low back pain was inversely correlated with the cultural dimensions of Power Distance and Collectivism. Moretti et al. provide evidence that medical curricula of highly ranked universities worldwide are biophysically-focused at the expense of the needs and expectations of patients. Moretti et al. contend that the role of men in biomedical science has been negatively impacting the delivery of high-quality and personalized medical care to women and they offer an innovative education intervention to limit the effects of gender bias on future medical practitioners.

Li and Hapidou report a multidimensional analysis of variables affecting outcome to psychosocial treatments that revealed two groupings (i) anxiety, depression, catastrophizing, somatic symptoms, pain intensity and pre-contemplation, and (ii) contemplation, action, maintenance, activity engagement and pain willingness; these groupings resonate with Jensen et al.'s bivalent Behavioral Inhibition System—Behavioral Activation System (BIS-BAS) model (14). Monaco et al. offer perspective on combining digital technologies such as social media, open data, and Artificial Intelligence to create virtual communities that empower and support patients, the public and practitioners. Monaco et al. conclude that innovative non-biomedical approaches will emerge to improve the understanding of pain and its prevention and management.

Potential impact

Contributions in this Research Topic confirm the value of broadening the lens through which the persistence (stickiness) of pain is studied. The contributions weave together a variety of perspectives that situate pain at the intersect of tissue and environment to reveal avenues of exploration aligned with pain *experience*. In doing so, the contributions transcend the orthodox tissue-centric biopsychosocial way of thinking to reveal opportunities for scholarship, research, clinical practice, and society that go beyond mainstream pain science. Contributions in this Research Topic demonstrate the power of non-biomedical perspectives to inform whole-person centred approaches, such as contemplative practices and the performing arts, to enable people to curiously explore the relationship between their pain and their living experience. Shifting the focus from pain perception to pain perspective opens a vista of interconnectedness between bodymind, "spirit", community, and environment; and the realisation of greater need for community-based pain support. We hope that this eBook inspires pain scholars, researchers, and health care practitioners to investigate more thoroughly the complex milieu in which individuals, communities, and populations experience pain, to develop an ecology of pain grounded in a more constructive and meaningful societal narrative.

Author contributions

MJ: Writing – original draft, Writing – review & editing. AB: Writing – review & editing. EG: Writing – review & editing. JW: Writing – review & editing.

Conflict of interest

MJ declares that in the previous 5 years, MJ's employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

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A healthy settings approach to addressing painogenic environments: New perspectives from health promotion

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Structural approaches to promoting health focus on policies and practices affecting health at the community level and concentrate on systems and forces of society, including distribution of power, that foster disadvantage and diminish health and well-being. In this paper we advocate consideration of structural approaches to explore macro level influences on the burden of persistent pain on society. We argue that health promotion is an appropriate discipline to ameliorate painogenic environments and that a "settings approach" offers a crucial vehicle to do this. We encourage consideration of socio-ecological frameworks to explore factors affecting human development at individual, interpersonal, organizational, societal, and environmental levels because persistent pain is multifaceted and complex and unlikely to be understood from a single level of analysis. We acknowledge criticisms that the structural approach may appear unachievable due to its heavy reliance on inter-sectoral collaboration. We argue that a settings approach may offer solutions because it straddles "practical" and cross-sectorial forces impacting on the health of people. A healthy settings approach invests in social systems where health is not the primary remit and utilises synergistic action between settings to promote greater health gains. We offer the example of obesogenic environments being a useful concept to develop strategies to tackle childhood obesity in school-settings, community-settings, shops, and sports clubs; and that this settings approach has been more effective than one organisation tackling the issue in isolation. We argue that a settings approach should prove useful for understanding painogenic environments and tackling the burden of persistent pain.

KEYWORDS

pain, pain management, painogenic environment, health promotion, social structure, healthy-settings approach, socio-ecological

Introduction

Persistent pain is defined as experiencing pain for at least 3 months or beyond the normal time for tissue healing (1). The global prevalence of persistent pain is high, with estimates of one in five adults experiencing pain most days for at least 3 months (2). Previously, Johnson has discussed the notion of "painogenic environments" by exploring how an evolutionary mismatch between modern-day Anthropocene lifestyles and Palaeolithic physiological heritage may contribute to persistent pain in society (3).

Indeed, one decade ago Johnson and Dixey revealed an absence of discourse between the disciplines of pain and health promotion (4). Since then, there seems to have been limited debate and discussion about the role of health promotion in addressing the burden of persistent pain in society. The reasons for this are perhaps twofold – first, the reliance of pharmacology to address painful symptoms in individuals; and second, the limited application of health promotion beyond traditional realms of addressing "lifestyle" changes.

Critics have consistently argued that health promotion, as a concept and as a practice, has been applied liberally to a range of health conditions with limited debate or consideration (5). Indeed, many have argued that applying health promotion with casual abandon is de-valuing the specific contribution it can make to improving the health and social circumstances of the most vulnerable in society (6). Those who de-subscribe from health promotion being about "lifestyle" and addressing manifestations rather than causes of the social determinants of health, argue clearly that health promotion is about individuals and communities taking greater control over their circumstances (7). While this seems utopian, many, including Marmot's body of scholarship (8, 9), have fundamentally challenged the status quo advocating for structural change to improve health (10). The notion of obesogenic environments, one which follows an ecological model of health promotion (11, 12), has caught the attention of a range of stakeholders. It is perhaps timely to re-ignite and galvanize debate on the role of health promotion in tackling other issues that could benefit from a whole-systems or structural approach.

This paper seeks to advocate consideration of structural approaches to tackle the burden of persistent pain in society by shifting away from looking at individuals, to broader "macro" influences. We suggest that health promotion may be an appropriate discipline to ameliorate painogenic environments and that a "settings approach" offers a crucial vehicle to do this. In sociology, structure refers to components or "structures" that comprise the way society, and people within society, are organised and interact, including: social class, gender, ethnicity, politics, and culture (5). Structural approaches to promoting health focus on policies and practices affecting health at the community level, with the purpose of transforming structures to improve health experience and health outcomes for people. In other words, structural approaches put a spotlight on systems and forces of society, including distribution of power, that foster disadvantage and diminish health and well-being.

The Burden of Persistent Pain

The burden of persistent pain on society continues to rise despite major advances in medicine. Yong et al., estimated that 50.2 million adults (20.5%) in the USA reported experiencing pain on most days or every day (13). An analysis of the National Health Survey Data in the USA found that the percentage of adults with persistent pain increased from 16.4% in large central metropolitan areas to 28.1% in rural areas (14). A meta-analysis estimated that the point prevalence of persistent pain in the U.K. adult population to be 43.5% (95% confidence intervals (CIs) 38.4% to 48.6%), with moderate-severely disabling pain ranging from 10.4% to 14.3% (15). The Global Burden of Disease (GBD) project provides evidence that pain associated with musculoskeletal conditions is common, with persistent low back pain being the primary source of disability worldwide (16–18), although the precision of inferences drawn from GBD studies have been criticised because estimates were based on modelling rather than primary data (19). Nevertheless, the economic costs associated with medical and healthcare expenditures and loss of work productivity due to persistent pain is high, and has a severe impact on society (20–24).

As noted earlier, pain and health promotion do not seem to be a coherent marriage. Biomedical approaches utilising surgical, pharmacological, and non-pharmacological treatments continue to dominate clinical practice despite having potential for harmful consequences on individuals and communities through illogical prescription of drugs, including long-term opioid use, and unnecessary and inappropriate surgery (25–27). The association between persistent pain and social determinants of health, including socioeconomic status, education, occupational status, social connections etc. is undisputable (28) and recognised by professional and governmental bodies (29–31). It is widely acknowledged that optimal management of pain is *via* a biopsychosocial approach with emphasis on holistic patient-centred care with pain education and "healthy lifestyle" advice (32). In practice however, participation in and adherence to "healthy lifestyles" (such as exercise and physical activity and healthy diets) falls short of recommended levels in people with and without persistent pain, mostly because societal structures inhibit or discourage healthy behaviours (33–36).

Indeed, we argue that modern-day socio-ecological environments may hinder achievement of healthy lifestyle advice including exercise and diet because of an evolutionary mismatch between modern structures and inherited Paleolithic physiology. In other words, modern environments are "painogenic" in nature (3). This means that practitioners and decision-makers need to "zoom out" exclusively from individual approaches and perhaps consider wider impacts that determine pain.

Painogenic Environments

In 2019, Johnson defined painogenic environments as "the sum of influences that the surroundings, opportunities or conditions of life have on promoting persistent pain in individuals or populations" (3). *Painogenicity,* the tendency to promote or contribute to (persistent) pain, acknowledges the influences that surroundings, conditions of life and/or opportunities have on the lived experience of pain of individuals in society. The idea of painogenicity and painogenic environments aligns with Boyd Swinburn's seminal work on obesogenicity, the tendency of (obesogenic) environments to promote or contribute to obesity (37). We suggest that persistent pain and obesity have similarities. Both conditions are influenced by a broad spectrum of biopsychosocial factors and managed, with only partial success, by multidisciplinary teams using biopsychosocial approaches including medical, educational, and behavioural interventions.

Living in modern society offers potential for health improvement through technological advances and digital advancements; however modern society also increases exposure to a multitude of health determinants (physical and biopsychosocial) with potential to augment the frequency, severity, quality, bodily location, and persistence of pain. These health determinants have potential to mediate, directly or indirectly, a variety of psychophysiological mechanisms with the potential to facilitate pro-inflammatory states, peripheral and central sensitisation, descending and ascending modulatory physiological systems, neuroimmune compromise, and maladaptive psychological appraisals and behavioural outcomes. Social context has a major influence on the lived experience of pain and this is acknowledged in key messages in public awareness campaigns - "*Everything matters when it comes to pain*" (https://www.flippinpain.co.uk). There has as yet, been no formal attempt to map "everything", perhaps because of the complexity of the challenge, or because of a myopic view that solutions to the burden of persistent pain lie solely within the domain of biomedicine (38).

To date, investigation has focussed on generating domain specific knowledge about physiological (predominantly nociceptive) processes influencing the body in pain at a micro (organism) level. Far less attention has been given to generating domain specific knowledge at the macro level i.e., the influence of social, community, economic, political, cultural, and built (biosphere) environments. The coupled interaction of the macro-and micro level factors on the lived experience of pain is largely unexplored. Ultimately, socio-ecological factors are realised as changes in physiological processes (e.g. bioplasticity) and in the sense of agency driving behavioural response.

Socio-ecological conditions influence a person's lifestyle and may result in unhealthy behaviour such as sedentary routines, diets high in the ratio of omega-6: omega-3 polyunsaturated fats, carbohydrates, salt, and additives, and excessive use of recreational drugs and prescription medication. However, the situation is complex. Socio-ecological factors may augment or abate pain. For example, systematic review evidence suggests that the severity of persistent pain associated with osteoarthritis shows a positive relationship with fat and sugar intake, possibly due to pro-inflammatory mechanisms (39), yet obese people with osteoarthritis report momentary pain relief and elevated mood from eating foods high in fat or sugar, despite this being counterproductive to pain-severity in the longer term (40).

Exposure to the socio-ecological conditions of modern living is known to instigate neuroendocrine "stress" responses, and allostatic overload can result if the cumulative burden of these environmental challenges exceeds an individual's ability to cope (41, 42). A systematic review of 267 studies indicate that allostatic load and overload are associated with poorer health outcomes (43). Ramsay and Woods argue that homeostatic systems are not adapted to handle certain aspects of modern living, and the cumulative burden of chronic stress and life events leads to dysregulation of psychophysiological responses and adverse health outcomes (44). Dysregulation of the nociceptive system is known to contribute to pain that persists beyond the normal time of healing leading to significant emotional distress or functional disability, i.e. pain as a disease entity in its own right. Such chronic primary pain, which includes fibromyalgia and nonspecific low-back pain, has been included, for the first time, in the International Classification of Diseases (ICD-11); socioeconomic, cultural and ethnic influences are acknowledged as being key factors influencing symptoms (45, 46).

There is strong evidence that cumulative exposure to stressful life events in childhood is associated with poorer health outcomes and increases the likelihood of experiencing persistent pain in children and adults (47–50). Adversity during childhood generates allostatic overload that has detrimental consequences to maturing neurological, immune and endocrine systems (51) contributing to overactive stress responses, pain sensitisation, pro-inflammatory states and persistent pain in adulthood (52–54).

Thus, we advocate using a socio-ecological lens to shed light on painogenicity and reveal macro forces impacting individuals and communities. As a first step, we identify a sample of items with painogenic potential as viewed through a broader socio-ecological framework (**Figure 1**).

Unpicking the influence of the complex bio-psycho-socio-ecological milieu on a person's experience of persistent pain appears overwhelming; this may be one of many reasons why attempts to tackle the burden of persistent pain remains embedded within an individual-centred biomedical paradigm. The notion of "lifestyle drift" summarises this in many ways (57) as discussed later in the paper. We believe that mapping socio-ecological factors "into the body" may offer insights to their influence of physiological processes contributing to pain. Examples include:

- industrialisation producing toxic particulates in the atmosphere that contribute to neuroimmune compromise,

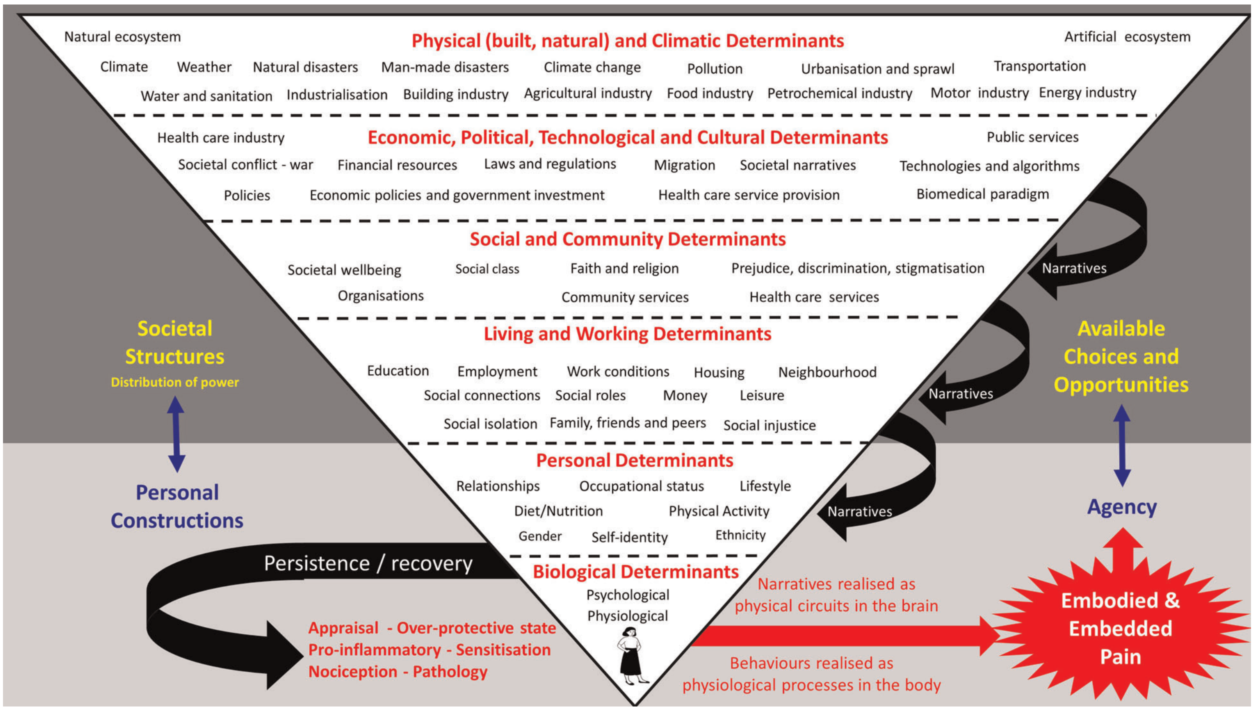

FIGURE 1
A "first step" to identify generic socio-ecological factors with potential to influence the lived experience of persistent pain and limit choices and opportunities for recovery. The schematic was developed by adapting the model of ecological development by Bronfenbrenner (55). Items (determinants) were organised within and between levels *ad hoc;* hence, the purpose of the schematic is to encourage a systematic and comprehensive analysis in the future. Attention is drawn to the role of information (words and symbols) that arise in meta-levels to form frames, metaphors, memes, and narratives, that lubricate the painogenic milieu and shape a person's bodily self, including identity, by altering circuitry and processing in the brain (56).

- pro-inflammatory states, and peripheral and central sensitisation.
- Urbanisation and suburban sprawl creating reliance on motor vehicles and sedentary lifestyles resulting in painful comorbidities including pro-inflammatory states and sensitisation, and difficulties in adhering to health care professional advice to undertake more exercise.
- Economic policies contributing to socioeconomic inequalities that preclude accessibility of specialist pain management services, and a worsening pain condition.

Mapping is also likely to offer novel solutions and strategies for alleviating associated suffering and disability.

The biopsychosocial model of pain was proposed over 40 years ago, and it has proved to be a resilient construct and acknowledged within health care as the foundation of our understanding of pain and its management. Yet, treatment for persistent pain remains unimodal and embedded within a biomedical paradigm. Recently, Nicholas has called for a reappraisal of the situation (32). Exploring pain through a painogenic lens, forces attention on the role of physical, political, and sociocultural environments of modern living. To achieve this we advocate a whole systems health promotion approach in the spirit of Nettleton and Bunton's (10, *p*.44) structural critique that accounts for the physical and political environments that impact on the social environment in which the person lives. Given its strong socio-political fundamentals, health promotion may be an appropriate discipline to offer opportunities and solutions to the burden of pain.

The role of health promotion

The structural approach

The notion that environmental influences directly impact on the health choices that individuals make is well-understood (5). While health promotion is a broad and a contested discipline, there has been consensus from those politically drawn to the left-of-centre to see the endeavour of health promotion as being about a systems or structural change. This comprises of macro-level or environmental interventions which draws its focus towards the social, economic, political, institutional, cultural, legislative, industrial and physical environments of societies in order to modify behaviour change (58). Nettleton and Bunton (10, *p*.44) summarise:

> "Essentially the structural critique argues that attempts to prevent illness and to promote health have failed to take into account the material disadvantages of people's lives. This works at three levels: the political environment, the social environment and the physical environment."

The structural approach avoids focusing on the individual and instead intervenes at a political or systems level to achieve positive health outcomes (59). It has potential to achieve big change in health outcomes but requires cultural and political shifts (as has been seen in smoking acceptance and cultural norms). Governments, therefore, act as stewards to create policy frameworks which encourage individuals to make healthier choices. There has been contemporary traction for this viewpoint, operationalised, for example, through the notion that "obesogenic environments" are creating adverse health outcomes for society and need to be addressed through whole-system approaches (60). Taxation has been a common way to place barriers on the purchasing of certain "unhealthy" products. The soda tax, a piece of public policy originating in the USA, was an illustration of state intervention in modifying people's consumption of sugar. Despite soda companies opposing the policy to raise taxes on sugary drinks to reduce consumption, many jurisdictions across the USA implemented this tax increase to prevent the consumption of sugary drinks and, indeed, saw reductions in consumption (61). It has been interesting to observe how "obesogenic environments" have caught the imagination of health promotion researchers, practitioners, and policy-makers. We see no strong reason why "painogenic environments" could not do the same.

The rhetoric that addressing environmental determinants of health – such as the environment; living conditions; and transport infrastructure – is well-rehearsed and yet, in countries such as the United States, the UK and Australia, there has still been a dominant view held in practice that health promotion is about modifying and addressing individual behaviour. The frequent frustration from some sections of the health promotion community is that health promotion activities are merely a "sticking plaster" for deep underlying societal problems that manifest behavioural choices (62).

Lifestyle drift

Several theoretical insights offer explanatory frameworks for why this occurs. The issue of "lifestyle drift" has prohibited the translation of ecological health promotion strategy to actual delivery. Lifestyle drift is the inclination for policy that recognises the need to act on upstream social determinants only to drift downstream to focus on individual lifestyle factors (63). The reasons underpinning why lifestyle drift has occurred has not been fully explored, although practical factors may be an issue. For example, lifestyle interventions are easier to devise than "upstream" interventions (57) and, moreover, lifestyle interventions are significantly easier to evaluate (64). This is certainly the case in pain practice where health promoting advice and intervention in guidelines for care remains individual-centred.

According to Green et al. (65), one of the definitive features of health promotion has been an emphasis on the environmental determinants of health (structures), but, as mentioned, this is often reduced to focus on individual choices and behaviour. The recognition, however, that the major influences on the health of an individual are outside of their immediate control has resulted in a drive to create supportive environments that are concordant with our evolutionary heritage so that the "healthy choice" is the "easy choice" (66, 67). Several international declarations on health promotion have emphasised the structural factors on people's health – the Shanghai declaration on health promotion (68) strongly emphasises the role of structural forces on health over and above the role of individual decision-making and choice.

Implications for researchers, practitioners, policy makers and funders

Socio-ecological frameworks

We advocate greater attention given to adapting socio-ecological frameworks, such as the Bronfenbrenner social-ecological model of human development (55), to facilitate a comprehensive approach to explore factors affecting human development at individual, interpersonal, organizational, societal, and environmental levels. The ecological orientation has grown in recent times because there has been acknowledgement that many health challenges are too multifaceted and complex to be understood from a single level of analysis (69). The approach suggests that multifaceted interventions that integrate environmental and behavioural components and that cover multiple settings and levels of analysis, are more likely to be effective in promoting personal health and public health than those narrower in scope (70).

Adapting socio-ecological frameworks to issues arising from persistent pain can identify what to address at each level. Recently, Wu et al applied the socio-ecological framework to the opioid epidemic to inform chronic pain management and successful opioid tapering for individuals living with persistent pain (71). The model of Wu et al. revealed actions for providers that could improve care of patients including recognising individual and interpersonal factors, influencing organizational policies, and shaping legal and societal issues. Wu et al. found that health care professionals are trained to assess the legitimacy of patient complaints and often consider non–life-threatening such as pain and distressing symptoms of opioid tapering of less importance. This is detrimental to a person's well-being. Wu et al. concluded that transformation in how we care for patients is needed and proposed that the focus of practitioners should be to compassionately support people living with persistent pain by empowering them in their own healing and helping them build resilience.

Challenges when addressing structural level forces

The structural approach can be criticised to be utopian and perhaps unachievable given that it relies heavily on inter-sectoral collaboration – perhaps through town planners, health experts, decision-makers, and community groups – but it is the radical paradigm shift that may be necessary to move the challenge of persistent pain and its management away from the narrow focus on individuals. The promise of health promotion informed by socio-ecological frameworks is countered by an apparent disempowerment of health care professionals faced with the challenge of implementing structural solutions in practice. Quite simply, where would someone start? This perhaps underscores Frohlich and Potvin's criticisms that ecological models ultimately revert back to targeting individual behaviour modification (72). Similarly, Ziglio et al. note that despite the acceptance of this model, most health promotion activity has reverted to dealing with specific issues or has ignored wider social determinants (73). They suggest that the rhetoric, therefore, has failed to be a reality.

The settings approach as a solution?

The credible critique of addressing structural level forces that impact on health is that it becomes almost impossible, or at least markedly challenging, for practitioners to address macro forces. A settings approach offers a crucial vehicle to do this and can straddle both "practical" and cross-sectorial forces that impact on people's health. Settings-based approaches to health promotion, grounded in the World Health Organization's (WHO) Ottawa Charter and Health for All strategy (7), utilises a holistic and multi-disciplinary "whole-systems approach" based on community participation, partnership, empowerment and equity [WHO - https://www.who.int/teams/health-promotion/enhanced-wellbeing/healthy-settings]. Settings-based approaches have become increasingly popular because they sit between the interface of tackling *big* structural issues (often outside of the remit of many practitioners) but in a way that is manageable and not overwhelming.

Governments have used a systems approach to develop and deliver policies to address structural level forces. For example, the Welsh Government used a systems approach to raise awareness of the detrimental impact of childhood adversity on health to target structural factors to support parents and protect children from harm. They introduced training of public service workers (e.g. teachers, police and youth officers), promoted community-led programmes to reduce adverse childhood events and improve resilience, and developed a "Support Hub" (74).

Settings-based approaches in communities have been particularly successful when supported fully at governmental levels. Sure Start, for example, was a UK Government initiative that sought to reduce and alleviate child poverty and improve health outcomes in children under 4 years and their families who live in socially deprived communities in England. Sure Start did not have a prescribed model or intervention, but it does include outreach or home visiting; family support; support for good quality play, learning, and childcare experiences; primary and community health care; advice about child and family health and development; and support for people with special needs, including help in accessing specialised services. Community participation is central to the mission of these programmes (75).

While this, of course, is not reflective of the *true* notion of an ecological model, it is an opportunity for wider synergy across social milieu. The key idea of the settings approach, or healthy settings approach, is that investments in health are made in social systems where health is not their primary remit (76). Through synergistic action between settings, it is argued that there is potential for greater health gains – including, in this case, reduced prevalence of persistent pain. Shifting back to obesity, the approach is, theoretically, relatively straightforward: childhood obesity is more effectively addressed when a range of settings work synergistically – when the school-setting, community-setting, shops and sports clubs work together to tackle the issue. This approach seems intuitively more effective than one organisation tackling the issue in isolation (77). The same *has* to be the case for the prevention and management of persistent pain.

In 2010, Australia was the first country to develop a national level holistic framework to coordinate interdisciplinary and individualised assessment, treatment, and management of acute, chronic and cancer pain (78). Subsequently, in May 2018, the Australian Government published a National Strategic Action Plan for Pain Management that endorsed a "sociopsychobiomedical prism" to view pain; the overarching goal was to minimise the pain burden for individuals and the community, and to improve the quality of life for people living with pain (79). The plan consisted of eight goals and 27 objectives. At its core was raising community awareness and knowledge about pain and its management through education to empower consumers, carers, and the wider community. The plan emphasised the need for government to recognise pain as a national and public health priority by linking pain to chronic disease frameworks in key national health and economic strategies and policies. These were to be delivered *via* "whole-of-community" engagement, and with partnerships between health care services, not-for profit organisations, researchers, the private sector, individuals, and communities.

Conclusion

This paper has drawn on the discipline of health promotion to offer new perspectives on the conceptualisation and management of persistent pain. Compared to biomedicine, health promotion is in its infancy, but it views the experience and management of health in a more holistic way and argues that environmental factors – or structures – are as potent in their contribution to health and indeed illness than individual behaviours and choices. The application of health promotion to pain and painogenic environments has been discussed and this potentially offers future directions for the pain field. The paper suggests that socio-ecological models that address social and physical determinants of health (i.e. modern physical, social and political environments) alongside individual behaviours and practices is a sensible way to reconfigure current approaches to reducing the burden of persistent pain in individuals and communities. This will mean a move away from "health services" toward looking at other "settings" that people interact with on a regular basis. The settings-approach to health promotion is proposed here as one practical way of addressing socio-ecological factors in practical and tangible ways for practitioners and policy-makers.

Further research is needed in this field to take forward and empirically "test" or explore these ideas. Hancock (80) suggested that the settings approach is one of the most successful strategies in health promotion, but one major drawback is a paucity of high quality evaluation leading to "*an uneven and under-developed evidence base*" (81, *p.*335). St Leger (82, p100) reiterated this and argued that the approach has been legitimised more through "*an act of faith*" rather than through robust research and evaluation. If there is to be a fuller understanding of an individual's lived experience of pain in the complex environment of the modern world, we argue a need for a critical-mass of researchers working across traditional disciplinary boundaries in the future. Research areas to explore may include methodological innovation to capture how socioecological determinants impact on the exacerbation and alleviation of pain, and to ascertain lay views on how pain and societal factors impact on experiences and overall control. Such an approach to research, which relies on community-based, participatory approaches, is exceptionally common in health promotion research (83) and could be highly complementary to the pain field.

Manuscript contribution to the field

This paper draws on the discipline of health promotion to offer new and broader perspectives on the conceptualisation and management of persistent pain. We explore how health promotion research views the experience and management of health in a more holistic way and argue that environmental factors – or structures – are likely as potent in their contribution to persistent pain as individual behaviours and choices. We discuss the application of health promotion to pain and painogenic environments to offer future directions for research in the pain field. The paper suggests that socio-ecological models that address social and physical determinants of health alongside individual behaviours and practices could reconfigure current approaches away from "health services" toward other "settings" that people interact with on a regular basis. The settings-approach to health promotion is proposed here as one practical way of addressing socio-ecological approaches in practical and tangible ways for practitioners and policy-makers. We argue that a critical-mass of researchers working across traditional disciplinary boundaries is needed in the future if there is to be a fuller understanding of an individual's lived experience of pain in the complex environment of the modern world.

Data availability statement

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

Author contributions

Both authors contributed equally to the article and approved the submitted version.

Conflict of interest

In the previous 5 years, MIJ's employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MIJ declares book royalties from Oxford University Press. The remaining author declares no conflicts of interest.

Publisher's note

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The Analgesic Museum

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This manuscript uses the perspectives and insights that emerged from the Analgesic Museum conference held virtually on March 11, 2022 as a mechanism for considering the role museums and artists can play in the public health effort to reduce the burden of persistent pain. One hundred and fifty-seven individuals from 22 countries registered for the Analgesic Museum conference. The event explored the intersection of art and pain management practices with presentations centered on three domains of interest: exhibition development, arts experiences and practices, and research and creative scholarship.

KEYWORDS
persistent pain, museums, social connection, art, wellness

Introduction

Persistent pain affects hundreds of millions of individuals globally with a recent review in the Lancet boldly proclaiming, “it is difficult to overestimate the burden of chronic pain.” (1) While social factors, such as social isolation and loneliness, can greatly impact the lived experience of pain, the biomedical community has not operationalized many treatment approaches to address these factors (2). Concurrently, a meaningful body of scientific literature now supports what practitioners of the humanities have argued for centuries—the arts can improve health (3). But can the arts relieve pain?

On March 11, 2022, 13 speakers along with 157 registrants from 22 countries came together on a virtual platform to explore the potential of cultural engagement in museums and art spaces to reduce the burden of pain. The day-long conference titled, *The Analgesic Museum* focused on three overlapping areas of interest:

- **Exhibition development** to showcase the aesthetics of analgesia
- **Arts experiences and practices** to reduce the burden of persistent pain
- **Research and creative scholarship** to explore how museum-based interventions can lessen pain

The goal of the conference was to seed an international interdisciplinary network of scientists, museum and healthcare professionals, individuals living with persistent pain, and artists committed to investigating the aesthetics and impact of museum engagement to reduce the burden of persistent pain. To provide highlights from the day with a broader audience this paper offers summaries of the featured speakers’ perspectives and insights. The entire conference can be viewed for free at: https://health.ucdavis.edu/pain/acupuncture/CrockerArtRx.html.

Setting the scene

Christopher Bailey, Arts and Health Lead for the World Health Organization (WHO), and **Melissa Menzer**, Senior Program Analyst at the National Endowment for the Arts (NEA), began the conference by helping to frame, through both personal testimonial and review of the evidence base, the impact the arts have on health and wellbeing. A WHO review on the role of the arts in improving health and well-being, which included over 3,000 studies, identified a major role for the arts in preventing ill health and promoting wellbeing across the lifespan (3). Relevant to this conference the review found that little work has been done in the art and health field focused on persistent pain, a finding that has been confirmed elsewhere in the literature (4). Menzer detailed the NEA's recent review on arts strategies for addressing pain and the opioid crisis. This landmark review produced several findings that informed both the intention and structure of the Analgesic Museum conference. First, the NEA review found that the majority of studies conducted on pain management focused on post-operative pain (vs. persistent pain) and investigated music-based interventions (vs. museum-based interventions) (5). Second, the report called for more research on the arts' impact on persistent pain and on the social dimensions of pain (5). The conference responds to these findings by not only highlighting projects that specifically examine the role of non-music-based arts programming to address persistent pain, but through the identification of topic areas—Exhibition development; Arts experiences and practices; Research and creative scholarship—that will foster more research and programming in these gap areas of study and practice.

Exhibition development

How do we curate art to reduce the burden of pain?

Sabrina Kamstra, Chief Curator and Head of the Art Department at the Amsterdam University Medical Center (UMC) oversees a collection of more than 7,000 works of art. Kamstra's team creates encounters with art for patients, hospital staff, students, and visitors along the hospital's corridors, public spaces, and clinical rooms. The art department at Amsterdam UMC participates in collaborative research to explore the impact of art within the context of a major urban teaching hospital. Kamstra discussed the work of artist Nieke Koek who through conversations with patients and staff at the hospital's rehabilitation clinic created an automata of a leg. The leg was intended to help individuals discuss and represent the experience of pain. "We believe that artists can give a different insight on specific medical questions, which can be of help to medical research," Kamstra said.

Jasminko Halilovic, Founder and Managing Director of the War Childhood Museum in Sarajevo, Bosnia and Herzegovina, discussed the process of creating and sharing a collection focused exclusively on childhoods that have been affected by war. Halilovic emphasized how the museum, with its ability to respect, care for, and amplify an individual's story can contribute to both the individual and collective healing of pain and trauma. "The process of giving a personal object to the museum collection is not a mere act of donation," Halillovic said. "This is a long-term connection, which is developed between people and museum. And this [connection] then transcends to the interactions with visitors." In addition to a permanent museum and traveling exhibitions, the War Childhood Museum hosts workshops for teachers and parents on how to discuss the sensitive topic of conflict with children at home and in the classroom.

Ine Gevers, Founding Director of the Niet Normaal Foundation, Institute for Inclusive Innovation in Utrecht, The Netherlands, highlighted several of her exhibitions that focused on radical inclusivity and the dichotomy of pain and pleasure. "We really make a mistake in thinking that people with disabilities or chronic illness are [the] minority. They are actually a majority," Gevers said. Her most recent exhibition, *Come Alive*, is a large-scale immersive experience that explores eroticism as a creative energy that can help individuals to reconnect with themselves and others in precarious times. The exhibit invites attendees to reflect on the redistribution of sensual love to all who need it as well as the use of pleasure to release pain.

Arts experiences and practices

How do we make art that reduces the burden of pain?

Jeroen Lutters, Professor at the ArtEZ University of the Arts in Arnhem, The Netherlands, challenged participants to consider the spectator as artist. Lutters presented an overview of Arts Based Learning (ABL), a method for learning from art that questions the duality between receiving and making an aesthetic experience. ABL asks the spectator to begin with a question of personal relevance, and then to bring that question into an extended dialogue with an object of art. The individual then enters into "possible worlds," as Lutters explains, allowing the dialogue between art and spectator to generate responses to the original question. This process positions the spectator viewer as co-creator, and not consumer, of art. Lutters offered conference attendees the hypothetical of an individual who could embark on this process with the question, *how can I get rid of this pain?*

Designer and Artist, **Nienke Helder**, Eindhoven, The Netherlands, then spoke about her project, "Sexual Healing," in which she developed several objects that invite women to explore their bodies and sexuality in a safe and non-clinical way. She described her design process, which involved partnering with medical experts and women seeking help for "sexual dysfunctions" such as painful intercourse, shame, problems with penetration, difficulties with getting in the "mood" or orgasms. Helder emphasized the need for, and challenges with, evaluating the impact of her work in the world. "After all," Helder explains, "It's through this public engagement that we will be able to translate new knowledge into tangible experiences for those who eventually need them."

Social designer, **Joost van Wijmen**, based in Hertogenbosch, The Netherlands, discussed his project ENCOUNTER #6. Van Wijmen invited individuals with bodily scars to partner with him and his creative team to make silk embroidered reproductions of those scars. These testaments to the changing body reveal the potential for even the most painful and difficult transformations to be expressions of beauty and meaning. ENCOUNTER #6 is displayed in a mobile exhibition that travels to libraries, museums, and hospitals among other locations. The project allows participants to enter into a deep conversation about their scar and their changing body, while also reframing these processes as a work of art. Viewers engage with such universal themes as intimacy, loss, and vulnerability. Van Wijmen says, "I don't solve problems. I listen mainly and provide a space for both funny stories, or sometimes success, but also discomfort. The goal of ENCOUNTER is sharing personal experiences … I ask participants or an audience to place themselves in the shoes of the other."

Mohsin Mohi-Ud-Din, Founder and CEO of #MeWeInternational, which is headquartered in Georgia, United States, but works in 15 countries to provide communications tools that enable individuals to unlock their agency, reframe their narratives, and author the future, invited the audience to understand communication as foundational to art and health. Mohi-Ud-Din called for considering "words as living things that actually reshape the brain, reshape your nervous system, reshape how you view yourself." MeWeInternational's work is a powerful example of the impact that narrative art can have on pain across multiple contexts with program evaluations demonstrating improved communication skills, emotion regulation, goal-setting, problem-solving, perspective taking, and creative publishing opportunities. However, Mohi-Ud-Din also shared critical insights into the potential harm that can come from measuring the lived experience of people sharing personal experiences where, "The process of monitoring, evaluation, and data gathering retraumatized the communities that this data was meant to serve." Mohi-Ud-Din called for balancing community control of language and process with scientific integrity.

Research and creative scholarship

How do we evaluate art intended to reduce the burden of pain?

The University of California, Davis (UCD) is involved in a number of studies exploring the public health potential of museums and arts spaces to address the burden of persistent pain. **Ian Koebner**, Director of Integrative Pain Management at UCD and Cultural Agents Fellow at Harvard University, discussed his partnership with the Crocker Art Museum in Sacramento, California to create and evaluate museum-based programs for individuals who self-identify as living with persistent pain. Their initial studies focused on the feasibility of the partnership from an organizational perspective (6) and from the perspective of individuals living with persistent pain (7). UCD is currently conducting the first ever randomized controlled trial of museum- and virtual-museum-based programs for individuals who self-identify as living with persistent pain (8).

Museum-based interventions can be conceptualized as complex in that they involve multiple and interacting factors (9). For example, the effect of the art in any museum-based program will interact with the group-dynamics, as well as the spatial context of the museum itself, to create a total effect. Disaggregating these factors in an effort to demonstrate causality can be difficult. **Jorge Peña**, a Professor in the Department of Communication at UC Davis, discussed a study that he co-leads with Koebner, to explore the specific effects of art and social connection in a virtual-museum model. Individuals living with persistent pain are randomized to a virtual museum gallery with or without art and with or without a social connection prime to test the separate and joint effects of these two factors—art and social connection (10).

Sarah Herrera, Assistant Director of Business Intelligence at the Mondavi Center for the Performing Arts at UCD shared how the Mondavi Center has initiated a program to learn more about the health of the people who visit the Center, as well as the degree to which they feel they belong at the Center. Herrera noted that the cultural sector has many audience development efforts, however less work is done to investigate how those audiences feel in cultural spaces, and how those feelings may differ among subpopulations. "Our hope is through understanding the experiences of those living with chronic pain that we may create experiences where they feel like they belong more in our spaces," Herrera said. Herrera also provided insight into how museums and other art spaces might expand their diversity, equity, inclusion, and accessibility efforts by centering the construct of belongingness.

Olivier Beauchet, Professor and Director of AgeTEQ Laboratory at the University of Montreal, concluded the Research and Creative Scholarship section of the conference with a discussion of his work examining the effects of museum-based participatory arts programs on frailty, health, and socialization among the elderly. Beauchet first discussed a study with the Montreal Museum of Fine Art (MMFA) to explore the effects of a participatory art-based activity called "Thursdays at the Museum" for older adults (11). Following this study, the Fuji Museum, Tokyo, Japan, joined the partnership between the MMFA and the AgeTeQ laboratory in a bicentre RCT that enrolled 228 community-dwelling older adults to receive either a 12-week participatory art-based program or the control condition, which involved no art-based interventions over the study period. Well-being and quality of life improved significantly in the intervention group compared to the control group, while mixed results were observed with frailty (12).

Conclusion

The 21st century ushered in two seemingly disparate truths that the *Analgesic Museum* conference sought to bridge: the social dimension of persistent pain is inadequately addressed in the current biomedical model of care (2, 13) and the arts may be an unlikely, yet valuable public health partner (14). The day of dialogue offered a creative response to the difficult and important question of if, and how, the arts can relieve pain. An international interdisciplinary group of individuals with the lived experience of persistent pain, policy makers, funders, scientists, curators, museum and healthcare professionals, and artists came together to share their experiences at the intersection of art and pain management practices. Panelists emphasized the potential benefits of arts-engagement on pain, from mitigation of pain and pain-related outcomes for the individual to facilitating education and compassionate understanding for society. A common theme among the diverse and myriad project examples shared by panelists was the importance of creating opportunities for individuals to author their experience of pain and to engage in dialogue about those experiences. Panelists also stressed the challenges associated with developing arts-based experiences that target the reduction of persistent pain. Examples of challenges include intervention design, appropriate evaluation methods, and partnering across divides such as epistemological perspective (e.g., positivism vs. constructivism), discipline (e.g., the "arts" vs. the "sciences") and social position (e.g., "able" vs. "disabled" bodies).

The Analgesic Museum conference was a critical if first step in the establishment of a framework for exploring the aesthetics and impact of museum engagement to reduce the burden of persistent pain. This manuscript aims not only to highlight and amplify specific projects at the intersection of art and pain management practices, but also to showcase the conference itself as a mechanism for network building in this undeveloped topic area. The conference's themes—Exhibition Development, Arts Experiences and Practices, and Research and Creative Scholarship—offer domains of practice for developing the field of art and pain management. Our hope is that the conference will serve as a template for additional convenings that center other regions of the world, with the ultimate goal of creating a global interdisciplinary network dedicated to the intersection of art and pain management practices.

Data availability statement

Conference presentations can be found at https://health.ucdavis.edu/pain/acupuncture/CrockerArtRx.html. Further inquiries can be directed to the corresponding author/s.

Ethics statement

Written informed consent was obtained from the conference presenters included in this article.

Author contributions

IK, BB, JS and MP contributed to the conception and design of the Analgesic Museum conference and the corresponding manuscript. IK and BB wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Understanding pain in modern society: insights from attitudes to pain in the Medieval Period

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Historical records provide knowledge about the way people lived in the past. Our perspective is that historical analyses of the Medieval Period provide insights to inform a fuller understanding of pain in the present era. In this article, we appraise critiques of the writings of people living with pain during the mid (high) to late Medieval Period (c. 1,000–1,500 AD) to gain insights into the nature, attitudes, lived experience, and sense-making of pain. In the Medieval Period, pain was understood in terms of Galen's four humours and the Church's doctrine of pain as a "divine gift", "punishment for sin" and/or "sacrificial offering". Many treatments for pain were precursors of those used in modern time and society considered pain to be a "shared experience". We argue that sharing personal stories of life is a fundamental human attribute to foster social cohesion, and that nowadays sharing personal stories about pain is difficult during biomedically-focussed time-constrained clinical consultations. Exploring pain through a medieval lens demonstrates the importance of sharing stories of living with pain that are flexible in meaning, so that people can connect with a sense of self and their social world. We advocate a role for community-centred approaches to support people in the creation and sharing of their personal pain stories. Contributions from non-biomedical disciplines, such as history and the arts, can inform a fuller understanding of pain and its prevention and management.

KEYWORDS
pain, medieval, history, painogenic environment, social cohesion, ascetics, attitudes and behaviors

Introduction

Exploring pain through a historical lens offers insights into human understanding, thought and expression, and can provide perceptions of relationships between human biology and sociocultural conventions. The Medieval Period is one of the three traditional divisions of Western history (antiquity, medieval, modern) and a time of great religious, cultural and social development in Europe, paving the way for new scientific thinking. In this perspectives article we examine the meanings attributed to pain and the attitudes and responses to pain during the mid (high) to late Medieval Period. We will discuss the possible mindsets of medieval people experiencing pain and discuss how this may inform a fuller understanding of pain in modern society.

Pain in the Medieval Period

The Medieval Period (Middle Ages) began with the fall of the Western Roman Empire (c. 476 AD) and transitioned into the Renaissance period (c. 1,500 AD). During this time, approximately 90% of the population were peasants (villeins) working the land and living in small communities under the control of overlords. Much of Europe had become Christian and the first universities were established.

The Medieval Period is divided into: the Early Middle Ages (c. 425–1,000 AD); the High Middle Ages (c. 1,000–1,300 AD); and the Late Middle Ages (c. 1,300–1,500 AD). The bubonic plague (Black Death) occurred during the Late Middle Ages and was associated with mortality of over 20 million people, 30%–50% of the continent's population. A common view in society was that the plague was God's punishment for sin, although some believed that it was a result of an astrological event or an earthquake which released poisonous vapours (1).

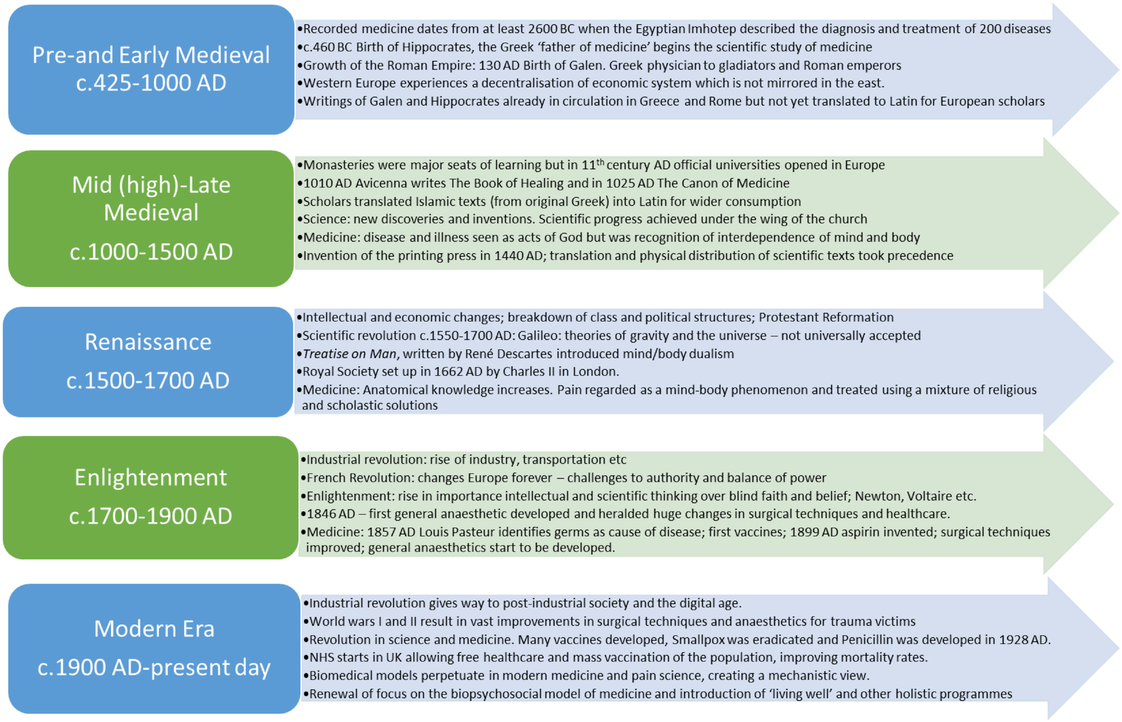
Knowledge and attitudes

The book *A History of Pain* by Rey provides a synopsis of institutional and scientific conditions in which theories and knowledge about pain were made (2). Before the Medieval Period Hippocrates (c. 460 – c. 377 BC) argued that diseases were caused naturally, and not because of superstition and gods. The Greek physician and philosopher Galen (c. 129–216 AD) described pain as a "rupture of continuity" or a "change in temperament" caused by an imbalance of the four humours: blood, phlegm, yellow and black bile. Galen believed the mind/soul and body were intimately interconnected and therefore involved in the experience of pain (3). The *Treatise on Man,* published by René Descartes in the 17th century, differentiated the body and the mind (or soul). This catalysed a biomechanistic model of pain which paved the way for modern medicine but may have marginalised the significance of the mind (4). The Medieval Period spans Galenism with its focus on anatomy and the four humours, and the early modern period with Descartes' mechanistic model of pain (**Figure 1**).

Throughout history pain has been considered "a passion of the soul". Acute and chronic are relatively recent additions to the pain lexicon and generally physicians only became interested in chronic pain without obvious pathology in the 1900s, with people complaining of long-term pain often regarded as deluded or malingerers. Thus, historical texts discuss long-term illness and/or pain but do not describe pain in terms of "acute" or "chronic".

During the Medieval Period, knowledge and attitudes towards pain and suffering arise from biographical sources (*vitae*) of historical figures, and occasionally some autobiographical details, although these were rare due to high levels of illiteracy. Most knowledge originates from religious establishments. Convents were one of the few places where women could receive an education, and nuns wrote, translated, and illuminated manuscripts. It is largely from these sources, which were heavily influenced by the Christian beliefs and culture of the time, that an understanding of pain in the Medieval Period is informed. However, early scribes probably exaggerated, diminished, added, or removed events from the accounts of the lives of individuals, so caution is needed in interpretation.

In the Medieval Period, pain was frequently written about with a scholastic or devotional theme, or both, as seen in letters written by the Benedictine Abbess Hildegard von Bingen (1,098–1,179 AD), a medieval visionary and mystic to those who sought her medical advice (5). These letters revealed attitudes towards pain and illness



•Recorded medicine dates from at least 2600 BC when the Egyptian Imhotep described the diagnosis and treatment of 200 diseases
•c.460 BC Birth of Hippocrates, the Greek 'father of medicine' begins the scientific study of medicine
•Growth of the Roman Empire: 130 AD Birth of Galen. Greek physician to gladiators and Roman emperors
•Western Europe experiences a decentralisation of economic system which is not mirrored in the east.
•Writings of Galen and Hippocrates already in circulation in Greece and Rome but not yet translated to Latin for European scholars

•Monasteries were major seats of learning but in 11th century AD official universities opened in Europe
•1010 AD Avicenna writes The Book of Healing and in 1025 AD The Canon of Medicine
•Scholars translated Islamic texts (from original Greek) into Latin for wider consumption
•Science: new discoveries and inventions. Scientific progress achieved under the wing of the church
•Medicine: disease and illness seen as acts of God but was recognition of interdependence of mind and body
•Invention of the printing press in 1440 AD; translation and physical distribution of scientific texts took precedence

•Intellectual and economic changes; breakdown of class and political structures; Protestant Reformation
•Scientific revolution c.1550-1700 AD: Galileo: theories of gravity and the universe – not universally accepted
•*Treatise on Man*, written by René Descartes introduced mind/body dualism
•Royal Society set up in 1662 AD by Charles II in London.
•Medicine: Anatomical knowledge increases. Pain regarded as a mind-body phenomenon and treated using a mixture of religious and scholastic solutions

•Industrial revolution: rise of industry, transportation etc
•French Revolution: changes Europe forever – challenges to authority and balance of power
•Enlightenment: rise in importance intellectual and scientific thinking over blind faith and belief; Newton, Voltaire etc.
•1846 AD – first general anaesthetic developed and heralded huge changes in surgical techniques and healthcare.
•Medicine: 1857 AD Louis Pasteur identifies germs as cause of disease; first vaccines; 1899 AD aspirin invented; surgical techniques improved; general anaesthetics start to be developed.

•Industrial revolution gives way to post-industrial society and the digital age.
•World wars I and II result in vast improvements in surgical techniques and anaesthetics for trauma victims
•Revolution in science and medicine. Many vaccines developed, Smallpox was eradicated and Penicillin was developed in 1928 AD.
•NHS starts in UK allowing free healthcare and mass vaccination of the population, improving mortality rates.
•Biomedical models perpetuate in modern medicine and pain science, creating a mechanistic view.
•Renewal of focus on the biopsychosocial model of medicine and introduction of 'living well' and other holistic programmes

FIGURE 1
A contextual history of scientific and medical understanding.

during the Medieval Period; there were no straightforward causal relationships and they involved both the body and the mind. Even when trained physicians were available from around the 12th century, most people were unable to pay and therefore sought treatments from untrained healers and through religious means.

Treatment for pain was largely reliant on traditional folklore, superstition and herbal tinctures (6). Physicians used astrological charts to aid diagnosis and treatment. In the late 11th Century, new ideas were imported into Europe, probably as a result of the first Crusade. Islamic scientific and medical texts (originally from Greece) were translated into Latin so that they could be read by western European scholars. At this time, Avicenna (*Ibn Sina*), a Persian polymath (980–1,037 AD) followed Galenic thinking and published "*The Canon of Medicine*" in 1,025 AD (7) which set the standard for medicine in medieval Europe and the Islamic world into the 18th century. Within "*The Canon*", Avicenna challenged some aspects of Galen's work and argued that pain was not always an "interruption of continuity", and that bodily adaptation could occur in the presence of pain (8). Although medieval texts did not distinguish between chronic and acute pain as such, some writers referred to long-term painful illnesses.

In the 12th century, the Andalucian polymath and physician and philosopher Averroes (*Ibn Rushd*) wrote *The Book of the Principles of Medicine (The Kulliyat)* which recognised observation rather than mere speculation in the diagnostic process (9) suggesting early practise of evidence-based medicine (10). Guy de Chauliac defined pain in his *Grande Chirurgie* (1,363 AD): "*Pain, according to Avicenna, is a feeling of contradictory qualities. But along with these contradictory humors which might inflict pain, according to Galen, there may be alterations which break or cut, stretch or abrade: pain is therefore the result either of personally generated contrary qualities, or interruptions in continuity caused by accidents*". [Cited in (2)].

Lived experience

Rey claims that there are few accounts of how individuals experienced pain and suffering until the shift in religious preoccupations in the 12th century (2). Figurative scenes of endurance of agony, pain, and suffering of saints, as depicted on stained glass windows, offered clues about the societal relationship with pain. Medieval society was ordered by powerful men of church authorities or feudal lords warring with one another. Rey speculates that during this era there would be little time to ruminate on pain experience. Christianity positioned itself as a religion of salvation and healing through faith and prayer. Rey argues that this social milieu would provide little space for "intimate attention to the body" and encouraged a stoic indifference to pain.

Rey's views of stoicism and indifference to pain are contested by Cohen who devotes an entire chapter of the book *The Modulated Scream: Pain in late Medieval Culture*, to impassibility; mainly of the martyrs but also of those undergoing torture …. "*They did suffer; they did not possess miraculous impassibility*" (11). Cohen argues that written accounts of the pain of others was speculative and that any apparent indifference to pain must have been an ability to withstand it. It is unlikely that medieval people had the ability to be indifferent to pain and would utilise various strategies and narratives to cope with it. Religious and scholastic attitudes towards pain and disease were so intertwined during this period that people would have tried various strategies for relief. "Saintly stoicism" was probably confined to a few individuals, such as the mystics and pious religious figures.

Cohen draws attention to a difference between people experiencing pain in the late Medieval Period (c. 1,300–1,500 AD) and those of modern time; referring to the social milieu of living with pain in the modern era as "*utter isolation and solitude of the sufferer*" (12). Cohen states "*The modern sufferer is trapped inside her pain, unable to share or express it. In contrast, in the later Middle Ages pain was definitely a social sensation … pain was shared, discussed and transmitted through speech, art and patterns of behaviour*" (12). Cohen argues that sharing pain with others fostered social cohesion and solidarity amongst similar social groups, such as the small, impoverished village communities. The Renaissance and the scientific revolution (c. 1,550 AD) grounded an understanding of pain in bodily pathophysiological disruption, locating pain and its treatment within tissue. People not responding to biomedical treatments were left isolated, disorientated, and helpless by an indifferent and uncomprehending medical paradigm; over time these sentiments spread in the wider social world (13). In the modern era, people continue to share pain experience with family and friends, and within cultural, religious, and societal groups which mirrors the medieval experience of "shared suffering"; however, constraints on resources and the need to quantify pain means that sharing pain experience remains marginalised in health service delivery.

Sense-Making

In the mid to late Medieval Period the pain of Christ was an important part of sense-making. medieval people interpreted the church's premise that pain was a "divine gift" or "sacrificial offering" to get closer to God or as a means of punishment and redemption in various, often contradictory ways. The mystic Beatrice of Nazareth (c. 1,200–1,268 AD) wrote that her many illnesses were a blessing and her pain was a way of being tested and to get closer to God (14). The visionary Margery Kempe (c. 1,373–1,439 AD) thought her painful illnesses were a punishment for being an imperfect human rather than for any specific sin (15). Kempe rationalises the unpredictability of her pain by attributing its origin to God, although she was not affiliated with any religious order.

Medieval *vitae* of the ascetics describe how they practiced severe self-denial and self-infliction of pain either as a form of self-punishment or to mimic the suffering of Christ, possibly through altering their conscious state, in order to be morally acceptable before the divine (16, 17). The mystic and Augustinian Marie d'Oignies (c. 1,177–1,213 AD) self-inflicted pain as a means of punishment and to develop her spirituaty (18), and she overcame this pain claiming that she "had been so inflamed by the overwhelming fire of love" (of God) (18). medieval mystics and others, such as religious martyrs appear to have been able to divert their attention away from pain, possibly by thought suppression and self-hypnosis (17), similar to that observed in modern times, e.g., sport ultra-endurance athletes (19) or extreme sports protagonists (20). In both medieval and modern times context would determine whether such behaviours of mystics and ascetics were perceived as a psychiatric disorder, a feat of "strong will" or the intervention of a supernatural force (21).

Alleviating pain

During the mid to late Medieval Period the first universities in Europe were established. Trained physicians mostly tended to those who could afford to pay. The Universities were affiliated with the Church and scholars were expected to take minor orders, thus forming a complex theology/medicine relationship in medieval Europe (3). A debate about the tension between the Christian "suffering self" and the desire to relieve pain by any means during the Medieval Period remains unresolved (3, 12).

The prevailing Christian view, that pain was a punishment for sin or a divine intervention worthy of reward in the afterlife, fostered an attitude that pain was something to be endured. Nevertheless, evidence suggests that medieval people *suffered* pain and wanted relief from it. Importantly, painful illness which prevented people from working the land had financial consequences because rents to overlords and tithes to the church could not be paid. This provided a strong incentive to find relief from pain and also placed reliance on small village communities to support the ill and infirm (22). It has widely been thought that life expectancy was only 30–35 years during the Medieval Period, but this has now been shown to be incorrect and skewed due to high infant mortality. Those living to the age of 25 had a good chance of surviving until they were 50 and possibly much longer (23, 24). Therefore, they would have a greater likelihood of experiencing pain and illness, and possibly for a prolonged period of time.

Spiritual relief of pain was often sought by an array of religious activities including prayer, pilgrimages and seeking miracles all of which continue into modern times (25). John of Mirfield (1,362–1,407 AD), amongst others, understood the desire for pain relief and that pain in itself could result in further illness or death (26). Nevertheless, in some circumstances pain should be borne without relief as it was believed that interventions to alleviate pain would interfere with natural processes e.g., by causing contractions to stop during painful childbirth (27).

Medieval healers often used painful antiquated treatments such as bloodletting and other types of purging to rid the body of noxious substances, balance the humours and to 'drain away sins'. In 1,363 AD, Guy de Chauliac's *Grande Chirurgie* described principles for treatment based on "opposites" to counteract disorders including pain, e.g., humidity for dryness, heat to "ward off cold" (28). Guy de Chauliac advocated evacuation or purges and remedies to inflame or suppurate using fats and oils, mixed with bread and eggs, and applied as plasters to defuse heat. He also used ligatures to render painful body parts insensate and to prevent bleeding. The acceptance of painful procedures to cure pain continues to modern times, e.g., surgery, emetics, laxatives, and the draining of bodily fluids such as cysts.

Methods of soothing pain during the Medieval Period included sparing use of plants such as hemlock or opium (29). The earliest version of the Old English Herbal is the Cotton MS Vitellius C III, written in the early 11th century, describing plants and their uses. The Antidotarium Nicolai, written between 1,160–1,220 AD, distinguished between antidotes for pain and those treating illness and was written as a guide to the ingredients required for popular remedies (30). Examples included sponges infused with narcotic substances applied to the skin prior to incision or inhaled as gases through the nose. These procedures echo modern-day analgesic practices such as the use of morphine patches or inhaled Entonox. Hildegard von Bingen (1,098–1,179 AD), Benedictine abbess of the Rhineland in Germany, was a visionary, mystic and healer, that produced remedies for a multitude of ailments using some substances still in use today (31). Some remedies contained dangerous substances such as mandragora root (mandrake), nightshade, and henbane that were administered in small quantities. Some became the precursors of modern-day analgesic agents, for example, opium and willow bark (containing salicylic acid).

It was believed that people undergoing surgery in the Medieval Period received no relief of pain because it had been thought that there were no effective anaesthetics in England until approximately 150 years ago. However, the use of anaesthetics pre-dates Roman times in southern Europe (c. 800 AD) (32, 33). Late medieval English texts (c. 12th–15th century) discovered towards the end of the 20th century contained a recipe for an anaesthetic concoction called Dwale; based on bile, lettuce, vinegar, and bryony root, hemlock, opium, and henbane. Some ingredients were highly dangerous and yet the Dwale recipe was administered by ordinary people (34) and appeared in household recipe books (35). Bryony was sometimes used as a substitute for mandrake (*Mandragora officinarum*). Mandrake could cause hallucinations and was therefore associated with magic powers and might have been responsible for out of body experiences occurring in witchcraft, although this has not been widely confirmed (36). Jeanne d'Arc (d. 1,431 AD) was accused of carrying mandrake at her trial (37).

Discussion

The complex interchange between medical and Christian beliefs and the debate about the relative influence of medical thought on scholastic theology made the Medieval Period an interesting time in the history of pain. We have used in-depth analyses of the writings of other scholars to gain insights of the mindset of people living in the Medieval Period as summarised in **Table 1**.

In the Medieval Period, pain was a multifaceted shared social experience with several meanings, and people sought to alleviate pain using physical, spiritual, and social interventions. Sharing pain promotes social bonding, cooperative behaviour, camaraderie, and well-being (38–40). Nowadays, people report

TABLE 1 Comparison of attributes of pain in medieval and modern periods.

	Medieval Period	Modern Period (including present-day)
Dates of period	• 5th Century A.D. (fall of western Roman Empire) to c. 1,500 A.D. (start of Renaissance period) • Mid (high) to late Medieval Period started c. 1,000 A.D.	• Early modern period began c. 1,500 and late modern period began c. mid-18th century A.D. • Contemporary history began 1,945 A.D. following the second world war
Major events	• Seats of learning; monasteries and the first universities • 1,025 A.D.—Canon of Medicine (Avicenna) set standard for medicine in medieval Europe and the Islamic world • Late 12th century *The Book of the Principles of Medicine* (Averroes) • 1,160–1,220 A.D.—The *Antidotarium Nicolai* guide to the ingredients for remedies that distinguished antidotes for pain and illness • First crusades—Islamic medical documents translated into Latin for European Scholars • Bubonic plague (c. 1,346 to 1,353 A.D.)	• c. 1,550–1,700 A.D.—start of scientific revolution • Circa 1,600 A.D.—Descartes–Cartesian dualism fostered mechanistic biomedical model of healthy body and denied significance of mind • 1,846 A.D.—advent of anaesthetics • 1,950 A.D. onwards—emergence of influential pain specialists/ scientists e.g., Bonica, Melzack and Wall, Woolf etc.
Pain experts/influencers	• The church • Local healers • Medical scholars (later Medieval Period)	• Medical practitioners/specialists • Registered and unregistered therapists/healers • Pain specialists • Social media
Phenomenology of pain	• "Social sensation" • Shared experience • Coherent with shared life demands and expectations of community	• "Individual sensation" • Private experience • Coherent with damaged body needing medical attention creating expectation of diagnosis and cure
Phenomenology of suffering	• Social and public suffering within a cohesive family and community unit	• Suffering in isolation and solitude perhaps reflecting some fragmentation of family and community units
Meaning of pain	• Multiple meanings • Humoural imbalance • Result of treatment or process of healing • Blessing from God • Devine punishment for sin, a penitence, retribution, punishment, or martyrdom	• Single meaning (i.e. biomedically dominant) • Tissue damage or dysfunctional physiology • Present-day recognition of biopsychosocial influences
Ontology	• Holistic, part of a whole person, including the personality • Carried within the soul	• Materialistic, body parts and biomedical constituents • Produced by the brain
Explanatory model	• No straightforward causal explanation • Humoural imbalance involving body, mind and/or soul • God / Metaphysical processes • Unclear whether medical or scholastic attitudes were separate or intertwined	• Symptom of pathology • Neuro-mechanistic processes with biopsychosocial influences • Dysfunctional somatosensory system
Expression of pain	• Verbalisation, behaviour and artform rooted in diverse narratives	• Verbalisation and behaviour predominantly rooted in biomedical narrative
Societal attitude	• Tension between Christian "suffering self" and desire to relieve pain • Pain from illness required alleviation • Pain from surgery, or childbirth should not be treated • Endure pain because 'from God' • Spiritual relief by prayer, pilgrimages, miracles and religious power	• Relief of pain is a human right • Expectation of a cure • Biomedical, and more recently psychosocial, approaches to 'fix' body and mind • Pain as a technical problem • Treatment 'failure' if individual remains in pain
Individual hopes, beliefs and expectations	• Hope for relief and possibility of cure • Fear pain could result in further illness or death • Treatment failure—'God's Will' • Behaviour—short period of therapy shopping • Continue to work to survive • Low expectation of complete relief and return to 'normal'/'optimal' health	• Expectation of relief and of cure • Fear pain could signal sinister disease • Treatment failure—multiple explanations, incorrect treatment, poor medical practice, complex medical condition • Behaviour—prolonged therapy shopping … symptom relief whilst searching for diagnosis and cure • Absence from work—illness benefits • High expectation of complete relief and return to 'normal'/'optimal' health
Asceticism	• Often by religious leaders, mystics, martyrs experiencing torture to be morally acceptable before the divine	• Often by sportspeople, military to be stoic, competitive or exhibitionistic
Forces of power	• The Church • Social power	• Biomedicine/health care • Medical power
Pain practitioners	• Local trained and untrained healers and 'wise women' using folklore • Mystics and religious orders (in case pain resulted from sin) • Physicians (medical scholars) available c. 12th century A.D., often aided by astrological charts—but too expensive for most people	• Physicians, health care practitioners, multidisciplinary teams, using biomedical diagnosis • CAM practitioners • Religious orders • Untrained and unregistered healers
Modes of treatment	• Access to medical care very limited • Traditional folklore, herbal tinctures, external concoctions, plants (hemlock, opium, willow bark), salves and plasters • Purging to rid the body of noxious substances or drain away sins • Balance humours	• Access to medical care widespread • Treatment targeting biomedical constituents such as anaesthetics, analgesics, pain adjuvants and surgery • Biopsychosocial approaches and health promoting and lifestyle adjustments
Pain writings	• Scholastic and devotional theme • Often only available to educated few	• Applied biomedical/psychosocial theme • Knowledge generated by pain specialists/scientists and available to society

feelings of being "trapped" inside a painful "damaged" body likened to incarceration in prison and resulting in self-imposed isolation (41). Self-isolation is an evolutionary adaptation that aids survival following injury, and people will have self-isolated in the Medieval Period, although this seems to have been heightened in modern times. The rise in individualism and the inability to adequately share pain in health care settings appear to be contributing factors (42, 43). Conversely, technological developments have enabled sharing of pain via the world wide web and social media, enabling global reach way beyond the confines of local groups and communities. Sharing pain in this way may have a profound impact on pain experience, and research on the topic is in its infancy. Likewise, a bewildering multitude of choices and opinions are available nowadays for people experiencing pain. This may provide greater opportunities for recovery but may also increase the sense of isolation and hopelessness when treatments fail. We advocate a need to allow society, including health care systems, to provide opportunities for modern-day people to share pain, through for example, telling stories of pain experience using various vocabularies. Contemporary approaches to assist people on a healing journey are delivered using clinical and non-clinical personnel in settings that are "non-threatening" including the arts and visual imagery (44–46).

Medieval explanations of pain residing "within the soul" have parallels with contemporary concepts of "inner-self", "embodied pain" and "body-mind theory" (47). Medieval humoural theory is a rudimentary framework for contemporary concepts associated with balance of the body and mind and the connection to the natural and built environments (48, 49). The shift from Galen's holistic view of pain resulting from humoural imbalance to a neuro-mechanistic model of pain has provided great advances in the understanding of nociception, sensitisation, bioplasticity and neuroimmune function. Neilson argues that the neuro-mechanistic view of pain is an "illusion of great scientific progress" because the vast accumulation of physiological knowledge conceals a model that does not explain the *subjective* experience of pain i.e., the hard problem of consciousness (50). A consequence of conflating nociception (neurophysiology) and pain (51) has been to decontextualise physiological processes from the lived experience (42) resulting in neglect of the socio-ecological factors that shape a person's lifeworld and contribute to painogenicity (13, 52).

Contemporary models describe pain is an emergent phenomenon of brain activity rather than an identifiable "thing" (51, 53–56). Calls to reflect social and phenomenological aspects of pain in scientific definitions (57, 58), consistent with the shared social experience of pain in the Medieval Period, are growing. Bourke argues that pain should be considered a "*… type of an event … one of those recurring occurrences that we regularly experience and witness that participates in the constitution of our sense of self and other*" (59) p. 5. Our appraisal suggests that pain would have been considered more like a "type of event" than a "thing" in the Medieval Period.

Under the power of the Church's narrative, failure to relieve pain in the Medieval Period was probably interpreted as "God's will"; an attitude which remains to this day in some cultures and communities. We speculate that this may have fostered an acceptance of the need to endure pain without relief. The biomedical paradigm which has driven advances and refinements of the medieval pharmacopeia has raised societal hope and expectations of relief (and cure). Advances in biomedicine have produced a wealth of beneficial pain treatments, yet unremitting pain and suffering remains a major challenge of the modern period. Forces controlling societal narratives about pain (e.g., the Church or biomedicine) have, to some extent, disenfranchised people. We argue greater focus on investigation of "upstream" factors, such as societal narrative, that may be creating painogenic environments, as this is likely to assist prevention of pain and its persistence. We also advocate a need to empower people to take control of their own pain story (60), with a role for community-centred biopsychosocial approaches to assist recovery and to live well with pain (61). Contemporary approaches to de-marginalise people in pain include a recognition that the arts (45, 46), including the use of imagery, aid understanding of the lived experience of pain (44) and give meaning to life itself: "*If health is about adaptation, understanding, and acceptance, then the arts may be more potent than anything that medicine has to offer.*" (46)

Conclusion

The medieval perspective of pain provides insights for a fuller understanding of the socio-ecological conditions contributing to a painogenic milieu, offering insights to upstream strategies to prevent pain. Severe physical hardship was common for many people during the Medieval Period (i.e., in Europe) and pain was probably common, with chance of relief low. Improvements in living standards and in pain treatment have not resolved the burden of unremitting pain in society. In some ways, the mindset of medieval people toward pain parallels people in the modern era; people seek relief under the constraints of affordability, availability and acceptability and guided by therapeutic, community and theological beliefs. Personal life-worlds about pain are constructed within the social narratives of the time, and many medieval narratives survive to the present day in refined forms. Pain as a shared experience is a longstanding characteristic of human communities. This supports the need for flexibility in modern-day explanations of pain that are acceptable to individuals and communities, so that they can connect with a sense of self and the social world (62). To do this, we advocate exploration of pain and its management via an eclectic mix of subject disciplines, including history, the arts and storytelling, which would help patients validate their pain and allow them to express psychological and spiritual aspects of their experiences (63).

Accessing research materials

Underlying materials related to our paper can be accessed by contacting Professor Mark I. Johnson.

Data availability statement

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

Author contributions

All authors contributed equally to this work. All authors contributed to the article and approved the submitted version.

Conflict of interest

In the previous 5 years, MJ's employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press. All other authors declare no conflicts of interests.

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

Publisher's note

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The influence of cultural and religious factors on cross-national variations in the prevalence of chronic back and neck pain: an analysis of data from the global burden of disease 2019 study

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Introduction: Low back pain and neck pain are among the most commonly reported forms of chronic pain worldwide, and are associated with significant distress, disability and impairment in quality of life. Though these categories of pain can be analyzed and treated from a biomedical perspective, there is evidence that they are both related to psychological variables such as depression and anxiety. The experience of pain can be significantly influenced by cultural values. For example, cultural beliefs and attitudes can influence the meaning attached to the experience of pain, the responses of others to a sufferer's pain, and the likelihood of seeking medical care for particular symptoms. Likewise, religious beliefs and practices can influence the both experience of pain and the responses to it. These factors have also been associated with variations in the severity of depression and anxiety.

Methods: In the current study, data on the estimated national prevalence of both low back pain and neck pain, obtained from the 2019 Global Burden of Disease Study (GBD 2019), is analyzed in relation to cross-national variations in cultural values, as measured using Hofstede's model (n =115 countries) and in religious belief and practice, based on the most recent Pew Research Center survey (n = 105 countries). To address possible confounding factors, these analyses were adjusted for variables known to be associated with chronic low back or neck pain, namely smoking, alcohol use, obesity, anxiety, depression and insufficient physical activity.

Results: It was found that the cultural dimensions of Power Distance and Collectivism were inversely correlated with the prevalence of chronic low back pain, and Uncertainty Avoidance was inversely correlated with the prevalence of chronic neck pain, even after adjustment for potential confounders. Measures of religious affiliation and practice were negatively correlated with the prevalence of both conditions, but these associations were not significant after adjusting for cultural values and confounders.

Discussion: These results highlight the existence of meaningful cross-cultural variations in the occurrence of common forms of chronic musculoskeletal pain. Psychological and social factors that could account for these variations are reviewed, along with their implications for the holistic management of patients with these disorders.

KEYWORDS

chronic pain, low back pain, neck pain, religion, culture, spirituality

Introduction

Pain is a universal defensive mechanism present in both animals and humans. From an evolutionary perspective, the mechanisms involved in the perception of pain and the response to it have been conserved due to the survival advantages they confer. These advantages include withdrawal from injurious or noxious stimuli, the promotion of wound healing, and the ability to signal danger or a need for help (1). Molecular mechanisms involved in the perception of such stimuli, and withdrawal from them, have been documented even in invertebrate organisms, such as mollusks (2). However, in many cases, humans experience pain that is persistent, severe, disabling, and not seemingly related to any acute risk of tissue damage or injury. This condition is referred to as chronic pain, and it is one of the leading causes of disability around the world (3). One of the commonest types of chronic pain occurs in relation to the components of the musculoskeletal system, and is referred to as chronic musculoskeletal pain (4). For example, meta-analysis of 122 publications from low- and middle-income countries found that the prevalence of chronic pain was 35% in the general population and 56% in elderly adults. Among the population of those diagnosed with a chronic pain, musculoskeletal pain was the commonest diagnosis, accounting for over 40% of all cases in these countries (5). Similar results were obtained in a large cross-national study of older adults from Europe, in which 36% of respondents suffered from chronic musculoskeletal pain (6). Chronic musculoskeletal pain is a particularly common problem among adults in active employment, affecting over 60%–70% of this population, and frequently leading to reduced work performance, loss of income, or unemployment (7–9).

The category of chronic musculoskeletal pain is itself a broad one, including such entities as chronic widespread pain, shoulder pain, low back pain and neck pain. However, low back pain and neck pain are among the commonest types within this category. The prevalence of chronic low back pain has been estimated at around 11% in the general population and 20%–36% in older adults (10, 11), while the lifetime prevalence of chronic neck pain has been estimated at around 48% (12). Moreover, these two types of pain frequently co-occur: it has been found that around 30%–55% of patients with chronic low back pain also experience neck pain (13). Chronic back and neck pain also show evidence of familial aggregation, which suggests that they may share genetic risk factors (14).

The cause of most cases of chronic low back or neck pain is largely unknown. Many hypotheses have been advanced to explain the pathogenesis of these conditions, including mechanical or degenerative changes in local musculoskeletal structures, increased inflammatory activity, increased sensitization to pain at the level of the central nervous system and impairments in sensorimotor control (15–18). Despite much active research in this area, the evidence supporting these hypotheses is often inconsistent, and there is a paucity of evidence to guide the choice of safe and effective treatments in these patients (18–20). Notwithstanding this knowledge gap, most patients with these disorders are treated with pharmacological therapies, such as analgesics and antidepressants (21), and some undergo surgical procedures with the aim of correcting problems of a mechanical or degenerative nature (22). However, these treatment modalities are often of limited efficacy (22–24), and some of them, such as opioid analgesics and surgery, are associated with a significant risk of harm (25, 26).

Owing to these limitations, there is also a significant amount of interest in the role of psychological and social factors in the onset, persistence, and outcome of chronic low back and neck pain. From a psychological perspective, both these conditions appear to be genetically linked to depression (14). Depressive disorders are more common in patients with these disorders than in the general population (27, 28), and depression has been found to predict functional outcomes in these patients (29, 30). Apart from depression, other negative emotional states such as anxiety and anger have also been associated with both the occurrence of these conditions, and the level of disability associated with them (31–33). Psychological stress, particularly when chronic in nature, has been associated with both these types of pain (33, 34), and there is some evidence that patients with these conditions are more sensitive to the effects of stress (35, 36). The cognitive styles of individuals with these pain disorders also appear to differ from those of healthy controls in certain key aspects, such as reduced flexibility (37) and exaggerated ideas or beliefs regarding the causes or likely consequences of their pain (38). In the light of these findings, a wide range of psychologically-oriented therapies, based on cognitive- or mindfulness-related principles, have been tried in patients with back or neck pain, and have been found to reduce both subjective perceptions of pain severity and quality of life (39, 40).

These psychological findings should, like the biological models discussed earlier, not be viewed in isolation, but as part of a biopsychosocial approach to the pathogenesis and management of chronic musculoskeletal pain (41). Cultural factors can influence individuals' mental health and psychological responses to pain, as well as community- and workplace-related factors that can either facilitate or hinder recovery from chronic back and neck pain. For example, cultural variations in individualism-collectivism—that is, in the extent to which the society accords importance to the individual or to the larger community—have been associated with regional or cross-national variations in the prevalence of depression (42), in emotional responses to a given experiences (43), in coping with stress or adversity (44), and in the manner in which others in the patient's environment respond to their pain (45). Cross-cultural variations in cognitive flexibility, which is significantly associated with chronic pain, have also been shown to exist from childhood onwards (46). Similarly, cultural differences in power distance, which measures the level of hierarchy and the tolerance of inequality in a given society, are associated with cross-national variations in workplace culture and stress (47, 48), which are risk factors for chronic neck pain (49). Culture can also influence how individuals experience and report chronic pain and the disability associated with it, requiring adaptations in the instruments used to measure these variables (50). Moreover, culture can also influence the type of medical care received by these patients. For example, a study of prescribing trends in

Europe found that cultural dimensions, such as individualism-collectivism, long-term orientation, and indulgence vs. restraint, influenced variations in the prescriptions of drugs used to manage these types of pain, such as duloxetine and pregabalin, between countries (51). In a meta-analytic review of studies of chronic pain, it was observed that three cultural dimensions—power distance, individualism-collectivism, and indulgence vs. restraint—mediated the association between fear-related avoidance and the severity of pain (52).

Religion and spirituality, as integral parts of culture that shape most aspects of human existence, have also been associated with certain aspects of these types of pain. From a theoretical perspective, religious or spiritual coping has been postulated to exert a beneficial effect both on pain and on the negative mood states, such as depression, that are both caused by and exacerbate it (53). However, due to the relatively small number of studies examining the association between religiosity and musculoskeletal pain, results have often been inconsistent or even conflicting in real-world settings. A study of elderly adults with chronic low back pain found that self-reported religious coping was negatively associated with the intensity of pain and positively associated with pain acceptance, suggesting a protective effect (54). A subsequent systematic review confirmed the association between religious beliefs or attitudes and pain acceptance, but also reported possible negative outcomes such as worse pain-related cognitions and mood states; however, this review acknowledged that most of the available evidence was of low quality and possibly biased (55).

One of the major reasons for variations across studies is that “religion” and “spirituality” are not unitary constructs: different religions, or even different sub-groups or sects within a religion, differ substantially in the significance that they attach to pain, the responses to suffering that are considered appropriate, and the extent of support provided to an individual suffering from chronic pain. Moreover, cultural beliefs and attitudes that are not directly related to religion can act as confounding factors. For example, a study of Ghanaian adults revealed that their religion was a source of hope and support in the face of chronic back pain; on the other hand, many of these adults had culturally-derived maladaptive beliefs related to pain, which were not specifically related to their religion (56). Similar results regarding the positive role of religion were reported in a study of Spanish and Brazilian patients with back pain (57). A study of Arab Muslim patients found that religion was associated with both active and passive coping strategies, with the former having a more positive effect on well-being (58). In a study of office workers with chronic low back pain from Thailand, respondents’ self-reported level of adherence to Buddhist beliefs and practices was associated with lower levels of depression and lower salivary cortisol—a marker of stress—but not with any significant reduction in disability (59). Two studies from Nigeria further underline the complexity of the associations between various aspects of religion and these types of pain. In the first, it was found that low back pain was more common in Christian than in Muslim adolescents (60). In the second, it was observed that “unconventional” health practitioners, who are often the first point of contact for Nigerian patients with chronic low back pain, differ significantly in the nature of the guidance they offer: practitioners of herbal medicine seemed to endorse passive coping and adherence to pharmacotherapy (both herbal and allopathic), while pastors favoured spiritual explanations of the cause of back pain, and accordingly offered spiritual healing to their clients, but also encouraged pain acceptance and fostered resilience in their clients (61). Finally, it should be noted that these relationships are not unidirectional: the presence of chronic low back or neck pain can interfere with body posture and mobility, leading to difficulties in adhering to certain religious practices. This can in turn lead to psychological distress, which might exacerbate the underlying pain (62, 63).

The foregoing discussion makes it clear that the management of chronic neck and back pain, particularly in non-“Western” settings, requires a careful integration of both cultural factors and of religion/spirituality into treatment approaches (41, 53). Such a wish is often reported by patients themselves (64). To achieve this effectively, it would be useful to identify those cultural factors, or those aspects of religious belief or practice, that are meaningfully associated with variations in the occurrence of these disorders. Such an analysis would gain additional validity if an attempt was made to correct for lifestyle, medical and psychosocial factors, such as obesity, physical activity and depression, that are themselves associated with chronic low back and neck pain (27, 49).

The aim of the current study is to examine whether cross-national variations in cultural values, and in self-reported religious affiliation and practice, are associated with significant variations in the prevalence of chronic low back pain and neck pain, as estimated by the 2019 Global Burden of Disease Study. To minimize the risk of spurious correlations, this study will also attempt to correct for the effects of factors independently associated with these disorders, namely tobacco use, alcohol use, depression, anxiety, obesity and insufficient physical activity.

Materials and methods

The current study was a cross-sectional, cross-national, ecological association study. The outcome variables of interest were the estimated prevalence of chronic low back pain and neck pain, obtained from the 2019 Global Burden of Disease Study (GBD 2019). The independent variables of interest were: (a) scores measuring specific cultural values at a national level, namely the Global Collectivism Index (GCI) and Hofstede’s six cultural dimensions, and (b) self-reported levels of religious affiliation, belief and practice, based on the most recent Pew Research Center report. The confounding/interacting variables studies were the estimated prevalence of depression, anxiety and obesity; the percentage of the population of each country reporting tobacco or alcohol use; and the estimated proportion of adults in each country whose level of physical activity was considered insufficient.

Data sources

The Global Burden of Disease studies provide cross-national estimates of the incidence, prevalence and disability associated with a wide range of diseases and disorders, including musculoskeletal disorders, for 204 countries and territories (65). In this group of disorders, separate estimates have been made for the distribution of both chronic low back pain and chronic neck pain in each country. These estimates are available through database queries from the Global Burden of Disease Collaborative Network, which is hosted by the Institute for Health Metrics and Evaluation (IHME) located in Seattle (66). To minimize the confounding effect of variations in population demographics, such as higher life expectancies leading to higher prevalence estimates, age-standardized estimates of prevalence were obtained for both disorders and used in this study.

Two measures of cross-national variations in culture were used in this study. The first, the Global Collectivism Index (CGI), is a measure of individualism-collectivism that has been computed for 188 countries and territories with the explicit aim of providing a measure of this value that is valid regardless of a country's income grouping or geographical location. The GCI is a composite index calculated based on five factors: fertility rate, household size, marriage-to-divorce ratio, religiosity, collective transportation, and attitudes favoring interdependence. Higher scores on the GCI indicate a collectivistic cultural orientation, while lower values indicate an individualistic orientation. GCI scores range from a maximum of 1.92 (Somalia) to a minimum of −1.85 (Monaco) and were retrieved from the original publication describing the development of this index (67). The second measure of a nation's culture was the six-factor model developed by Geert Hofstede and his colleagues. This model describes each nation's culture in terms of ordinal scores, rated from 0 to 100, on six roughly orthogonal dimensions: Power Distance, Individualism-Collectivism, Masculinity-Femininity, Uncertainty Avoidance, Long-Term Orientation and Indulgence-Restraint. A full definition of each of these dimensions is provided in **Table 1** below. Hofstede's model was used for this study because (a) it captures a wide range of cultural values beyond individualism-collectivism, (b) data on this model is

TABLE 1 **Study variables, definition, sources and availability.**

Variable	Definition	Data source	Availability
Prevalence of chronic low back pain (CLBP)	Age-standardized prevalence of chronic low back pain (%)	Global Burden of Disease 2019 study	204 countries
Prevalence of chronic neck pain (CNP)	Age-standardized prevalence of chronic neck pain (%)	Global Burden of Disease 2019 study	204 countries
Global Collectivism Index (GCI)	A continuous measure of national individualism-collectivism. Higher scores indicate higher collectivism	Original publication	185 countries
Hofstede index of Power Distance (HOF-PD)	A continuous measure of the extent to which inequalities in the distribution of power are expected and accepted in a society. Higher scores indicate a higher power distance.	Hofstede Insights database	116 countries
Hofstede Index of Individualism-Collectivism (HOF-IC)	A continuous measure of the extent to which a society privileges independence or interdependence. Higher scores indicate higher individualism (i.e, scoring order is the reverse of the GCI).	Hofstede Insights database	116 countries
Hofstede Index of Masculinity-Femininity (HOF-MF)	A continuous measure of the extent to which social values favour competition in contrast to cooperation. Higher scores indicate higher masculinity.	Hofstede Insights database	116 countries
Hofstede Index of Uncertainty Avoidance (HOF-UAI)	A continuous measure of the extent to which a society tolerates uncertain situations and uses beliefs or social institutions to handle them. Higher scores indicate higher avoidance of uncertainty.	Hofstede Insights database	116 countries
Hofstede Index of Long-Term Orientation (HOF-LTO)	A continuous measure of a society's preference for tradition as opposed to modernity. Higher scores indicate a more "future" (long-term) orientation.	Hofstede Insights database	100 countries
Hofstede Index of Indulgence vs. Restraint (HOF-IVR)	A continuous measure of a society's willingness to allow individuals to engage in pleasurable activities, as opposed to restraining their desires and impulses. Higher scores indicate greater indulgence	Hofstede Insights database	96 countries
Religious affiliation (REL-AFF)	Percentage of respondents reporting affiliation to a particular religion	Pew Research Center report	105 countries
Religion—Weekly Attendance (REL-ATT)	Percentage of respondents reporting at least weekly attendance of religious services or rituals	Pew Research Center report	101 countries
Religion—Daily Prayer (REL-PRAY)	Percentage of respondents reporting the practice of daily prayer	Pew Research Center	104 countries
Religion—Importance (REL-IMP)	Percentage of respondents reporting that religion is "important" or "very important" to them	Pew Research Center	105 countries
Prevalence of depression (DEP)	Age-standardized prevalence of depressive disorders (%)	Global Burden of Disease 2019 study	204 countries
Prevalence of anxiety disorders (ANX)	Age-standardized prevalence of anxiety disorders (%)	Global Burden of Disease 2019 study	204 countries
Prevalence of tobacco use (TOB)	Percentage of adults estimated to use tobacco	Global Health Observatory	163 countries
Prevalence of alcohol use (ALC)	Percentage of adults estimated to consume alcohol	Global Health Observatory	188 countries
Prevalence of obesity (OB)	Percentage of adults estimated to have a body mass index (BMI) greater than 30 kg/m^2	Global Health Observatory	191 countries
Prevalence of insufficient physical activity (IN-PA)	Percentage of adults whose level of physical activity is estimated to be inadequate	Global Health Observatory	162 countries

All study variables refer to country-level estimates.

available for a large number of countries ($n = 116$), and (c) prior research has established a tentative connection between three of Hofstede's dimensions and specific aspects of chronic pain (52). The Hofstede dimension scores are based on survey data from individuals across various countries, and are available through database queries from the Hofstede Insights database (68).

Data on religion was obtained from the most recent (2018) Pew Research Center report, entitled "The age gap in religion around the world" (69). This report, based on data from multiple surveys conducted in the period 2008–2017, includes data from 105 countries. For each country, the following data is available: (a) percentage of respondents reporting any religious affiliation, (b) percentage reporting daily prayer, (c) percentage reporting weekly attendance at religious services or rituals, and (d) percentage reporting that they consider religion important in their lives. These four parameters were used as measures of religious belief and practice in the current study.

Though several lifestyle and psychosocial variables have been associated with chronic back and neck pain, reliable cross-national data is available for only some of them. Therefore, possible confounding factors were selected for inclusion in the current study based on two criteria: (a) clear evidence of an association between the variable in question and either low back pain or neck pain, based either on systematic reviews or large observational studies of good quality, and (b) availability of reliable data on the variable for at least 100 countries. Based on these criteria, the following variables were included in the analyses of the current study: estimated prevalence of depression, anxiety disorders and obesity (all age-standardized), estimated percentage of adults with insufficient physical activity, and estimated percentage of the population using alcohol and tobacco. Data on these variables was obtained from the World Health Organization's Global Health Observatory (70).

A complete list of all the study variables, their definition, their sources and availability is provided in **Table 1**.

Data analysis

In the initial step of the data analysis, direct bivariate correlations (Pearson's r) were used to examine the strength and direction of the associations between cultural and religious variables and the estimated prevalence of chronic low back pain and neck pain. For these analyses, Bonferroni's correction was applied to minimize the risk of false-positive results. The correlations between both these sets of variables and the potential confounding factors included in this study—namely depression, anxiety, obesity, insufficient physical activity, and alcohol and tobacco use—were also examined using the same method.

In the second step, partial bivariate correlations (Pearson's partial r) were used to examine whether any identified associations between cultural and religious factors and the prevalence of back or low neck pain remained significant after adjusting for potential confounders. Confounders were selected in these analyses if they were significantly correlated with either set of variables in the previous step. Both direct and partial correlation analyses were two-tailed, and a p value of $< .05$ (with Bonferroni's correction for the direct bivariate correlations) was considered significant.

When reporting bivariate and partial correlations, the strength of each association was reporting according to standard guidelines for psychosocial research (71) as follows: absolute value of r ($|r|$) $<$ 0.1, zero (no) correlation; $|r| = 0.1$ to 0.39, weak correlation; $|r| = 0.4$ to 0.69, moderate correlation; $|r| \geq 0.7$, strong correlation.

In the third step, multivariate linear regression analyses were carried out to identify the consistency and strength of the associations between cultural and religious factors and the prevalence of both types of pain. All variables that were significantly associated with either type of pain at $p < .05$ or less in the bivariate analyses were included in the regression analyses. To address the issue of possible multicollinearity between variables, variance inflation factors (VIFs) were computed for all independent variables. If the VIF exceeded 4 for any of these variables, it was excluded and the analysis repeated until the VIF for all independent variables was ≤ 4.

Results

Data on the estimated prevalence of chronic low back and neck pain was available for 204 countries and territories. The estimated prevalence of low back pain was 8.11 ± 1.61%, with a maximum of 13.47% (United States) and a minimum of 5.37% (India). The estimated prevalence of neck pain was 2.28 ± 1.14%, with a maximum of 5.55% (Philippines) and a minimum of 0.96% (New Zealand). There was a moderate positive correlation between the prevalence of these types of pain ($r = .55$, $p < .001$). Descriptive statistics for the other study variables are presented in **Supplementary Material Table S1**.

Bivariate correlations between culture, religion, and the prevalence of low back and neck pain

Unadjusted bivariate correlations between cultural variables and the prevalence of chronic low back and neck pain are presented in **Table 2**. In these analyses, the prevalence of chronic low back pain was negatively correlated with the GCI and positively correlated with Hofstede's index of individualism-collectivism; in other words, the prevalence of chronic low back pain was negatively associated with collectivistic cultural values, even after applying Bonferroni's correction. The strength of this association was moderate. Low back pain was also negatively correlated with Hofstede's index of Power Distance, and positively correlated with Uncertainty Avoidance and Long-Term Orientation. However, of these three, only the associations with Power Distance and Long-Term Orientation survived correction for multiple comparisons.

The prevalence of chronic neck pain was also negatively correlated with the GCI and positively correlated with the Hofstede index of individualism-collectivism. Though the strength of these associations was weaker than for low back pain,

TABLE 2 Bivariate correlations between dimensional measures of cultural values and the national prevalence of chronic low back and neck pain.

Variable	1 CLBP	2 CNP	3 GCI	4 HOF-PD	5 HOF-IC	6 HOF-MF	7 HOF-UAI	8 HOF-LTO	9 HOF-IVR
1	–	.55 (<.001)**	-.64 (<.001)**	-.32 (<.001)**	.55 (<.001)**	.07 (.433)	.21 (.026)*	.45 (<.001)**	-.09 (.393)
2		–	-.32 (<.001)**	-.37 (<.001)**	.43 (<.001)**	-.02 (.863)	-.20 (.033)*	.04 (.726)	.11 (.301)
3			–	.55 (<.001)**	-.66 (<.001)**	.00 (.981)	-.10 (.272)	-.46 (<.001)**	-.13 (.223)
4				–	-.65 (<.001)**	.05 (.563)	.25 (.007)*	.00 (.992)	-.30 (.003)*
5					–	.07 (.442)	-.20 (.033)*	.14 (.159)	.13 (.220)
6						–	.00 (.989)	.03 (.782)	.04 (.738)
7							–	.20 (.043)*	-.26 (.012)*
8								–	-.49 (<.001)*

*Significant at $p < .05$, uncorrected.

**Significant at $p < .05$ after Bonferroni's correction.

CLBP, prevalence of chronic low back pain; CNP, prevalence of chronic neck pain; GCI, Global Collectivism Index; HOF-PD, Hofstede Index of Power Distance; HOF-IC, Hofstede Index of Individualism-Collectivism; HOF-MF, Hofstede Index of Masculinity-Femininity; HOF-UAI, Hofstede Index of Uncertainty Avoidance; HOF-LTO, Hofstede Index of Long-Term Orientation; HOF-IVR, Hofstede Index of Indulgence vs. Restraint.

it remained significant after Bonferroni's correction. Neck pain was also negatively correlated with Power Distance and Uncertainty Avoidance, but only the former association was significant after correction. Overall, these results suggest that the prevalence both chronic low back pain and neck pain is lower in countries with a collectivistic orientation and a higher Power Distance; low back pain alone was also associated with higher Long-Term Orientation.

Bivariate correlations between measures of religiosity and the prevalence of both pain disorders are presented in Table 3. The prevalence of chronic low back pain was negatively correlated with all four measures of religiosity: this association was weak for affiliation, moderate for religious attendance and daily prayer, and strong for the importance assigned to religion. All these associations survived correction for multiple comparisons. The prevalence of chronic neck pain was also negatively correlated with all measures of religiosity; however, the strength of these associations was weaker, and only the associations with religious attendance and the importance assigned to religion were significant after applying Bonferroni's correction. These results suggest that countries with higher self-reported measures of religious belief and practice have lower levels of chronic low back pain and neck pain, particularly the former. It can also be noted from Table 3 that there was a strong degree of multicollinearity ($r = .84$ to.93) between the reported values for religious attendance, prayer and importance.

Correlations between the aforementioned variables and the possible confounding or interacting variables included in this study are presented in Supplementary Material Table S2. In these analyses, the prevalence of chronic low back pain was positively correlated with the prevalence of anxiety, obesity, insufficient physical activity, tobacco use and alcohol use. A similar pattern was observed for chronic neck pain, though the associations with insufficient physical activity and alcohol use did not reach statistical significance. Unexpectedly, both types of chronic pain showed a negative correlation with the prevalence of depression.

Among cultural dimensions, the most significant associations with confounders were noted for the Global Collectivism Index (positive correlation with depression, negative correlation with all other variables) and with Hofstede's indices of Power Distance (negative correlation with anxiety disorders and alcohol use), Uncertainty Avoidance (positive correlation with obesity, insufficient physical activity, tobacco use and alcohol use), and Long-Term Orientation (negative correlation with anxiety and depression, positive correlation with tobacco and alcohol use). All four measures of religiosity were positively correlated with the prevalence of depression, while the three measures of religious attendance, prayer and importance assigned to religion were negatively correlated with the prevalence of obesity, tobacco use and alcohol use. These analyses suggest that the variables selected for these analyses do represent genuine confounders, being significantly correlated with both cultural and religious indices and with the prevalence of both types of pain.

Supplementary Material Table S3 summarizes the correlations between cultural dimensions and measures of religiosity. All

TABLE 3 Bivariate correlations between measures of religious belief and practice and the national prevalence of chronic low back and neck pain.

Variable	1 CLBP	2 CNP	3 REL-AFF	4 REL-ATT	5 REL-PRAY	6 REL-IMP
1	–	.55 (<.001)**	-.34 (<.001)**	-.64 (<.001)**	-.62 (<.001)**	-.70 (<.001)**
2		–	-.31 (.002)*	-.35 (<.001)**	-.30 (.002)*	-.34 (<.001)**
3			–	.53 (<.001)**	.62 (<.001)**	.67 (<.001)**
4				–	.85 (<.001)**	.90 (<.001)**
5					–	.93 (<.001)**

*Significant at $p < .05$, uncorrected.

**Significant at $p < .05$ after Bonferroni's correction.

CLBP, prevalence of chronic low back pain; CNP, prevalence of chronic neck pain; REL-AFF, percentage reporting religious affiliation; REL-ATT, percentage reporting weekly attendance at religious services; REL-PRAY, percentage reporting daily prayer; REL-IMP, percentage that consider religion important or very important.

measures of religiosity were positively correlated with the GCI, and these associations crossed the threshold for multicollinearity ($r > .8$) for daily prayer and for the importance accorded to religion. Among Hofstede's dimensions, all measures of religiosity were positively correlated with Power Distance, and negatively correlated with Individualism and Long-Term Orientation.

Partial correlation analyses

For partial correlation analyses involving the prevalence of chronic low back pain, adjustments were made for all six confounding factors, as they were all significantly associated with this outcome. For those involving chronic neck pain, adjustments were made only for the four confounders—depression, anxiety, obesity and tobacco use—associated with this variable. The results of the partial correlation analyses are presented in Table 4.

In the first partial correlation analysis, after adjustment for confounders, the prevalence of chronic low back pain was significantly and negatively correlated with the Global Collectivism Index (partial $r = -.27$, $p = .002$) and the percentage of those who considered religion important (partial $r = -.29$, $p = .008$), and positively correlated with the Hofstede indices of Individualism-Collectivism (partial $r = .28$, $p = .006$) and Long-Term Orientation (partial $r = .24$, $p = .040$).

In the second partial correlation analysis, the prevalence of chronic neck pain was significantly negatively correlated with the Hofstede indices of Power Distance (partial $r = -.20$, $p = .045$), Uncertainty Avoidance (partial $r = -.34$, $p < .001$) and the percentage of those reporting a religious affiliation (partial $r = -.21$, $p = .041$) and positively correlated with the Hofstede index of Individualism-Collectivism (partial $r = .27$, $p = .008$).

Multivariate analyses

Two multivariate linear regression analyses were carried out. When selecting variables for these analyses, two issues related to multicollinearity arose. First, there was significant multicollinearity between three of the four measures of religiosity. To address this, a composite index of religiosity was constructed by taking the arithmetic mean of these three variables, and this measure was used in the multivariate analyses if issues related to multicollinearity arose in this context. This composite index was significantly and negatively correlated with the prevalence of both low back pain ($r = -.68$, $p < .001$) and neck pain ($r = -.35$, $p < .001$). Second, there was significant multicollinearity between the GCI and two of the measures of religiosity. To circumvent this problem, the Hofstede index of Individualism-Collectivism was used instead of the GCI in the multivariate analyses. The complete results of both multivariate analyses are presented in Table 5.

In the first multivariate analysis, the estimated prevalence of chronic low back pain was the dependent variable, and the following independent variables were included in the model: Hofstede's indices of Power Distance, Individualism-Collectivism, Uncertainty Avoidance and Long-Term Orientation, Religious Affiliation, and the composite index of religiosity. The overall model was statistically significant, and explained around 48% of the variance in the prevalence of chronic low back pain ($R^2 = .524$, adjusted $R^2 = .485$). In this model, individualism was positively associated with the prevalence of low back pain ($\beta = .49$, $p < .001$), while the composite index of religiosity was negatively associated with this outcome ($\beta = -.44$, $p = .006$).

In the second multivariate analysis, the estimated prevalence of chronic neck pain was the dependent variable, and the following independent variables were selected for analysis: Hofstede's indices of Power Distance, Individualism-Collectivism and Uncertainty Avoidance, Religious Affiliation, and the composite index of religiosity. The overall model attained statistical significance, and explained around 25% of the variance in the prevalence of chronic neck pain ($R^2 = .296$, adjusted $R^2 = .253$). In this model, only one individual variable—Uncertainty Avoidance—was negatively associated with the prevalence of this type of pain ($\beta = -.25$, $p = .029$), though there was a trend towards a positive association with individualism ($\beta = .26$, $p = .084$). Variance inflation factors were below 4 for all variables in both models, indicating a low risk of multicollinearity.

In both the aforementioned models, confounding factors were not included, as this would have led to a relatively low number of subjects per independent variable. Nevertheless, additional linear regression analyses were carried out for exploratory purposes, including those confounding variables that were significantly ($p < .05$) associated with each outcome, as even with a relatively

TABLE 4 Partial correlation analyses of the national prevalence of chronic low back and neck pain and cultural and religious indices, adjusted for confounders.

Variable	GCI	HOF-PD	HOF-IC	HOF-MF	HOF-UAI	HOF-LTO	HOF-IVR	REL-AFF	REL-ATT	REL-PRAY	REL-IMP
CLBP†	-.27 (.002)*	-.02 (.851)	.29 (.006)*	.04 (.689)	-.02 (.884)	.24 (.040)*	.04 (.718)	-.05 (.633)	-.12 (.307)	-.16 (.153)	-.29 (.008)*
CNP††	.01 (.876)	-.20 (.045)*	.27 (.008)*	-.01 (.918)	-.34 (<.001)*	-.03 (.790)	.13 (.256)	-.21 (.041)*	-.13 (.215)	-.13 (.217)	-.17 (.102)

[†] Adjusted for depression, anxiety disorders, obesity, insufficient physical activity, tobacco use and alcohol use.

[††] Adjusted for depression, anxiety disorders, obesity and tobacco use.

*Significant at $p < .05$.

CLBP, prevalence of chronic low back pain; CNP, prevalence of chronic neck pain; GCI, Global Collectivism Index; HOF-PD, Hofstede Index of Power Distance; HOF-IC, Hofstede Index of Individualism-Collectivism; HOF-MF, Hofstede Index of Masculinity-Femininity; HOF-UAI, Hofstede Index of Uncertainty Avoidance; HOF-LTO, Hofstede Index of Long-Term Orientation; HOF-IVR, Hofstede Index of Indulgence vs. Restraint; REL-AFF, percentage reporting religious affiliation; REL-ATT, percentage reporting weekly attendance at religious services; REL-PRAY, percentage reporting daily prayer; REL-IMP, percentage that consider religion important or very important.

TABLE 5 Multivariate linear regression analyses of cultural and religious variables associated with the prevalence of chronic low back and neck pain.

Dependent variable	Goodness of fit (F)	Degrees of freedom	Independent variables	Regression coefficient (β)	Significance level	Variance inflation factor	Percentage of variance explained (adjusted R^2)
CLBP	13.38*	79	HOF-PD HOF-IC HOF-UAI HOF-LTO REL-AFF REL-COMP	.11 .49 .11 .12 .20 -.44	.356 < .001* .283 .309 .077 .006*	2.24 2.48 1.49 2.03 1.98 3.66	.485
CNP	6.81*	86	HOF-PD HOF-IC HOF-UAI REL-AFF REL-COMP	-.14 .26 -.25 .05 -.13	.272 .084 .029* .732 .404	1.93 2.53 1.46 1.96 2.62	.253

*Significant at $p < .05$.

CLBP, prevalence of chronic low back pain; CNP, prevalence of chronic neck pain; HOF-PD, Hofstede Index of Power Distance; HOF-IC, Hofstede Index of Individualism-Collectivism; HOF-UAI, Hofstede Index of Uncertainty Avoidance; HOF-LTO, Hofstede Index of Long-Term Orientation; REL-AFF, percentage reporting religious affiliation; REL-COMP, composite index of religiosity (attendance, prayer and importance).

TABLE 6 Multivariate linear regression analyses of cultural and religious variables associated with the prevalence of chronic low back and neck pain, including confounding factors.

Dependent variable	Goodness of fit (F)	Degrees of freedom	Independent variables	Regression coefficient (β)	Significance level	Variance inflation factor	Percentage of variance explained (adjusted R^2)
CLBP	7.55*	71	HOF-PD HOF-IC HOF-UAI HOF-LTO REL-AFF DEP ANX OB IN-PA TOB ALC	.13 .40 .05 .19 .10 -.23 .26 .08 .07 .08 .28	.321 .013* .650 .159 .401 .048* .031* .518 .702 .464 .018*	2.56 3.60 2.01 2.56 1.79 1.83 1.98 2.25 1.42 1.69 1.93	.504
CNP	7.88*	82	HOF-PD HOF-IC HOF-UAI REL-AFF DEP ANX OB TOB	-.06 .12 -.32 -.03 -.05 .47 -.04 .22	.646 .417 .004* .761 .655 < .001* .762 .023*	2.12 2.81 1.54 1.51 1.45 1.58 1.86 1.22	.402

*Significant at $p < .05$.

CLBP, prevalence of chronic low back pain; CNP, prevalence of chronic neck pain; HOF-PD, Hofstede Index of Power Distance; HOF-IC, Hofstede Index of Individualism-Collectivism; HOF-UAI, Hofstede Index of Uncertainty Avoidance; HOF-LTO, Hofstede Index of Long-Term Orientation; REL-AFF, percentage reporting religious affiliation; REL-COMP, composite index of religiosity (attendance, prayer and importance); DEP, prevalence of depression; ANX, prevalence of anxiety disorders; OB, prevalence of obesity; IN-PA, prevalence of insufficient physical activity; TOB, prevalence of tobacco use; ALC, prevalence of alcohol use.

low subject-to-variable ratio, meaningful associations may be identified (72). These analyses are presented in Table 6. In the first of these analyses, the prevalence of chronic low back pain was the dependent variable, and the independent variables included the seven variables from the prior model, as well as the prevalence of depression, anxiety disorders, obesity, insufficient physical activity, tobacco use and alcohol use. In this analysis, significant concerns regarding multicollinearity (VIF = 6.64) were identified for the composite index of religiosity; therefore, this variable was excluded and the analysis repeated. This model showed a marginal increase in percentage of variance explained (adjusted $R^2 = .504$) and was significant overall. The individual variables significantly associated with chronic low back pain were individualism ($\beta = .40$, $p = .013$), depression ($\beta = -.23$, $p = .048$), anxiety disorders ($\beta = .26$, $p = .031$) and alcohol use ($\beta = .28$, $p = .018$). In the second analysis, the prevalence of chronic neck pain was the dependent variable, and the independent variables included were the five from the previous model, as well as the prevalence of depression, anxiety disorders, obesity and tobacco use. As in the previous case, the composite index of religiosity had to be excluded due to a VIF of 4.28. This model showed a substantial increase in the percentage of variance explained (adjusted $R^2 = .402$) and was significant overall. The individual variables associated with chronic neck pain were uncertainty avoidance ($\beta = -.32$, $p = .004$), anxiety disorders ($\beta = .47$, $p < .001$) and tobacco use ($\beta = .22$, $p = .023$).

Discussion

Chronic musculoskeletal pain is a paradigmatic example of a group of disorders requiring a biopsychosocial approach to treatment (73). Though most patients are offered biomedical treatments, both pharmacological and surgical, these are often ineffective or only partially effective, and some of the approaches that were often used in the past, such as opioid analgesics, are gradually being abandoned due to their unfavorable risk-to-benefit ratio (25). There is a substantial body of evidence linking psychological, social and religious/spiritual factors to various aspects of this group of conditions. The current study was conducted against this background, with the aim of identifying meaningful associations between cross-national variations in culture and religion and the prevalence of two common disorders—chronic low back pain and chronic neck pain—belonging to this group.

Cultural dimensions and pain prevalence

In bivariate analyses, the cultural dimensions of individualism-collectivism and power distance were significantly associated with the prevalence of both types of pain: broadly speaking, these conditions were more common in countries whose culture was characterized by a lower power distance and higher individualism. These findings are consistent with those of an earlier meta-analysis by Kroska (52), who found that these two dimensions of culture significantly mediated the association between respondents' fear-related avoidance and the severity of pain reported by them. Power distance is a measure of the extent to which institutionalized inequality and hierarchy is accepted as normal in a given society. In such societies, individuals may be more tolerant of acts and situations that could be perceived as unjust in others. Individuals' perceptions of injustice have been identified as an important predictor of symptom severity, depression, anxiety and disability in patients with musculoskeletal pain, independent of age and pain duration (74, 75). It is therefore plausible that cultural power distance may influence chronic pain through the intermediate variable of perceived injustice. However, though the negative relationship between power distance and pain was significant for chronic neck pain even after adjusting for confounders, it was not significant in the multivariate analysis; therefore, hypotheses such as the one outlined above should be considered speculative.

The two measures of individualism-collectivism showed somewhat different associations with the prevalence of chronic low back and neck pain. In the case of the Global Collectivism Index, this association was significant after adjusting for confounders only in the case of low back pain, whereas Hofstede's index of individualism-collectivism survived these adjustments for both types of pain. In multivariate analyses, the association between the Hofstede index and the prevalence of pain was significant only for chronic low back pain. Thus, while individualism-collectivism may account for some of the cross-national variation in the prevalence of these pain disorders, the consistency and strength of this association varies depending on how this cultural dimension is measured. Several factors may account for the inverse association between collectivism and chronic low back and neck pain. Collectivistic cultures are generally characterized by higher levels of collective coping (43, 76) and family and community support (77, 78), which may be associated with increased psychological well-being (76, 79). Social support has been identified as an important predictor of outcome in patients with chronic musculoskeletal pain, including low back and neck pain, affecting both the course and severity of pain and the likelihood of returning to work (80–82). Collectivistic cultural values may also be positively associated with key psychological processes such as self-regulation (83), which can influence both the perception of musculoskeletal pain and the disability associated with it (84, 85). These psychological and social factors may explain why collectivism appears to have a protective effect against chronic low back and neck pain: however, the current study was not designed to examine the mediating effects of such variables.

Among the other cultural dimensions studied, long-term orientation was positively correlated with the prevalence of chronic low back pain in both the direct and partial correlation analyses. However, this association was not significant in multivariate models, and may have been due to the negative correlation between long-term orientation and collectivism ($r_{(GCI, LTO)} = -.46$, $p < .001$). Uncertainty avoidance was negatively correlated with the prevalence of chronic neck pain after adjusting for confounders, and this finding was replicated in both multivariate models. A prior analysis of uncertainty avoidance at a cross-national level found that this dimension of culture was positively associated with experiences of "pain, worry and sadness"; however, this study only involved thirty high-income countries with predominantly individualistic cultures (86). In contrast, a study examining the association between Hofstede's cultural dimensions and quality of life found no significant correlation between pain-related quality of life and uncertainty avoidance (87). Uncertainty avoidance measures the extent to which a society is able to tolerate ambiguous or uncertain situations; high scores on this dimension imply that a country's culture would have rigid codes of conduct and be intolerant of unconventional ideas or behaviour (88). In a study of patients with chronic musculoskeletal pain, a measure of the complexity of each patient's psychosocial situation was found to be associated with altered methylation of the brain-derived neurotrophic factor (BDNF) gene (89). BDNF is an important regulator of neural plasticity, and plays a central role in several psychological processes related to chronic pain, including stress response, learning and memory. It has also been associated with chronic musculoskeletal pain in particular, perhaps through alterations in central pain processing (90, 91). It is possible that individuals living in cultures with well-defined norms and rules (in other words, high uncertainty avoidance) may experience less complex psychosocial circumstances, and that this might be a protective factor against chronic neck pain: however, such an explanation must be considered speculative.

Measures of religious belief and practice and pain prevalence

In this study, all four measures of religious belief and practice—affiliation, attendance at religious services, prayer, and the importance assigned to religion—were negatively correlated with the prevalence of chronic low back pain and neck pain, though stronger correlations were observed for low back pain. However, after adjustment for possible confounders, only two associations remained significant: chronic low back pain was negatively correlated with the importance given to religion in one's life, and chronic neck pain was negatively correlated with religious affiliation. These findings could not be replicated in the multivariate analyses. These results are consistent with the mixed findings of the available literature on the links between religion / spirituality and these types of pain (55–61). It is likely that the weak and inconsistent results related to religion obtained in this study reflect methodological limitations. First, there was significant multicollinearity between three of the four measures of religiosity reported in the Pew Research Center's publication; second, there was significant multicollinearity between these measures of religiosity and the Global Collectivism Index. This led to a loss of precision and specificity in the partial correlation and multivariate analyses. Secondly, the outcome variables in this study were the prevalence of each type of chronic pain, whereas prior research has found religious variables to influence the course, rather than the occurrence, of conditions such as chronic low back and neck pain. Third, there are several aspects of religiosity and spirituality—such as positive and negative religious coping, spiritual experiences, forgiveness and support from a religious group or community—that could be relevant to the onset, severity and chronicity of low back or neck pain, and which were not captured by questions asked in the Pew Research Center surveys. In this context, the results obtained by Rippentrop et al. in a sample of patients with chronic musculoskeletal pain are of particular interest. The findings of this study suggest that specific aspects of religious or spiritual belief and practice could have both negative and positive influences on the health of patients with this type of pain—as stated by the authors, "religion/spirituality may have both costs and benefits" in this context (92). Subsequent research has confirmed the "double-sided" nature of the relationship between religiosity and chronic pain—for example, an association between prayer and greater impairment, interference, and depression associated with chronic pain has been reported in Swedish adults (93), while a study of older adults from the United States found a longitudinal association between religious service attendance and decreased pain severity over a period of three years (94). In the absence of further longitudinal data, it is not possible to draw direct causal inferences from such results: for example, do people experience more pain-related distress when they pray more frequently, or are they more likely to turn to prayer when they experience intractable or disabling pain which does not respond to standard medical treatment? (95). It is certainly possible that certain aspects of religiosity may be protective against chronic low back and neck pain, but this cannot be confirmed in the current study. The variability in the results obtained to date highlight the need for better measures of the different facets of religion and spirituality, their relationship to the persistence of musculoskeletal pain and the disability associated with it, and the possible mediating role of psychological variables such as affective states and pain-related beliefs (96).

Relationship between other variables and pain prevalence

In both multivariate models, certain variables remained associated with the prevalence of chronic pain independent of cultural and religious variables. For chronic low back pain, these were the prevalence depression, anxiety disorders and alcohol use; for chronic neck pain, these were the prevalence of anxiety disorders and tobacco use. The positive association between anxiety disorders and both pain types is consistent with the existing literature: anxiety is associated with greater musculoskeletal pain severity (97) and negative pain-related cognitions (98), and there is a high degree of comorbidity between chronic musculoskeletal pain and anxiety disorders (99). In this study, the prevalence of anxiety disorders was also positively correlated with individualism and negatively correlated with power distance, suggesting that these cultural factors are associated with variations in the prevalence of both pain and anxiety. Unexpectedly, the prevalence of depression was negatively associated with the prevalence of chronic low back pain, even in the multivariate analysis. While this finding appears to contradict the existing literature, it should be noted that some studies have found that depression failed to predict variations in either the prevalence or the severity of chronic low back pain (100, 101). Moreover, the contradiction may be more apparent than real. In some non-Western cultures characterized by different idioms of distress, and in which a certain stigma is attached to mental disorders depression may present to the physician as chronic or intractable musculoskeletal pain (102). Such a presentation is referred to as "masked depression" and could account for the apparent inverse relationship between the prevalence of depression and chronic low back pain in these countries (103). In support of this contention, the negative correlation between chronic low back pain and depression was no longer significant when adjusting for power distance and collectivism ($r = -.11$, $p = .253$). Given the evidence of a genetic link between depression and both these types of pain (14), it is possible that cultural factors may interact with an innate genetic vulnerability, leading to phenotypic variations in which some patients present predominantly with depression and others with chronic back or neck pain. This result highlights the need for a more culturally sensitive assessment of depression in patients presenting with a primary complaint of chronic pain, particularly in low- and middle-income countries.

The possible confounding effect of healthcare systems and records

The use of prevalence estimates as measures of chronic low back and neck pain in the current study raises a further issue. Prevalence estimates in the Global Burden of Disease Study are based on a wide range of sources. These include published literature on the prevalence of each disorder, as well as data obtained from clinical trials, government records, hospital records and epidemiological surveillance (104). Cultural and religious factors have been shown to influence key components of individuals' interactions with healthcare systems, and may thereby influence the quality of the data obtained from these sources. High Power Distance is associated with a lower level of trust and satisfaction in healthcare systems (105); this may lead to reduced help-seeking and an underestimation of prevalence. Individualism-Collectivism, Uncertainty Avoidance and Long-Term Orientation can influence the quality of care received in primary settings (106), which could also influence patients' willingness to seek help for chronic pain. Likewise religious and spiritual beliefs could lead patients to seek complementary and alternative methods of care for their chronic low back or neck pain (61, 107); this could lead to underestimates of prevalence if these are based on hospital data. For these reasons, it is possible that the current study may have captured cross-cultural variations in help-seeking or data quality for chronic low back or neck pain, rather than in the actual prevalence of these conditions.

Differences between factors associated with chronic low back pain and neck pain

Another facet of this study's findings that merits discussion is the divergence in the cultural correlates of chronic low back pain and neck pain. Despite the evidence of a possible epidemiological and genetic overlap between these conditions, the majority of patients presenting with one of these types of pain do not experience the other, and they are rightly considered distinct types of chronic musculoskeletal pain. The risk factors for each of these conditions also differ in certain key aspects. For example, chronic neck pain is common in office workers and related to specific postural and ergonomic factors (108, 109), while chronic low back pain is common both in sedentary workers and those engaged in physical labor, and may be associated with factors such as physical exertion and toxin exposure in the latter group (110, 111). Besides influencing individuals' opportunities for employment and their working environment, cultural factors are correlated with economic factors such as national income and industrialization, at a national level (67, 112). It is possible that distinct cultural factors may influence chronic low back or neck pain through their associations with a country's economy and working conditions, though this could not be directly examined in the current study.

Strengths and limitations of the current study

This study is the first to examine cross-national variations in the prevalence of chronic low back and neck pain in relation to variations in cultural values and religious affiliation and practice. Data on each variable of interest was obtained from research studies of databases of good quality, which provided data on a large number of countries across income groups. In addition, efforts were made to minimize the risk of spurious associations by adjusting for key confounding factors identified in the existing literature.

Nevertheless, the current study is subject to certain important limitations. First, due to its cross-sectional design, it cannot draw any firm conclusions regarding causality; only associations between cultural dimensions and chronic back and neck pain can be inferred. Second, as countries were the unit of analysis, these findings cannot be directly generalized or applied to individuals. Third, it was not possible to capture variations within a country (such as urban-rural differences, or cultural variations in a multi-ethnic or multi-religious society) from the available data. Fourth, the data sources used for the GBD, though comprehensive, are not completely free of bias, as discussed in the preceding section. Fifth, though an attempt was made to correct for confounders, there are several other key confounding variables identified in the literature, such as social support, stress and workplace culture, that could not be assessed due to a lack of cross-national data. Finally, the variables used to measure various aspects of religion were of limited value in the analyses, due to a high degree of multicollinearity both among them, and between them and measures of collectivism.

Practical implications of the current results

Results obtained from analyses at the level of countries cannot be applied directly to individuals. Nevertheless, the results of this study have significance from a clinical perspective, as they highlight the need to consider variations in cultural and religious values and practices when managing patients with chronic pain. As mentioned above, the successful management chronic musculoskeletal pain requires a holistic approach that goes beyond the prescription of specific medical treatments. Culture and religion can shape the experience of chronic pain, the meaning attached to it, the affective responses associated with it (such as anxiety, depression, and anger) and the willingness to seek and adhere to specific types of treatment. The responses of both caregivers and the patient's immediate community to their suffering are also shaped by cultural and religious beliefs. This becomes especially relevant in contemporary medical practice, where migration and globalization often necessitate a greater degree of cultural sensitivity and competence on the part of healthcare professionals managing a patient with a chronic disorder. Awareness of the way in which variations in national cultural values, or in religious beliefs, influence these facets of chronic pain can foster the development of a better therapeutic relationship, enhance concordance between clinicians and patients, and possibly reduce the inappropriate use of treatments with a low risk-benefit ratio. Knowledge of cross-national variations in values and beliefs can also aid the judicious selection of specific treatment approaches, such as spiritually-informed cognitive or behavioral interventions.

Conclusions

Despite certain limitations, the current study has identified a possible influence of cultural values on cross-national variations in two common and disabling forms of chronic musculoskeletal pain. Though this study's results should be considered provisional, they are consistent with the growing body of literature highlighting the importance of cultural and religious factors in the pathogenesis and treatment of chronic low back and neck pain. Cross-national research in individual subjects would help to further elucidate the relative importance of these factors in a given case, as well as the biological and psychological processes through which they may exert beneficial or harmful results. The current study also highlights the need for further examination of the links between religion / spirituality and chronic musculoskeletal pain across different countries and regions, with a focus on the subjective aspects of religiosity instead of measures of affiliation or attendance which may reflect cultural norms rather than religious or spiritual conviction.

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

The sole author of this paper was responsible for its design, literature review, data collection and analysis, writing and editing.

Conflict of interest

The author declares 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/fpain.2023.1189432/full#supplementary-material

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Pain through the perspective of art and creativity: insights from the Unmasking Pain project

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People struggle to tell their story of living with pain and when they do it is articulated in a way that may not be understood, heard or taken seriously. Unmasking Pain is an artist-led project that explored creative approaches to tell stories of life with pain. The project was led by a dance theatre company that specialises in storytelling and emotional experiences for players and audiences. The project involved artists and people living with ongoing pain co-creating activities and environments to curiously explore "oneself", through imagination and creative expression. This article discusses insights and perspectives emerging from the project. The project revealed the power of art to make-sense of oneself with or without pain, and how art facilitates expression of complex inner experience and personal stories. People described Unmasking Pain as "explorative joy despite pain", and "a new set of rules" that contrasts with those experienced during clinical encounters. We discuss how art has the potential to improve clinical encounters and promote health and well-being, and whether artist-led activities are an intervention, therapy, or something else. Pain rehabilitation specialists from the project described Unmasking Pain as "freeing-up thinking", allowing conceptual thought beyond the biopsychosocial model of pain. We conclude that art has the potential to shift people living with pain from "I can't do, I am not willing to do it" to "Perhaps I can, I'll give it a go, I enjoyed".

KEYWORDS

pain, art, creativity, pain concepts, pain management

Introduction

Tension between subjective pain and objective medicalised health care is long-standing. In clinical practice, a person's narrative about their complex pain experience is amalgamated or deconstructed into scalable items used in assessment tools. Consequently, people struggle to tell the story of their pain and when they do it is articulated in a way that is not consistently understood or is not heard or taken seriously.

Unmasking Pain was a pilot project to explore creative approaches for telling stories of life with persistent pain. Unmasking Pain sought to find a voice for people experiencing ongoing pain through artistic collaboration with artists and artforms. The purpose of

Unmasking Pain was to use a co-creative framework to explore various approaches to express stories, experiences, and challenges of living with pain. Our viewpoint was that exploring pain through the lens of art and creativity provides a more encompassing understanding of pain experience, overcoming the challenges of conceptualising and expressing pain.

This perspectives article discusses the views of people who were involved in the Unmasking Pain project, i.e., artists, pain specialists, support personnel, and people living with pain (participants). These people provided consent to use materials that documented their opinions and experiences during the project, including notes and recordings taken during briefing sessions, workshops, specific feedback focus groups, and informal interviews (in-person and on-line). The lead author (MJ) created a draft manuscript to summarise common themes and interesting perspectives from these sources. All authors revised draft manuscripts through an iterative process to ensure an accurate reflection of viewpoints.

Synopsis of the project

A synopsis of the concept, design and delivery of the project is provided as **Supplementary Material**. In brief, artists collaborated with members of the project team and people with ongoing pain accompanying various conditions (participants), to design and deliver workshops to foster confidence in participants as human beings within a milieu of art and creative conversation. Artists worked with participants to articulate their story verbally and non-verbally, and to explore their story to help them understand themselves. Ethical approval was gained to embed two research studies in the project; a study to evaluate health-related data, including pain, and a phenomenology study to explore experiences via in-depth interviews.

During the project, participants engaged in various art activities including drawing, drumming, music making, writing, dance, drawing with pastels, clay modelling, puppetry, and nature walks. Some artists shared their own experience of living with pain and learning how to tell their stories, inspiring participants to find their own voice and gain self-confidence to unlock their own creativity. Art activities included mask-making of outer and inner facing selves, making personalised musical recordings with musicians, and taking personalised handmade puppets for a walk, to encourage participants to see themselves outside of themselves, i.e., a form of "creative treat".

Strategies in design and development of the project

Vision of the artistic director

The vision was to use art to bring the worlds of artists and people living with pain together, to co-create a framework and process that worked for both. The Artistic Director handled the direction of the project through sensitivity in the moment to oversee and guide artists, distinguishing Unmasking Pain from art therapy. Strategic partnership building, sharing of vision and creative process, and gaining a sense of trust between everyone has been critical for success.

Strategies of the artists

Early work of the artists involved developing sensitivity and trust by "circling around pain", often not mentioning pain unless people wished to do so themselves. This was endorsed by participants from the outset in the phrase "Don't see me for my condition. See me for me". Most workshops include an element of performance or the artist creating alongside the participants. Often, sessions started with the phrase "Sit back and relax, the artists are going to perform. You don't have to do anything. Just watch". Through this process artists were not seen as invasive or threatening and participants quickly gained a sense of trust and confidence to engage in collaborative creative conversations.

Initially artists designed activities using colour, sound, and movement to creatively explore the severity and impact of pain. Musical improvisation was used to express inner experience through, for example, louder and faster rhythm to signify more intense pain and emotion. Figurative language such as "my muscles feel knotted" was creatively explored as "knots being an art or decorative element", such as a plait of hair or "knots being a means of scaling experiences", such as a complex tight knot representing severe pain, being difficult to untangle. This catalysed imaginative and creative discussion.

Activities based on the children's playground game "Hopscotch" were used to explore various themes, including a different approach to measure and scale pain from 1 to 10, and to explore the programme Ten Footsteps to live well with pain (https://livewellwithpain.co.uk/ten-footsteps-programme/). Hopscotch involves movement through a court of ten boxes drawn on the ground and artists demonstrated creative ways of interacting with the hopscotch court before inviting participants to join them through considerate and compassionate encouragement. Eventually, participants gained confidence to interact imaginatively with the hopscotch court either on their own or with others, catalysing creative discussions about supporting people with pain. For example, lying down on the entire hopscotch court to express the need to rest during a flare-up when pain intensity may be fluctuating from mild to severe.

Experiences of participants: initial observations

A preliminary analysis of source materials suggested that participants experienced:

- Improvements in health-related data including pain and sleep, and reductions in medication
- Changes in sense-making, from the struggle of living with pain to developing a broader understanding of self and their own unique experience of "being". This helps to create ways to express and acknowledge their story through engagement with the body, the world around and others

- Changes in emotion, including diffusion of anger, frustration, shame, fear, worry and lack of joy. This helps to strengthen pleasure, enjoyment, and a sense of relaxation
- Changes in ability and confidence to communicate, by having greater awareness of a state-of-mind and being more at ease with difficult emotions
- Changes in a sense of self and capacity to engage in new relationships with people, places, activities, and creative arts. Some participants returned to knitting or music making or had started doing other activities such as dog walking
- Changes through multifacet mediums, by exposure to a range of artists, people living with pain, artforms, colour, visual experiences, sensations of touch, diverse sounds; and by moving from passive to active engagement with creative artform to express self-identity by, for example, beginning to regularly play a new musical instrument.

Overall, participants reported feeling empowered to creatively explore themselves and this encouraged participants to be more physically and socially active, including discovering possibilities beyond the project such as taking up art activities, creative crafting, knitting, playing musical instruments, walking in nature, swimming, and visiting art galleries, museums, and historical buildings. Unmasking Pain achieved impact across cultural groups, and we attribute this to the visibility, diversity and culturally sensitive nature of the creative organisation and artists.

Discussion: perspectives, insights, and implications

Without exception artists, pain specialists, support personnel and participants reported that involvement in the project affected how they think about pain. Here, we discuss insights and perspective-shifts arising from the project.

The power of art to make-sense of oneself with or without pain

Evidence from meta-ethnography suggests that people living with long-term pain struggle to construct meaningful explanations for their suffering (1). For humans, "being alive" involves making sense of the relationship between sensations, emotions and thoughts arising within the body, and objects and events happening in the "external world".

Chaplin contends that art enables contact with the external environment by acting as "… *a pre-reflective, nondiscursive mode of knowing, symbolizing, and being-in-the world.*" (2)p.1. Moreover, the symbolic practice of art enables humans to express emotional experiences that motivate re-interpretation and understanding of being in the world (2). For example, engaging in painting as an artform differs from painting a fence because that latter lacks significant symbolic action and interpretive meaning. Chaplin concludes that "… *the unique role of art [is] to be able to articulate or symbolize the world to the extent that it is affectively experienced. Put differently, art responds to the shapes, forms, and rhythms in the world to the extent that they can carry expressive meaning that resonates with the way we affectively experience the world*" (2) p. 10.

From an evolutionary perspective, art is a defining characteristic of the human species. The embodied nature of the practice and experience of art enables humans to project subjective sensory, affective, and cognitive experiences, such as pain, onto objects and events in the external world. Projecting subjective experience onto external objects facilitates a common understanding and sharing of bodily and spiritual states. Art can also bond values of justice, duty, social order, conflict, peace, and identity within and across diverse cultural backgrounds. A concept analysis of 85 studies by Kim and Lor revealed art activity "… *intrinsically motivated participants to create meaning for themselves and/or their health experiences. Such intrinsic motivation allows participants to experience growth, as well as the transformation of their health experiences*" (3) p. 8.

The power of art to express the complexity of pain experience

Pain is a complex, dynamic, and multidimensional experience. Clinical practice relies on pain assessment that fuses elements of pain complexity into simplified generalisations or deconstructs pain complexity into fragmented items. Often these items are scaled and measured perpetuating an illusion of objectivity and evaluated solely within a clinical context. Pain experience is subjective. Self-report is a proxy of inner experience. Pain questionnaires splinter a person's experience and may decontextualize care (4, 5). The organic nature of art practice enables people to express holistic and contextualised experience with or without pain, offering novel ways of gaining insight to a person's state-of-being, self-identity and pain experience (6). Art empowers people during clinical consultation, aligning with the idea of "lay perspectives in healthcare" (7).

The power of art to express personal stories

Unmasking Pain was conceived to enable people to share their self-identity, to tell the story of their pain, and for the story to be heard empathetically and taken seriously. Human social groups bond through story-telling and depriving humans of telling their stories is detrimental to health (8). Art enables people to express personal experiences and stories of bodily senses, emotions, thoughts, and journeys with or without words and syntax. Definitions of art vary over history and between cultures, although "… *the expression or application of human creative skill and imagination* …" (Oxford dictionary) is a fundamental characteristic of art. The educationalist, Sir Ken Robinson defined imagination as the ability to "bring to mind" things from the past, present, and future that are not immediately present to our senses; and creativity as the practical process of "applied imagination", putting imagination to work to create output for others to see (9).

The power of art to improve clinical encounters

People report having limited opportunities to tell their stories of living with pain and have them heard, especially in clinical environments (1). Bringing different artforms and media into conversations, opens new lexicons and modes of expression through which personal stories can be told, catalysing co-creation of meaning-making with family, friends, carers, strangers, and health care professionals. Evidence is growing that creatively expressing pain through visual artforms is likely to confer benefits to patients and improve clinical consultation (10, 11).

Healthcare professionals report having inadequate knowledge and skills to interpret verbal pain narratives, contributing to scepticism about a patient's self-report (12, 13). Hovey et al. (14) advocate expression of pain narratives through multiple artforms, including poetry and stories, to enable creative dialogues between patient and practitioner that foster empathy and understanding. Padfield et al. (10) argues co-creation of visual images can make the experience of pain visible, and that such images function as "transactional objects" that catalyse meaning-making and promote emotional disclosure by the patient, and non-verbal affiliative behaviour by the practitioner. Stilwell et al. (15) argues that art reveals to clinicians "how words might be received", and this facilitates a deeper level of understanding of the fluid and interpretive nature of pain-related metaphors used by patients. Unmasking Pain demonstrates the power of art to create shared spaces to negotiate and co-create meaning between people experiencing pain and others, including artists and pain rehabilitation specialists. Art has the potential to facilitate education of health care professionals about the human condition.

The power of art to promote health and well-being

In 2019, the World Health Organisation (WHO) published a scoping review that mapped evidence in the field of arts and health comprising over 700 individual studies and 200 literature reviews (16). The findings suggested that involvement in various types of artform can improve health and well-being in a variety of settings and for a variety of conditions including short and long-term pain (16).

The ethos of Unmasking Pain aligns with salutogenic models of health and well-being, i.e., that health is an outcome of everyday interactions between individuals and socio-ecological stressors (17). Salutogenic approaches focus on factors supporting well-being by maximising human potential, not just treating disease to return a person to "normality" (18). Increasingly, clinical care pathways and guidelines in the health sector are incorporating salutogenic concepts by recommendation of healthy lifestyle adjustment [e.g., National Institute of Health Care Excellence (NICE) guidelines for the management of chronic pain (19) and non-specific low back pain (20)]. The 2023 Global Awareness Campaign for the International Association for the Study of Pain (IASP) is "Integrative Pain Care" that emphasises non-drug, self-management care, and a person-centred focus (https://www.iasp-pain.org/advocacy/global-year/integrative-pain-care/). We advocate a role for art within health care frameworks, which raises debate how artist-focussed activities such as Unmasking Pain should be positioned within society, and health care.

Art as an intervention, therapy, or something else?

Art-therapy is a type of psychological therapy delivered by trained art therapists/art psychotherapists. The uniqueness of Unmasking Pain is that it is led by artists who do not have therapeutic training and focus instead on engaging people with art in non-clinical contexts. This fosters interactions with the person not the pain, allowing the person to lead, take control, and have creative ownership, something that a clinician may find difficult to do. People living with pain often described the artist-participant encounter as "a different set of rules". To paraphrase one participant during a workshop discussion "The pain clinic was good, but very clinical, and doesn't give you the social side. Unmasking Pain didn't feel rigid or like the artists were teaching you things. Most of the time, the artists had ideas of what they were going to do but the group of participants would take it somewhere else. And this didn't matter, and the artists were able to go with the new direction". Such an approach is often impossible in clinical environments.

In 2021, Toye et al. (21) published a meta-ethnography of 195 qualitative studies that suggested health interventions for persistent pain should focus on validating pain through meaningful and acceptable explanations, validating patients by listening to and valuing their stories, and facilitating safe reconnection of patients with the social world by encouraging them to connect with a meaningful sense of self, be kind to themselves and to explore new possibilities for the future.

Unmasking Pain appears to satisfy these criteria. Kim and Lor (3), revealed four defining attributes of art-making as a health intervention; creation of art, creativity, self-expression, and distraction and helping people to adjust to living with pain by returning to meaningful activities (e.g., work hobbies, socialising etc.). Pain is known to reduce the sense of mastery and pleasure. Accessing artists can counter this by fostering positive emotionality, e.g., enjoyment, pleasure, relaxation, fun, control, mastery, empowerment, and achievement.

Artist-led interventions could be delivered by community-based creative and cultural organisations and venues and made available through social prescribing. Funders of such services will seek evidence of benefit and safety. The health sector values evidence of efficacy and harm via systematic reviews of randomised controlled clinical trials. Evidence to support the value of art interventions for pain is growing with systematic reviews providing tentative evidence that art and music therapy is beneficial, and safe, for people living with pain (22–27). Unmasking Pain is grounded in a "social aspect", so using a conventional RCT paradigm to evaluate effectiveness is likely to be inadequate. In fact, the veracity of existing RCT evidence for pain treatments has been challenged (28). In 2021, NICE reported no relevant clinical studies comparing social interventions with standard care for the management of chronic primary pain (19).

The power of art to challenge conceptual thinking about pain

Involvement in Unmasking Pain has instigated discussions among our pain specialists about tensions between subjective pain and the objective world of pain medicine dominated by a Cartesian neuro-mechanistic explanation of pain. Neilson argues that overly simplistic mechanistic models of pain encourage treatments focussed on "blocking and cutting" neural substrates (29). Conflation of nociception and pain has contributed to misnomers and fallacies in reasoning such as reification of pain (i.e., the myth that pain is a concrete (objective) "thing") (30) resulting in conceptual misunderstanding (31). Pain scholars argue for conceptual shifts in models of pain that incorporate principles of meaning in relation to lived experience (32, 33), as well as contemporary understanding of neural processing that may influence pain qualia, such as nonlinearity, predictive processing and emergence (34). Debates about the biopsychosocial model of pain being conceptually narrow, fragmented, and dominated by biomedical paradigms has resulted in calls for broader perspectives (32, 35–38). Viewing pain through the lens of art and creativity can offer a more encompassing understanding of pain. For example, Agarwal used a medical humanism, social constructionist approach to develop an "ecology of wholeness" model for the person living with pain, in which art plays a key role in knowing, symbolising and healing the body and the self (39).

Conclusion

People struggle to conceptualise and tell stories of their pain experience, and our perspective is that Unmasking Pain overcame this challenge by helping people living with pain move from "I can't do, I am not willing to do it" to "Perhaps I can, I'll give it a go, I enjoyed, … I am not alone". This demonstrated the power of art to enable curious exploration of oneself, through imagination, creative expression, and explorative joy, enabling people to tell their stories and have them heard. To paraphrase Novalis (aka Friedrich von Hardenberg, 1772–1801) "*Art makes the familiar strange, and the strange familiar*".

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

BS conceived the project and ET, DF, BS, FC, PC, and MJ developed the bid for external funding. All authors were involved in the design, delivery and evaluation of the project and associated workshops. MJ 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

MJ declares that his institution has received income within the previous 5 years for the following, all of which are outside of the scope of the submitted work (taken from ICMJE form): Expert consultancy income from Neuromodulation Society of the United Kingdom and Ireland; GSK, TENSCare, and LifeCare Ltd; and a research grant from GSK. MJ also receives book royalties from Oxford University Press.

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

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpain.2023.1179116/full#supplementary-material.

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Gender and sex bias in prevention and clinical treatment of women's chronic pain: hypotheses of a curriculum development

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This discursive paper focuses on undergraduate medical education's role in tackling gender bias in clinical practice, specifically preventing and managing from a non-biomedical perspective chronic pain in women. A preliminary web search of medical schools' curricula was performed to identify programs content related to gender bias in pain management. The web search included 10 universities' websites selected from the top 10 rankings QS Universities Rankings 2022 for medical schools. Additionally, a questionnaire was sent to all deans of the selected academic institutions to explore the curriculum content further. The web search, and the lack of response from the deans, highlighted that relevant curriculum components on gender bias and chronic pain needed to be implemented. Therefore, this paper introduces an innovative curriculum development approach designed by the multi-professional research team to be implemented in medical school programs. This novel educational strategy could also cross-contaminate other healthcare practitioners' university programs and, thus, stimulate an interprofessional debate into fostering inclusiveness and equal opportunities in health.

KEYWORDS

chronic pain, women, gender bias, education, gender medicine

1. Introduction

Medical education has been concerned with providing predominantly undergraduate students with the knowledge of the biophysical determinant of illnesses of the human body (1). With this discursive paper, an interprofessional team of academics and researchers from anthropology, nursing, education, medical science, and public health aimed to design a curriculum development intervention for medical education on psychosocial aspects of health, specifically chronic pain and gender.

Western medicine is transitioning from a clinical and biological model to a new one developed around the more exhaustive definition of health as per the WHO definition that says "...a state of complete well-being, mental and not the mere absence of the state of disease or infirmity."

The so-called patient-centered medicine aims (2, 3) at placing the person at the center of care and at defining *disease* not only as a mere organic/physiological dysfunction of the organism (disease) but as a complex phenomenon experienced, both individually (illness) and socially (sickness) (4, 5). Nevertheless, Western medicine remains firmly rooted in biological determinism and the need to rely on data and evidence to offer answers using the most advanced technology. This biological determinism not only shapes medical and operational practices in healthcare settings but also strongly characterizes curricula and university programs attended by healthcare students and professionals. The limits of an exclusively "technical" approach with scant attention to the person emerge clearly when biomedicine is confronted with chronic pain, especially when the patient is female. Chronic pain is an enigma for evidence-based medicine because it is invisible. It cannot be traced objectively and visually in the organism, it cannot be examined by the "medical gaze" (6), and thus it escapes from empirical supervision. However, on the other hand, pain is also an experience (7): it is not a mere physiological sensation but, instead, is the result of an elaboration process of this sensation, where emotional, cognitive, individual, social, cultural, and environmental factors play a central role. In this sense, pain takes shape in the peculiarity of individual biographies, also manifesting itself as a "total" (8), having a multidimensional impact and affecting several aspects of life (psychic, social, relational, etc.). Therefore, pain management should be based on a holistic and personalized care approach. This approach contributes to defining *pain* as a multidimensional experience shaped by several elements. Among these elements are sex and gender differences that influence health and disease, particularly the processes of pain chronicization (9–12).

Chronic pain primarily affects the female population (13–16). However, most studies investigating pain mechanisms are mainly conducted on the male population (17–20), while physiological mechanisms underlying women's pain and gender/sex differences are yet to be explored in-depth. The same is true for pharmacology (21, 22): most drugs are tested on the 70-kilo ideal male type, and the recommended dosages refer to this standard, even if women and men have different abilities to metabolize the active ingredients (23).

In literature, and especially in gender medicine studies, it has been repeatedly highlighted how doctors' scant consideration and preparation for women's health and female patients' pain may be responsible for gender bias[1] in care settings (23–27). Gender stereotypes influence biomedical ways of analyzing, interpreting, and treating female pain. For instance, several studies have shown that female pain is often underestimated since health professionals tend to frame it as a phenomenon amplified by behavioral and attitudinal traits that are considered to be "typically" females–such as amplified emotionality, psychological vulnerability and dramatization–which would lead them to less tolerate pain and manifest it exaggeratedly (24, 28–30). This leads professionals to be more inclined to interpret the symptoms reported by the male population as organic and those reported by the female population as psychosomatic, underestimating them (31, 32). The invisibility of pain and the difficulty in identifying a specific pathology that causes chronic pain also lead to the stigmatization of women suffering from complex chronic pain syndromes, as is well shown in the literature (29, 30, 33–35). Many women with chronic pain report that they were not believed and that their pain was not treated (29, 33).

The gender biases within a clinician-person relationship can result in a lack of equity and access to care. Literature (24, 36) is rich in examples of such biases. Compared to men, women receive less intensive and effective pain care (37–42). Women are less likely to be prescribed analgesics and opiates (37, 43) and more likely to receive antidepressant prescriptions than men (38). Furthermore, when male and female patients express the same type of pain, female patients are more likely to be referred to psychotherapy, while men receive pharmacological medications (29, 42, 44, 45). Psychologizing women's chronic pain not only leads to an underestimation of a massive health problem but also has a negative impact on their illness experience; many women, in fact, state that they feel abandoned by health professionals, family members or partners, friends, and colleagues (29, 46).

Physicians' gender stereotypes are responsible for inequalities in medicine and clinical practice. Research must examine how these stereotypes generate care disparities and influence patient–professional interactions. Therefore, to reduce gender bias, the awareness of values and attitudes toward gender must increase within the medical society. A possible approach is including gender theory and discussions in medical school curricula. However, a growing body of literature shows how gender medicine, specifically women's health, is almost neglected in the medical schools' curricula (47, 48). In addition, 70% of postgraduate physicians in training indicated that gender medicine concepts are never or sporadically discussed in their training program (49).

Because sex and gender are health determinants, incorporating these contents into medical curricula could promote a more comprehensive patient-centered approach. Research should focus on understanding how basic pain mechanisms may differ in the two sexes and the diverse ways in which gender differences currently influence diagnostic and treatment decisions. In addition, optimal pain management requires that clinicians understand and examine their gender stereotypes and be prepared to evaluate whether these stereotypes result in less-than-optimal pain management for specific individuals. This paper aims to analyze whether courses centered on gender medicine and, in particular, on female pain are provided in medical schools' curricula. The paper aims to design a medical school's curriculum innovation intervention for tackling gender-based health inequalities and fostering a biopsychosocial model for preventing and treating pain.

2. Method

The project implied several explorative steps allowing the research team to reflect on and design a suitable new course aiming at tackling gender bias in pain management in medical students.

The first step consisted of browsing the available web content of 10 worldwide top universities and medical schools (50) programs. Specifically, the web search sought any humanistic or social sciences

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[1] By gender bias, we mean the bias generated by stereotypes, i.e., distortions, which occur when gender differences have not been adequately considered. The stereotype (from the Greek "stereos" and "typos," i.e., "rigid image") is equivalent to the representation shared by a social group regarding another social group to which characteristics are attributed that derive from approximate generalizations.

lectures, training, or awareness courses within the programs selected. This first step was necessary as it is highly probable that interventions or training proposals aimed at raising pain/gender awareness are included in program modules with a humanistic and relational focus. In fact, training medical students to orient their clinical lenses to observe pain as a complex and gendered phenomenon is directly linked with implementing their communication, psycho, and social skills (51, 52). We directed our attention to the manifest content of medical school websites as a retrospective process to help us answer our initial question. Therefore, we explored 10 of the most important worldwide medical schools' curricula and the available content to uncover to what extent medical curricula may contribute to tackling gender-based health inequalities and promote a non-biomedical approach to managing pain in women.

The second step of the project aimed at collecting more information on the university's websites mentioned above on the humanistic contents of their programs. A questionnaire was emailed to the Deans for students' teaching and learning experience and heads of departments of each of the 10 involved medical schools. The research team designed the three open-ended questions to investigate education leaders' awareness or possibility of foreseeing training on the project topic (Appendix 1). Three separate reminders were sent to elicit a response and maximize participation.

The last step consisted of the course design phase, considering the previous steps' findings. Therefore, the research team designed an innovative educational program in medical education that combines authors' different points of view and respective disciplines background.

The study took place under local regulations, and no ethical approval was sought from the university ethics committee. Therefore, no personal and sensitive data were expected to be collected according to the developed questionnaire. Moreover, the invited Deans/heads of the Department have yet to respond to the questionnaire; thus, only literature review data are presented in this article.

3. Results

The research team selected medical schools among the top 10 universities per several continents (Europe, Asia, America, and Canada) according to the Top 10 ranking QS Universities Rankings 2022 (Appendix 2). The team selected three universities per continent, plus one for the United Kingdom. Each university website was searched for downloadable programs and curriculum content. Therefore, the search aimed to detect humanities, social science, anthropology, psychology, sociology, and similar fields elements incorporated in the selected curricula. In addition, any element or suggestion about person-centered care, medical humanities, model of care, communication, and interprofessional approaches was also considered. Universities with these characteristics and access were included. Finally, the accessible university programs and curriculum were analyzed.

The general perception of the programs analyzed was limited space for humanistic content. The number of hours dedicated to these lectures is generally minimal compared to the number of hours devoted to formative sciences and clinical skills. However, this final material selection brought the team's attention to several crucial aspects. Although supported and preannounced to have a humanistic approach to health, some universities only possess some teaching with this content in the actual program. For example, one university describes its approach to medicine as holistic, but this concept needs to be explained or expanded within the program.

However, the same medical school proposed a course in psychological medicine in the third year. An interesting aspect is represented by an Asian approach for first-year students with a module called a *journey to understand myself, society, human beings and human life*. Nevertheless, the contents of this very promising module are not accessible, but they give an idea of a more person-centered model. A North American university teaches the "narrative medicine" approach within foundational seminars across all the programs.

Interesting to notice that some academic contexts put the study of communication, medical humanities, or psychology in the first 2 years. At the same time, others dedicate seminars on the same topics in the second part of their pathway when they are more senior. The Canadian model (CANmeds) adopted by two selected universities (Europe and Toronto) is worth mentioning. CANmeds consists of an integrated model of care developed by and for physicians. According to this model, the students approach medicine from the first year in an integrated way, combining clinical skills with aspects of medicine more concerned with relationships and community health.

The response to the second step of our inquiry into medical education was very scarce. The educational leaders have yet to respond to emails containing the brief questionnaire. Therefore, the research team decided to expand the search for references further in postgraduate education courses or training in the medical and health profession. From this last purposive review, the team found specific courses for the medical profession (sometimes open to interprofessionality) that are more focused on gender medicine and pain management. This last fact highlights that, at this moment, the education on topics so sensitive and deep into the human experience of illness is relegated to the ones who are probably already interested in it or looking for further specialization. Among the different courses, Harvard University, with a master's in public health, designed a course in Gender, Women and Health. In comparison, the University of Aberdeen has a course on Women's Health in a Global Setting, open to all health professions.

4. Discussion

The findings from this last search inspired the research team to enrich their course proposal, investing in a longitudinal pathway throughout the medical degree.

Therefore, this group proposes a foundational course that should become integral to the medical training curriculum. The course should last 4 years, starting from the first year of studies, with consequential modules that deepen, each time, different topics. The authors propose a four-year course considering the average length of medical education programs. In addition, the proposed workshops embedded in each year of study will ensure proportionate integration to student's clinical practical experience; therefore, this approach will support the student's progression in a reflective and lifelong learning perspective (53).

The course will consist of a mix of teaching and learning strategies. In addition, the course will provide for each year an analysis of specific initial needs (teachers will also use that to reorient the program) and an assessment of learning, educational impact, and satisfaction at the end of each module. The program is detailed in the table here below.

Course title: Health, gender, and chronic pain	
1st year–gender, medicine, and health	
Theme	Health and gender
Contents	I Module (1) Sex as health determinants (sex differences in organ and body systems) (2) Sex differences in effect and side effects of pharmaceuticals (3) Incorporating gender analysis into health research and interventions. II Module (1) Gender differences and their impact on pathogenesis, diagnosis, prevention, and medical care (2) Gender distribution of diseases in the population (3) The role of gender in shaping health inequities and how gender health inequalities affect health research and interventions.
Objectives	Develop skills in gender medicine
Teaching modalities	Autobiography Interactive lesson Case discussion Use of reflective diaries in clinical placement Reflective writing Final evaluation
Hours	20 h (frontal lectures and facilitated team-work)
2nd year–pain as a multidimensional experience	
Theme	The multiple aspects of pain
Contents	I Module The physiological basis of pain II Module The social/cultural aspects in pain III Module The psychological aspects in pain
Objectives	Understanding and deepening the multidimensionality of the pain symptoms
Teaching modalities	Initial autobiography Case discussion Interactive lesson Testimonials and reflections on the experience Use of reflective diaries in clinical placement Reflective writing Final evaluation
Hours	20 h
3rd year–gender medicine and female chronic pain	
Theme	Sex and gender differences in pain and pain management
Contents	I Module (1) Biologic factors may account for sex differences in pain (2) Psychosocial factors may account for sex/gender differences in pain sensitivity II Module (1) Medicine, pain, and gender bias (2) Pain, chronic pain, and women III Module (1) Reflect on one's own gender stereotypes and their impact on clinical practice (2) Medical practice and self-reflexivity
Objectives	To Deepen the characteristics of sex and gender related to pain and chronic pain To reflect on gender biases in pain and pain management and develop skills to trace them
Teaching modalities	Initial autobiography Case discussion Interactive lesson Testimonials and reflections on the experience Simulation lab (virtual reality, augmented reality, mixed reality etc) Role playing Use of reflective diaries in clinical placement Reflective writing Final evaluation
Hours	20 h
4th year–gender medicine and relationship with the patient	
Theme	Relationship with the patient
Contents	I Module (1) Review strategies for patient-centered communication (2) Personalized pain assessments (3) Assessment of chronic pain in women II Module (1) The impact of gender on communication and interaction with patients (2) Review strategies for patient-centered communication regardless of gender III Module (1) Ascertaining chronic pain in patients considering the gender difference
Objectives	Deepen knowledge and develop skills on the doctor/patient relationship, in particular in the assessment and therapeutic management of pain
Teaching modalities	Initial autobiography Case discussion Interactive lesson Testimonials and reflections on the experience Simulation lab (virtual reality, augmented reality, mixed reality etc) Role playing Use of reflective diaries in clinical placement Reflective writing Final evaluation
Hours	20 h

5. Conclusion

Undergraduate medical students have traditionally been exposed to biophysical-focused curricula with little attention to patients' needs and expectations. A similar trend has been taking place in clinical research. In addition to a specific focus on biological feedback to new medications and treatments, men represent the predominant population studied.

The predominant role of men in biomedical science has been negatively impacting the delivery of high-quality and personalized medical care to women. Gender bias is equally in place regarding pain assessment and management in the women population. This may drastically impact women's health and well-being, especially regarding chronic pain and daily living habits. Our purposive literature review and the subsequent exploration of medical schools' curricula have confirmed this concerning trend. Unfortunately, we could not ascertain relevant practices in this primary educational and medical area as none of the HE institutions we contacted responded to our questionnaire. Furthermore, only 10 universities from the most prestigious academic institutions in the world, as per the Top 10 ranking QS Universities Rankings 2022, were scrutinized. Despite this may constitute a limitation, the research team adopted this strategy due to time constraints and the assumption that world-renowned academic institutions would have posed much more emphasis on gender bias in medical practice and women's chronic pain management from a non-biomedical perspective.

The proposed educational intervention aims to stimulate a debate within the scientific community and allow the incorporation of a novel approach to limiting the effects of gender bias on future medical practitioners. This innovative approach spreads throughout the undergraduate medical curriculum, ensuring continuity and sustaining an adequate and harmonious development of clinical skills and increased awareness in medical students to manage chronic pain in the female population appropriately. Furthermore, it is worth stressing that gender bias in medical science does not impact negatively only on women's health as medical science must be as much as possible inclusive, fair, and open to the full spectrum of gender identities.

We recommend this approach in any medical school and curriculum cross-contamination in all other allied health professions university programs in a lifelong interprofessional perspective.

Future studies will include testing the curriculum mentioned above development strategy and exploring its actual and perceived outcomes on the student population.

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 authors.

Author contributions

CM, EDL, CD'A, and AB contributed to the conception and design of the study. CD'A and CM focused on the introduction section. EDL and AB worked on the methodology. All authors focused on the discussion and the curriculum development intervention and contributed to the manuscript revision, and approval of the submitted version.

Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmed.2023.1189126/full#supplementary-material

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Perspectives on emotional memory images and the persistence of pain

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Multiple influences prevent recovery from pain. Our viewpoint is that non-conscious emotional memory images (EMIs) triggers outdated stress responses contributing to the intractability of pain. In this perspectives article we explore the concept that EMIs contribute to the persistence of pain. We contend that psychophysiological “stress” responses, resulting from first-time, novel and unprecedented pernicious or adverse events form EMIs within very short time frames (split-second learning). Subsequently, these EMIs are re-triggered in daily living, “re-playing” stress responses. We postulate that EMIs continually “raise the alarm” to socio-ecological stimuli by re-triggering the HPA-axis and amplifying neural input associated with threat, fear, anxiety, and pain, creating a debilitating state of psychophysiological dis-ease. We position the EMI within a philosophical debate on the nature and locus of memory and explain how the EMI, irrespective of whether it is a “thing” or a metaphor, can create a basis of understanding for the client to grasp. We describe a therapeutic approach (Split-Second Unlearning) to “clear” EMIs and the “stickiness” of pain and help people embark on a healing journey. This involves surveillance of clients for micro-expression(s) signifying an in-the-moment stress response, representative of the presence of an EMI, and encouraging the client to become a curious observer within/of their own experience. This helps the client detach their EMI from its stress response. We contend that this occurs rapidly without the need to get bogged down in a whole-life narrative. We advocate further exploration of our EMI model of dis-ease in the context of intractable pain.

KEYWORDS
persistent (chronic) pain, pain, Split-Second Unlearning, psychotherapeutic, psychophysiological dis-ease, intractable pain, emotional memory images

Introduction

Intractable pain that persists beyond the expected time for recovery affects a large proportion of people and is burdensome on society (1). In 2018, Borsook et al. (2) introduced the concept of “pain stickiness” as a nickname to capture multiple influences preventing recovery from pain, i.e., being stuck in pain despite therapeutic intervention. Borsook et al. explored reasons why some people engage adaptive responses to a perturbation (e.g., physical trauma, surgery or disease) enabling recovery, whereas others do not. Borstook et al. argued that neurobiologically informed psychotherapy, focusing on pain as a motivational drive to avoid harm, would assist people to overcome maladaptive fixed pain behaviour.

Our viewpoint is that exploring pain stickiness through a psychoeducational lens offers opportunities to better understand the intractable nature of pain, and possible strategies to aid recovery. Previously, we proposed a psychoeducational model of “dis-ease” based on evidence that traumatic emotional events earlier in life block a person's ability to overcome maladaptive thoughts and behaviours later in life. This results in a state of psychophysiological stress (dis-ease) and a variety of symptoms, including intractable pain (3). We proposed that psychophysiological "stress" responses resulted from first-time, novel and unprecedented pernicious or adverse events. This formed emotional memory images (EMIs) within very short time frames (Split-Second Learning), and these EMIs are re-triggered in daily living "re-playing" stress responses (3, 4).

Our theory positions EMIs as a barrier to a person "moving forward". We offered a technique to "unlearn" the EMI and aid recovery, i.e., Split-Second Unlearning. This involves screening clients for the presence of EMIs and placing the client as a curious observer within their own experience. In doing so, the client is able to "detach" (uncouple) the EMI from their stress response (dis-ease) so they can become naturally adaptive again.

In this perspectives article, we explore long-term intractable pain through an EMI lens. Our viewpoint is that emotionally overwhelming experiences, real or imagined, induce, non-conscious, contiguously formed multimodal mental imagery. This can trigger amnesic, anachronistic, stress responses within a split-second that may contribute to the intractability (stickiness) of pain. Our intention is to describe how Split-Second Learning informs a broader understanding of intractable pain and how our model of Split-Second Unlearning offers opportunities for therapeutic approaches.

Context

Our Split-Second Unlearning model of psychophysiological dis-ease offers a new perspective on nebulous conditions, such as stress, anxiety, and pain that persists (e.g., chronic primary pain) (3). In brief, we proposed that physiological stress responses (i.e., sympathetically mediated) from first-time, novel and unprecedented "traumatic" emotional experience are learnt within a "split-second" and can be re-triggered later in daily life when a person encounters a "reminder". These "reminders" may be pernicious or benign events that re-trigger latent non-conscious EMIs. EMIs activate a sympathetically-mediated stress response, producing bodily sensations associated with fight-flight-fright-freeze-flop (e.g., rapid heart rate, shallow breath, and sweaty palms). The sympathetic response is like an "echo" of the original archaic trauma (adverse event).

In the modern world people often appraise such sensations as negative emotional states detrimental to health and wellbeing, e.g., pain of sinister origin producing anxiety and fear. The cumulative effect of re-triggering EMIs is low-level psychophysiological stress, hypothalamic-pituitary-adrenal (HPA) axis dysregulation and dis-ease. Our appraisal of the attributes of EMIs suggested that the concept of EMI was distinct from other entities described in psychology literature e.g., emotional memory, mental image(ry), mental representation etc. [see Hudson and Johnson (4) for review].

We proposed that people "access" EMIs during conversation and that this manifests as non-verbal, non-conscious, momentary micro-expressions, e.g., sharp peripheral peek movements of the eyes that focus on the same exact spot whilst the client chats about their presenting problem. We suggested micro-expressions that signify a non-conscious "freeze-like" response may be used as non-verbal cues to prompt the client to curiously observe and explore their in-the-moment experience. By recognising the EMI as a barrier to moving forward, the client can engage with observable fragments of their response to "triggers"; this helps to detach the EMI from psychophysiological stress so that they can become naturally adaptive again, i.e., Split-Second Unlearning. Uncoupling traumatic memory and the associated stress response reduces a person's allostatic load with positive consequences for health and well-being (5).

Our Split-Second Unlearning theory of psychophysiological dis-ease (distress) is relatively simplistic, and we emphasise that our model in no way reduces the persistence of pain to one causal mechanism. Nevertheless, psychological distress (depressive and anxiety-related symptoms), is a risk factor for the persistence of pain and is correlated with increased pain prevalence (6–8). In the next section, we explore how EMIs could influence the persistence of pain.

Learning and pain persistence: the role of EMIs

People learn the concept and construct of pain through life experience; thus pain is strongly influenced by social circumstances, i.e., past, present, and possible future events (9–11). Western medicine's deductive philosophical processes have to some extent, fostered a division between body and mind as separate entities, encouraging a biomedical model of pain that focuses on tissue at the expense of lived experience.

In biomedicine pain is defined as a subjective experience anchored to tissue, e.g., "*An unpleasant sensory and emotional experience associated with, or resembling that with, actual or potential tissue damage*" (12). Phenomenological definitions of pain tend to emphasise a fusion of body and mind and something that is familiar between people, e.g., "*Pain is a mutually recognisable somatic experience that reflects a person's apprehension of threat to their bodily or existential integrity.*" (13) p.6. Debates about the nature of pain as an entity ("thing") (14), a type of event (15), or something else (16), including associations with bodily and extracorporeal processes are long-standing and unresolved (17).

People learn how to conceptualise and experience pain from childhood. This involves coupling bodily sensations and emotions existing in time and space to the word "pain", under the influence of societal behaviours, narratives and norms (9, 11, 18). Pain is related to the ontological experience of being in a body, i.e., the embodied mind, conceptualised and narrated in language, influenced by environments, intersected by time, place and culture (19–22). Thus, pain, and its persistence, is a personal construct under the influence of a multidimensional array of interacting biopsychosocial factors. Contemporary models of pain management advocate a biopsychosocial approach grounded in contemporary pain science education, based on the principles of sensitisation and bioplasticity, to reconceptualise a person's view about persistent pain (23). Concepts at the core of pain science education include pain acts to protect, the "pain system [sic]" can become overprotective (hypersensitive), and a hypersensitive "pain system [sic]" can be "retrained" to work "normally" (24, 25). Lumley et al. (26) argue that trauma is treated to facilitate remission or recovery, whereas persistent pain is managed so that a person is better able to function with pain. Thus, Lumley et al. advocate pain science education to promote understanding of the role of brain processing (bioplasticity) in linking trauma and persistent pain, thus aiding recovery; meta-analyses evaluating the efficacy of pain science education are inconclusive due to a paucity of large robust clinical trials (27, 28).

Perceived threat, often associated with specific emotional episodic memories, is a key feature of persistent pain and anxiety disorders (29). Post-traumatic stress disorder, adversity, and emotional regulation is associated with central nervous system processes and brain function abnormalities, e.g., in the cingulate gyrus, inferior parietal lobule, and precuneus (30). Evidence suggests that in later life, detrimental early life conditions and adverse childhood events (ACEs) are associated with increased pain severity, persistence, and complications (31–37). Functional somatic syndromes, including chronic primary pain with central sensitisation (fibromyalgia, chronic widespread pain, irritable bowel syndrome etc.), is associated with post-traumatic stress disorder-type events (38, 39). In addition, pain is associated with adversity from more common distressing experiences that occur throughout life owing to social conditions including neglect, family discord, abuse, social injustice and national displacement (40).

Our viewpoint is that psychological trauma (adversity) may occur at any juncture in life, resulting in the formation of an EMI; the key is that the trauma is first-time, novel and unprecedented. For example, we speculate that EMIs produced in adults due to trauma associated with uncertainties and distress experienced by global populations during Covid-19, [e.g., lockdown, job insecurity, social isolation etc (41, 42).] contribute to the rise in Covid-19-related distress (dis-ease) (43), including new onset and persistent (stickiness) of pain (44).

Psychological therapy-based treatment is recommended for people living with intractable pain, yet high-certainty evidence of clinically meaningful benefit remains elusive. The most recent Cochrane review of 59 studies (>5,000 participants) provided moderate evidence of small or very small beneficial effects of Cognitive Behavioural Therapy (CBT) for reducing pain and distress in persistent pain (45). Evidence of benefit for Behaviour Therapy (BT, 8 studies, 647 participants) or Acceptance and Commitment Therapy (ACT, 5 studies, 443 participants) was less certain and judged to be of moderate to very low quality. In 2017, Eccleston and Crombez (46) contended that the development of psychological treatment had stalled and they advocated a "… radical re-imagining of the content, delivery, place, and control of therapy" p.1.

For some people with pain there is a "psychological barrier" to moving forward, even following pain science education and conventional psychological interventions. Our viewpoint is that EMIs have a critical role in this stickiness of pain. We defined an EMI as "*Trauma induced, non-conscious, contiguously formed multimodal mental imagery, which triggers an amnesic, anachronistic, stress response within a split-second.*" (4) p.1. We posit, EMIs are created when a person experiences a situation perceived to threaten bodily or existential integrity. For example, a person who has experienced a dog bite may develop fear and anxiety of all dogs. The EMI generalises a threat to bodily or existential integrity across time and space (place). Fear and anxiety may be learnt through observation of others. For example, an infant witnessing a parent in fear when encountering a spider may develop an EMI themselves, causing fear and anxiety of spiders. A vast array of pernicious or adverse experiences in early life, including learned behaviours and social modelling, may generate EMIs that trigger contextual fear and anxiety. Thus EMIs, when re-triggered later in life, catalyse a stress response mediated by HPA-axis activation and the release of hormones and neuromodulators (e.g., cortisol and adrenaline). This causes symptomology associated with fear, anxiety, palpitations, muscle tension, shortness of breath, and sensitivity to stimuli that mediate pain.

We argue that people are unaware of EMIs (i.e., non-conscious), leaving them oblivious to precipitating stimuli that cause a sense of "threat", despite no apparent danger being present. Re-triggering of EMIs through exposure to stressors of modern life and chronic activation of the HPA-axis creates allostatic overload and a debilitating state of dis-ease comprising psychophysiological stress, anxiety, apprehension, and fear (47). Over time people may generalise anxiety and fear to other situations expanding precipitating circumstances beyond the scope of the original trigger i.e., stimulus generalisation (48).

The resultant allostatic overwhelm leads to dis-ease and intensification of pre-existing modern-day afflictions, (e.g., non-communicable disease) promoting behaviours to avoid situations that trigger further fear, anxiety, distress, discomfort, and pain (47, 49). Avoidance behaviour promotes a cycle of reinforcement, where the individual avoids situations that exacerbate anxiety and fear, increasing the likelihood of avoidance and further distress (dis-ease) (50, 51). As the dominant societal narrative is biomedical in nature people, appraise symptomology as medical (pathological) in origin and seek support from health care services that provide biomedical and/or psychological interventions.

Our viewpoint is that EMIs are grounded in a person's social context, past, present, and possible future. Consequently, EMIs serve to amplify the detrimental effects of social and economic risk factors for health, including persistent pain, such as family disruption, poverty, violence, crime, social isolation, and diminished economic opportunities. By exacerbating the impact of social risk factors on health and well-being, EMIs promulgate dis-ease, disability, and suffering, and hinder a person's "healing journey".

The World Health Organisation (WHO) advocate a salutogenic approach to health and well-being by acknowledging the need to address socio-ecological risk factors for health and well-being, through, for example, a whole system healthy settings approach. Policymakers acknowledge the need for integrative health care services and interdisciplinary teams that adopt a biopsychosocial approach to manage persistent pain. This includes helping clients to understand the psychological effects of pain and improve confidence to cope with pain, as well as the importance of movement, pacing, relaxation of body and mind, and strategies to manage everyday activities, such as hobbies and work. At the practitioner level, we advocate consideration of the Split-Second Unlearning model as a framework to "clear" EMIs and help people with persistent pain "move on" (heal).

Split-Second Unlearning and pain persistence

We postulate EMIs are formed (learned) in a split-second and hinder adaptation to the stressors of daily living, forming a barrier to recovery from pain. Our Split-Second Unlearning model (3) describes a novel psychotherapeutic approach to clear a client's EMI. This involves surveillance of clients for non-conscious "freeze-like" micro-expression(s) that signify an in-the-moment stress response, representative of the presence of an EMI. Encouraging the client to become a curious observer within/of their own experience, feeding back the non-verbal cues as they arrive in the moment, assists interruption of the informational flow of observable fragments, helping to detach their EMI from their psychophysiological stress response. We contend that this occurs rapidly without the need to get bogged down in a whole-life narrative.

Our psychotherapeutic approach has evolved from Eye Movement Desensitisation and Reprocessing (EMDR) (52). Gaze behaviour, where a person intensifies or averts gaze, is a behavioural strategy to regulate emotions and cope with stressful situations (53). We hypothesise that gaze behaviour may be associated with avoidance of, or fixating on, EMIs within the "mind"s eye". EMDR is used to treat various conditions, including trauma and persistent pain, with evidence of physiological changes to support observations of clinical benefit (54, 55). Nevertheless, systematic reviews and meta-analyses evaluating the benefits and safety of EMDR interventions for persistent pain and post-traumatic stress disorder are inconclusive due to insufficient high-quality studies (56–60).

Our approach is based on EMDR and posing open questions such as "What would you like to work with today?" or "What is troubling you at the moment?". These questions provoke the client to scan, in a non-conscious manner, memories in relation to their problem (e.g., pain) prior to formulating a conscious verbal reply. The therapist observes non-verbal micro-expressions, e.g., a sharp intake of breath, head tilt, pupil dilation and/or eyes making a sharp peripheral peek or fixating on a specific point in space. These occur in a split-second and indicate an emotional connection between a thought and a reflex stress response as if the client is re-experiencing some event from the past. These micro-expressions, of which eye movement and fixation are of importance, are indicative of a troubling EMI.

It is the connection between the EMI and the associated stress response that the therapist seeks to break. This is achieved by making the client curiously aware of their involuntary micro-expressions, such as fixation of eyes in a specific peripheral peek that appear each time they are asked about their presenting problem. States of curiosity enhance the capacity to learn new information such as dispassionate acceptance, this can break associations between emotions and reflex stress responses which no longer serve a useful purpose (61). The therapist uses various techniques to help the client uncouple the EMI from the stress reflex (i.e., unlearning), such as asking the client to direct their gaze to a different position while still trying to think about their problem.

Split-Second Unlearning refers to a brief window of opportunity in which the therapist observes the activation of the EMI. They then deploy an interruption to disconnect the non-conscious memory from the reflex stress response, replacing it with a more objective appraisal of the overall situation. Thus, the EMI may be deemed unimportant or infused with a clarity of hindsight. The "uncoupling" of an EMI to a stress response is usually "immediate" and recognised as (emotional and cognitive) confusion. Longer-term benefit arises from a stress response that is no longer re-triggered by the EMI, enabling the person to embark on a journey to recovery. This approach differs from conventional psychotherapeutic interventions because it does not encourage clients to share their personal narratives, simply to explore their experience within the moment.

Clinical vignettes

The Split-Second Unlearning model offers a framework for practitioners to diagnose and treat EMIs born out of adversity. MH has used it successfully in a variety of conditions presenting with persistent pain including dysmenorrhea, irritable bowel syndrome, fibromyalgia, migraine, rheumatoid arthritis, and neuropathic pain. Here, MH describes two cases as examples of Split-Second Unlearning in practice.

Case 1 - dysmenorrhea

A 34-year-old female presented in an online clinical session reporting long-standing severe period pain that started at menarche. When the client described her pain story, I noticed that her eyes moved to the left when speaking of past events and to the right when speaking of future events. Rather puzzling to me was the observation that the client's eyes remained fixated to the right when describing period pain, irrespective of describing the past or future. I explained that first-time emotionally overwhelming events can lead to the creation of EMIs that remain within the mind and invisible to the person. I explained that EMIs can trigger similar "stress" responses to encounters with similar contexts and that feelings of vulnerability, guilt, shame, embarrassment, and being dirty or unclean, can rapidly create emotional overwhelm. The client nodded her head in agreement. I described Split-Second Unlearning and directed the client to fixate her eyes on my hand (central field of vision) and think about her period pains while I moved my hand back and forth for a few seconds. Whilst doing this the client looked a little confused and commented that "Something was different", and I noticed her eyes were moving freely without any eye fixation or avoidance; I surmised the EMI had been effectively erased. The client was given an appointment for an online follow-up call at 1 month at which she reported no recurrence of symptoms. There were no symptoms at the 12-month follow-up.

Case 2 – trigeminal neuralgia

A 43-year-old male presented in an online clinical session with trigeminal neuralgia. The client reported first onset of pain at age 16 that was intractable and resistant to various treatments. This included a rhizotomy at age 25 and prescription medication that included carbamazepine, gabapentin, baclofen, and ibuprofen. These interventions provided only partial short-term relief. The client had been able to hold down a full-time job, marry and raise children. As the client told his story, I noticed that he continually fixated his eyes on a spot in his left peripheral field of vision. The client accessed the same spot when I asked what was happening in his life just before 16, and he replied, "My mum and dad got divorced". For a fleeting moment the client's face flushed red. I described EMIs and Split-Second Unlearning and pointed out that he was continually accessing an EMI "on his left". I invited the client to fixate his gaze on me (centre) and to re-tell the history of his pain (i.e., pain story); almost immediately the client smiled and said, "It's gone!". I surmised that the process had, in a split-second, interrupted triggering of the EMI and in doing so broke the connection between the EMI (stimulus) and the stress response. I asked to be kept informed of any changes. The client reported being pain-free at follow-up contacts of 1, 3, 6 and 12 months.

A rationale for the speed of Split-Second Unlearning

The process of Split-Second Unlearning aligns with principles of memory reconsolidation by:

1. Reactivating the client's awareness of the EMI.
2. Pointing to the EMI as the source of their pain, giving fresh insight into the experience.
3. Embellishing stages 1 and 2 to stimulate the process of unlearning, nullifying, and reconfiguring the EMI.

For further insight see (62, 63).

Discussion

People visit health care professionals expecting to receive a physical diagnosis and biomedical (physical) treatment to "fix" all types of pain, including pain that has become intractable. This poses a challenge for practitioners trying to explore with their clients, psychosocial or metaphysical factors that may be influencing the persistence (stickiness) of pain. Biomedical interventions that "fix" pathology and/or facilitate symptomatic relief has revolutionised the management of painful conditions and the quality of life. Nevertheless, there remains a treatment-prevalence paradox whereby increasing varieties of biomedical and psychological interventions have not reduced the prevalence of persistent pain.

Foell states: "*It would be so easy and straightforward if persistent pain could be a thing. Pain without a lesion is a condition charged with moral judgement. … But, unfortunately, pain is not a thing. 'Pain does not emerge naturally from physiological processes, but in negotiations with social worlds'* (15)" (64) p.126–127. Agarwal's "ecology of wholeness" model of chronic illness and the body in pain conceptualises pain according to the self (reflexive and embodied), the body (material and conversational) and the context (including body/self-integration, food, nature, time, change, illness intrusion and information). Contemporary neurophysiology suggests that pain emerges from predictive processing in the brain informed by multisensory input that "threatens" the integrity of the body and peri-personal space, at tissue and psychological levels (65). Moseley et al. (65) name coarse neural representation of the body and peri-personal space as the "body-matrix", and suggest that disruption of the integrity of the body matrix by damage, malfunctioning or anomalous feedback, may drive various functional and psychological disorders including persistent pain. It is not our intention to debate the reification of pain, but rather to draw attention to the consequence of people being socialised to believe that pain is a "thing" that always results from tissue damage.

Pain and EMIs are positioned within a philosophical debate on the nature and locus of memory, and whether memory is an entity, phenomenon, or something else. The dominant neurophysiological, synaptic-plasticity theory of memory has been critiqued [e.g. (66)] and defended [e.g. (67)]. Deconstruction of the body within the reductionist framework of the Standard Model of Physics at organ, tissue, cellular, molecular, and subatomic levels has failed to resolve this debate. Thus, we do not constrain EMIs to be solely dependent on brain function and neural connections but indigenous to "the self", and possibly extracorporeal (3, 4).

Practitioners may be afraid to step into the vulnerable space of discussing trauma and the metaphysical aspects of the EMI, as they fear reprisal from the client who expects a pathological cause and a biomedical treatment. Engaging the client in a discussion around the EMI, irrespective of whether the EMI is considered a "thing" or a metaphor for how the client's pain exists can create a basis for understanding for the client to grasp. For example, engaging the client's curiosity by discussing the possibility of the EMI acting as a metaphysical cloud storage at the intersection between the body and the socio-ecological context (external environment).

As a concept, this could have significant implications for understanding the intractability of many psychophysiological diseases, including persistent pain. Moreover, it could inspire new therapeutic approaches that incorporate both mind-based and body-based techniques. For example, the Split-Second Unlearning process has been integrated with eye-tracking technology to create "MindReset" a digital intervention that can be accessed through a mobile phone, with the potential for rapid, cost-effective and scalable "treatment".

Conclusion and next steps

In summary, we postulate that EMIs may contribute to the stickiness of pain, continually "raising the alarm" by re-triggering the HPA-axis in response to socio-ecological stimuli, i.e., a sensitised threat/fear system that in turn amplifies pain and suffering and blocks "recovery". We postulate that the EMI is non-conscious, shrouding the original emotional overwhelm (trauma and adversity) in amnesia, so people are unable to verbalise the origin of their persistent and intractable pain, only that they have it and "cannot get rid of it".

In conclusion, we advocate exploration of the persistence (stickiness) of pain through the lens of EMIs, psychophysiological dis-ease, and Past Adversity Influencing "Now" (PAIN). We plan to integrate EMIs with psychological (68), social communitive (10), and ecological (69) models of persistent pain. We suggest clinical research focuses on the utility and efficacy of the Split-Second Unlearning technique to (i) reveal pre-verbal trauma in people living with persistent pain; and (ii) alleviate the persistence of pain and related symptoms.

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

MH and MJ contributed equally to the conception and writing of the manuscrip and approved the submitted version.

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Conflict of interest

MH is the co-founder and co-creator of MindReset app which is supported by individual subscribers. In the previous 5 years, MJ's employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

Publisher's note

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A perspective on the role of language about pain

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This article contributes a perspective on pain motivated by the philosopher Ludwig Wittgenstein. According to Wittgenstein, the child learns from others that the occasions on which it manifests certain reactions—the reactions that human beings manifest when injured—make it appropriate to self-ascribe "pain". When the child can signal correctly that she is in the requisite bodily state, then she has a conception of pain. Using the concept *pain* to symbolise an experience also makes it possible to tell other people what is going on and to solicit their help in managing the pain. In pain discourse, we can say "Sam can tell that Jason is with pain", or "She could tell you that Jason is with pain if she wanted to". These uses are linked to social milieu where rules are learnt for the application of concepts, such as the concept *stoicism*. In many rural communities, adults tell other adults about pain when it interrupts work or social activities. Otherwise, it is normative to "carry on". The rural stoic who tells another about pain only if he wants to can complicate clinical pain management, which can undermine the patient's special authority. In contrast, convergence in pain definitions and judgements between the patient and health professional can protect the authority of the patient and improve the clinical interaction. Pain is not simply a quale that is privately perceived; it must be capable of being expressed. Thus, pain has a social role, which is learnt. The study of linguistic rules in pain discourse could help explain the learning and application of the concept *pain*.

KEYWORDS
pain, Wittgenstein, language, rule, rural

Introduction

A significant body of knowledge exists on the pathologies, injuries, and diseases, as sources of pain, and their impact on the host, as related to neurobiology and personal experience. The contribution of the social environment in which pain is experienced has received less study perhaps because we think of the personal experience as given, and the behavioural manifestation of the experience as secondary, as symptoms through which we come to know the mind of another human being. Pain is undoubtedly a private experience but ascribing the word "pain" to other human beings presupposes the possibility of behavioural manifestations (1–3). Behavioural manifestations of pain include facial expressions and bodily gestures, what people say and do, and the occasions for the use of "pain" (4). If we encountered a society of people who used a word that lacked any connection with pain-related behaviour, and the complex situations in which we show pain, we would not translate it as "pain". Pain is neither totally reducible to, nor totally separable from, its associated behaviours. Pain must be capable of being expressed (3).

Understanding pain means recognising that it is an event that occurs in the weave of social life, with the person's pain manifestly obvious, usually based on the social context and reactions of others. In a community of people who manifest pain behaviour as we do, but do not react to it with sympathy, "pain" would not have the same meaning. The two communities could be more in harmony if the social context is used to make sense of some phenomena connected to pain, such as "disinterest in other people with pain", although this couldn't hold for some pain-behaviours, notably involuntary manifestations of pain like facial expression or paralinguistic speech, as phenomena like apathy, hope, pretence, or expectation are not assigned to others using straightforward behavioural criteria but require an elaborate social context (3).

Linguistic skills are learnt in specific familial and ethnic contexts and provide the child a symbolic mode of reacting to "what is going on". The child learns from others that the occasions on which it manifests certain reactions make it appropriate to self-ascribe "pain". This step instructs the child what "pain" refers to. This skill develops into more sophisticated linguistic abilities, which include using more complex statements about pain ("Her pain is getting worse", "The dog is howling with pain", "He is not in pain now"), and relating pain to other experiences ("I am not in pain; I'm just sad") and to reason-governed action ("Going to the dentist will help my toothache") (3, 4). When the child can tell that it is with pain, it not only can register a private experience, but it can also give the *concept pain* a role in social activity and in the organisation of social reactions. According to Wittgenstein, it is a mistake to think that we can meaningfully speak about things that are experienced *only* in the private mind (3). Consequently, if mental contents are not only meaningfully private, then there is an essential link between personal experiences like pain and the social world. In the next sections, I briefly survey the elements of Wittgenstein's argument, focusing on linguistic meaning, rules of language, and agreement in judgements. Following this review, I apply these elements to the rule-governed use of concepts such as *stoicism* in rural pain discourse.

A brief survey of Wittgenstein's "private language argument"

Linguistic meaning is use

Wittgenstein claims that understanding what a word means involves correct (normative) use: "For a large class of cases—though not for all—in which we employ the word 'meaning' it can be defined thus: the meaning of a word is its use in the language" (3, §43). Thus, in the following clinical anecdote, it is unclear if the patient understands the word "pain": "After the operation, the patient no longer complained spontaneously of pain and no longer appeared to be in distress, though when asked, he acknowledged that pain was still present" (5, p. 588). If the ward nurse checks the patient's understanding, she could ask, "Does your pain bother you?" If the patient does not demonstrate real-life familiarity with the use of "pain" or does not do anything that normally is inseparable from feeling pain, the nurse could infer that he does not understand it (or the situation is too ambiguous to resolve). For Wittgenstein, understanding is correct use, which is a social fact.

Rules of language

The person who can self-ascribe "pain" can correctly discriminate reactions that make it appropriate to say, "I feel pain", from reactions that do not. Thus, the person who understands the concept *pain* can understand and communicate pain, and only pain, by use of the concept. For example, the person who understands the concept pain:

- Does not self-ascribe "pain" to sensations of hunger or thirst.
- Does not self-ascribe "pain" based on inference; for example, using introspection, categorisation, behavioural observation, or verifying the cause of the pain.
- Does not misidentify who is with pain; for example, she does not claim "I believe my pain was Eli's, not mine, although I can't be sure".

Correct use of "pain" means following rules that link pain and the word "pain". In practice, linguistic mastery of "pain" is achieved by using the word such that the person's successes and errors are in principle manifest and can be corrected by others (3, §202). The successful learner shows enough correct application to count as having understood the concept *pain*. Wittgenstein concludes, "Hence it is not possible to obey a rule 'privately': otherwise thinking one was obeying a rule would be the same thing as obeying it" (3, §202). The truth of privacy in relation to pain is not introspective knowledge, but that what I say or utter about my pain is a spontaneous and authentic manifestation of "what is going on within me". The special role granted the person with pain is not a special knower, but a special actor (6).

Agreement in linguistic judgements

Learning the concept *pain* is triangulated with interpersonal interactions and behaviour in which personal judgements about pain in oneself and others are manifest to others and corrected by them. The person who achieves a sufficient level of agreement in judgements with others is counted as having mastered the rule-governed ability use of "pain". The result of this educational training is that judgements of the learner gradually converge with those of others who already understand the concept *pain*. In the clinical situation quoted above in which self-ascribed pain does not lead to agreement in judgements, the patient's care team must determine whether the patient understands what pain is. The conclusion the team arrives at would rely on the patient's use of "pain" in different situations, and the role he or she gives the concept in a range of thoughts.

The possibility of disagreement in judgements about the pain of others reflects an indeterminacy, which is constitutive of our concept *pain* (3). That indeterminacy in turn is due to social patterns of behaviour: our concept *pain* must be flexible because pain behaviour, and our complex reactions to it, is diverse and unpredictable (3, 4). Caregiving in pain settings can involve a threat of pain to the carer and is conditional on the authenticity of manifest pain behaviour. As observers of pain in other people, we are sensitive to signs of exaggeration, suppression, or malingering, in behavioural displays of pain (4). Accordingly, our concept *pain* does not always rigidly connect behaviour, situation, and personal experience (3). Given the same evidence, one health professional can be convinced of a diagnosis, another is not (7). However, we do not on account of this disagreement exclude either from the medical profession, as being unaccountable or incapable of judgement. This reflects not professional incompetence, but the indefiniteness of pain.

Discussion

Telling others that I am with pain

Using the concept *pain* to symbolise an experience makes it possible to tell other things about it. For example, "I feel better now", "It burns", "The pain is spreading", "I need a break". It also allows a person to tell other people what is happening and to solicit their help in delivering analgesia and care. However, in the swing and play of life, people tend to be careful about who and when they communicate pain (4). The unpredictability of social reactions to pain in others reveals indeterminacy in our concept *pain*, which is reflected in different uses of "tell". In pain discourse, "telling" can be used in at least two ways. We can say "Eli can tell that Susan is with pain", or "He could tell you that Susan is with pain if he wanted to". Again, these uses are linked to participation in a social milieu where specific rules are learnt for the regulation of concepts. For example, people growing up and living in rural communities in Australia and New Zealand conventionally learn social rules for the use of certain concepts, commonly self-reliance, stoicism, or fatalism (8–11), which make them more accepting of chronic pain, disease, or illness than people in urban environments. These concepts are paired with rules that instruct when it is appropriate to tell others about being with pain. A common rule in rural communities is for adults to tell other adults about personal pain when it interferes with work or important social activities (12). Otherwise, it is appropriate to "carry on" (8). One farmer in New Zealand observed (8, p. 403):

> "Our home is where our farm is, where it's all encapsulated together. So, our whole family, the whole structure is—maybe not for all farmers, I don't think that's true, but for many of us. So, we don't just look for what's gratification for ourselves, we're looking through for the next generation, wanting to provide. So that's why we struggle with removing ourselves from the workplace".

Who in particular is told about pain in rural areas is also guided by rules. In rural and remote Australia, the GP in some communities is from a different culture and speaks English as a second language (13). Rural people tend to distrust "outsiders", including medical professionals, consulting instead with their own community networks for assistance or advice about pain or illness (14, 15). This practice could mean that rural people prefer concepts to function against a more stable than changing background; therefore, concepts must be more determinate than indeterminate. Such speculation highlights the importance of tight kinship in rural community networks, for correct use of the concept *pain* involves convergence in judgements about what is significantly the *same;* thus, it involves understanding the consequences of pain in the rural milieu. Telling another about being with pain involves having some idea what to expect from the other and being able to relate to and understand this person. Thus, together with applying certain rules, "telling" in this setting also involves a sensitivity, or "feel" for human behaviour. This could explain why rural people prefer not to tell "outsiders" about personal pain.

> "Well, the one before Dr P. didn't understand, just didn't know anything about this and wasn't interested. He just said straight out that wasn't his line—he wasn't going that way. And he couldn't understand, I suppose, the amount of pain. He was forever telling me that 'don't do this, don't do that'. In his opinion I should have been just be sitting in my chair you know, knitting the rest of my life away" (16, p. 481).

Telling another about being with pain *if one wants to* can create divergence between patient verbal self-report and non-verbal pain behaviour, which can limit or obstruct the efforts of health professionals to intervene on the patient's behalf, resulting in inadequately managed pain (17). In comparing rural and urban nursing homes, rural nursing home staff, "more so than their urban counterparts, emphasized stoicism as an attitudinal barrier on the part of residents that interfered with pain assessment" (18, p. 745). A foundation of pain discourse is that the person's sincere utterances about his or her own pain are treated as correct. To introduce doubt here (e.g., "stoicism as an attitudinal barrier") could alter normal discourse; specifically, it could undermine the authority of the subject. In contrast, convergence in pain definitions and judgements can preserve the special role of the person with pain and improve the clinical interaction. In a qualitative ethology study (17), Spiers describes a rule co-created between patients and nurses in urban home-based care, for which "stoicism did not imply enduring excessive pain but…the ability to know where one's pain boundaries lay and to take appropriate measures to keep pain within those boundaries" (17, p. 296). The nurses effectively implemented this shared rule using different communication strategies (17).

From clinical cases like these, Beeckman et al. (18) speculates that rules in the pain setting are a "double-edged sword" as rigidly following pain-related rules despite costs could be a risk factor for worse outcomes, whereas flexibly switching between pain-related rules—e.g., exchanging a rule stipulating pain-related avoidance for one stipulating acceptance of pain—depending on the situation and benefits could help explain "resilient functioning" with chronic pain. According to rural nurses, generational and geographical factors explain stoicism in rural people with chronic pain (19). Residents in rural nursing homes expect to be with pain; according to nurses, "It's how they age here" (19, p. 745). For rural residents with pain, the switch to following a new pain rule would need to contribute to desired consequences (e.g., minimal interruption to work) but perhaps more importantly, the new rule would need to integrate into the fabric of rural life: "…we don't just look for what's gratification for ourselves, we're looking through for the next generation, wanting to provide" (8, p. 403). As our needs or interests change, or simply as part of life, our concepts can evolve over time. An evolved concept could supply us a new rule guiding the way we behave, which could correspond more or less with existing rules (3). Although our concept *pain* is flexible on the rules we use, the rules *we* adopt must be usable.

In experimental studies, rural groups tend to report higher rates and more intense chronic pain than people from urban groups (e.g. 20),. Poorer access to pain treatments for rural compared to urban residents could partly explain differences in pain outcomes (e.g. 21–23),. Another possibility is that urban residents are less attentive to their pain due to the multiple interruptions that can compete for their attention in the city environment (20). By contrast, rural living is described as "peaceful, tranquil, spacious, friendly and caring" (24, p. 211). With fewer external interruptions competing for personal attention in the rural setting, rural residents could have learnt, on average, to be more alert to pain and its qualities than urban residents.

In this article, I have argued for the perspective that pain is not merely a "raw feel" that is privately and unproblematically perceived by human beings; it also has a social role, which is learnt. When a person can correctly signal that she is in the requisite bodily state, then she has a conception of pain. The risk of disagreement in our judgements about others with pain, which rests on our diverse and unpredictable reactions to pain behaviour, should motivate trust-building and shared decision-making in the clinic. I have lent support to these claims in the article through linking the ambiguity of "tell" to rules for the use of concepts, such as *stoicism*, as applied in rural settings.

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

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares 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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Understanding chronic pain in the ubiquitous community: the role of open data

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The combined use of social media, open data, and Artificial Intelligence has the potential to support practitioners and empower patients/citizens living with persistent pain, both as local and online communities. Given the wide availability of digital technology today, both practitioners and interested individuals can be connected with virtual communities and can support each other from the comfort of their homes. Digital means may represent new avenues for exploring the complexity of the pain experience. Online interactions of patients, data on effective treatments, and data collected by wearable devices may represent an incredible source of psychological, sociological, and physiological pain-related information. Digital means might provide several solutions that enhance inclusiveness and motivate patients to share personal experiences, limiting the sense of isolation in both rural and metropolitan areas. Building on the consensus of the usefulness of social media in enhancing the understanding of persistent pain and related subjective experiences via online communities and networks, we provide relevant scenarios where the effectiveness and efficiency of healthcare delivery might be improved by the adoption of the digital technologies mentioned above and repeated subsequently. The aim of this perspective paper is to explore the potential of open data, social media, and Artificial Intelligence in improving the prevention and management of persistent pain by adopting innovative non-biomedical approaches.

KEYWORDS

chronic pain, non-biomedical approach, open data, artificial intelligence, patient empowerment

1. Introduction

Chronic or persistent pain lasts for more than 3 months and it is estimated to affect 20% of the world's population and account for up to 20% of physician visits (1, 2). Chronic pain is not only a significant symptom but also the root cause of the daily practices and discourses of sufferers that are centred around this critical condition (3).

Individuals with persistent pain may well be users of modern technologies such as social media, search engines, and wearable technologies to name a few. These types of technologies can potentially provide a wealth of information to healthcare databases and contribute to the development of innovative chronic pain prevention and management strategies. Moreover, electronic footprints provide important insights on lifestyle, allowing a better understanding of underlining chronic pain issues.

We postulate that persistent pain and related lifestyle repercussions are intertwined with digital everyday habits, as illustrated by five scenarios presented in this study. Such scenarios are provided as a supplement to this perspective paper, with the aim of clarifying the importance of interaction and inclusion for people living with persistent pain, at various social levels, through the use of technology and social networking.

Even though data anonymity is a requirement to be met during open data collection and analysis, recent methods of processing COVID-19 anonymised open data have demonstrated the effectiveness of this approach in designing innovative strategies to promote health. Therefore, we suggest that open data analysis of digital habits pertaining to persistent pain may become an equally effective strategy in the prevention and treatment of chronic pain.

2. Overview of non-biomedical approaches for chronic pain

Despite biomedical treatment being the predominant approach against chronic pain, there has been considerable debate with regard to its therapeutic appropriateness. Looking at the overcomplicated reality of individuals living with persistent pain (4), researchers have considered the need to include an array of therapeutic options to implement/personalise chronic pain treatment in order to provide an alternative framework to the mind–body dualism and to promote the adoption of holistic care (5).

The literature proposes cultural (6), social (7), and psychological solutions to relieve pain (8) and to overcome iatrogenic complications caused by medication (9). Integrating alternative therapeutic options into biomedical treatment would ignite new perspectives on conceptualising and managing pain through an innovative holistic ecosystem. A recent initiative looking at diverse solutions towards the prevention and treatment of chronic pain has suggested the need to move away from the current urbanised painogenic environment (10). This study describes various living conditions exacerbating pain, such as the frequent exposure to a multitude of physical and psychosocial determinants amplifying the frequency, severity, and length of undergoing pain and associated body sensations (11).

To provide a simplistic explanation, the current ways of tackling persistent pain through the biomedical approach seem to be too limited to appropriately handle such a multifaceted and complicated phenomenon. As Johnson and Woodall (12) state, “Living in modern society offers potential for health improvement through technological advances and digital advancements…”. Investing in advanced technology solutions aimed at preventing and managing chronic pain includes means such as cloud services, Artificial Intelligence, social networks, Internet of Things (IoT), and so on. Such means are explained below.

3. Open data for the advancement of chronic pain research

A better understanding of the needs of individuals affected by persistent pain implies the acquisition of their personal perspectives. Focusing on how people think and feel about pain, including on the opinions of those surrounding them, such as caregivers, friends, neighbours, and so on, may offer us new perspectives on the impact of the painful experience, including personal meaning and related daily practices. This seems to provide important opportunities for appreciating the complexity of chronic pain from a holistic perspective.

Adequate and comprehensive data such as Big Data may contribute to improving the quality of previously acquired minimal datasets (13). Understanding which ontological approach and related data elements (14) would be more suitable for data sharing could facilitate the study of behavioural patterns appearing in social networks and the creation of digital citizen labs (15) where open discussions may foster public engagement on an important topic. A valuable example may be given by the introduction of effective ways to support individuals affected by persistent pain. Promoting the adoption of positive thinking techniques and allowing practitioners to share successful stories on social networks might support the formulation of self-management strategies (16).

Recent developments on Open Data management in delivering responses to the COVID-19 pandemic have demonstrated how helpful this information is in improving evidence-based practice. Automated data collection, databasing, and data processing through the adoption of forms of Artificial Intelligence and machine learning (17) may be critical for effectively enhancing disease monitoring and for delivering high-quality care in a timely manner (18).

4. Open data helping ubiquitous communities of people living with chronic pain

Capturing the connections and types of interactions of online social life used by patients with chronic pain is not a new technique (19), especially when it comes to empowerment (20), given that online support groups tend to prefer interaction in a virtual environment (21). For a long time, the role of social interaction has been deemed important among individuals with persistent pain, showing the potential to meet the information needs and expectations of users (22). Health-related issues have been discussed in open and innovative platforms (23) as part of European Union–funded projects (https://cordis.europa.eu/project/id/688670). For example, the links between menopause and chronic pain (24) were identified through the platform named GENNEV, subsequently allowing the delivery of telehealth and coaching services (https://www.gennev.com/). Despite its success, GENNEV lacks an essential feature, which is the opportunity for peer interaction.

In other studies, such online interaction is considered an important component of tackling chronic pain (25). It seems that patients with chronic pain may be able to overcome the stigma and invisibility of persistent pain through mutual online empowerment (26). For example, the possibility of being visible and of having unlimited opportunities for conversation with a wider audience may have important positive effects (27, 28).

5. Open data and community resilience

Despite the obvious concerns about data privacy, the case of open data sharing during the COVID-19 pandemic shed light on how data may suggest the adoption of new collective and individual tasks/habits. Online networks and communities provide a digital infrastructure, where each member may share useful data through peer-to-peer interactions, and favour positive impacts on chronic pain (29).

Such data types are of great value for communities and researchers, especially when they allow them to explore daily routines around pain and related habits and to gain a better understanding of community practices that are put in place for the benefit of both patients and stakeholders. Such communities seem to grow by sharing common needs, values, and interests. Furthermore, a variety of relevant healthcare professionals may be invited to be a part of such communities, ensuring further benefits to their members.

6. Ubiquitous communities: when patients, caregivers, and experts come together

Various examples may prove the potential of public engagement in tailoring innovative evidence-based practice. In the mid-1980s, AIDS prevention campaigns were driven by the successful integration of public awareness into biomedical research (30). Similarly, not-for-profit organisations such as the Cochrane Collaboration or James Lind Alliance offer examples of possible collaborations among patients and healthcare providers or researchers.

Making use of the vast potential offered by the World Wide Web (WWW), today's technology users provide an unprecedented ubiquity of resources and digital infrastructures that may connect people who share common interests and goals around the world. Enhanced opportunities that serve to connect people may be utilised similarly in advancing health collaborative practices. Open data sharing is key in this regard, especially when information is drawn from different sources and combined to get a more comprehensive picture of the experiences of users suffering from persistent pain (31).

The EU-funded project Opencare (http://opencare.cc/) is part of the Collective Awareness Platforms for Sustainability and Social Innovation (CAPSSI), which provides a valuable example of such enhanced interconnectivity. This initiative unveils the potential of allowing people affected by chronic pain in Europe to engage in discussions about the kind of support they need and to undertake initiatives to reach out to local governments and health authorities, thus eliciting a higher quality of care.

Digital communities, along with the support of experts, may potentially play a more active role in supporting individuals suffering from persistent pain (32). Health-promoting infrastructures (HPIs), such as networks aimed at finding the availability of health expertise and at promoting solutions for global health problems, are a relevant example of such digital communities (33).

We use "ubiquitous computing" as an umbrella term that describes a plethora of technologies able to support research and healthcare delivery while providing a formidable health data monitoring and surveillance opportunity for shaping everyday living healthcare provision plans (34). This goal becomes even more relevant when addressing health issues, especially in complex urban contexts (35). We acknowledge the need for the adoption of such a concept that includes important design features (36) based on the increasingly common use of wearable devices (37).

Equally, social network sites (SNSs), such as social media create a platform for the exchange of accurate information among peers belonging to virtual communities (38). Nonetheless, using social media to address chronic pain issues and provide relevant related services (40) implies fulfilling ethical and professional requirements (39). Further research and subsequent regulations on these aspects are deemed crucial in order to proceed without encountering any stumbling blocks or drawbacks. An example of a suggested model for this data analysis is presented in **Figure 1**.

7. A foresight approach with multiple scenarios

To build our case, five descriptive scenarios were developed concerning people affected by chronic pain. These scenarios include examples of patients producing data by blogging, using social networking, and adopting wearable technologies and sensors. The heterogeneity of the conditions described in these scenarios offers a constellation of narratives that will be useful in predicting future opportunities in terms of interoperability among patients, healthcare providers, digital experts, and policymakers. Scripts suggest ways to acquire data and the advantages of adopting an open data approach where patients, researchers, and practitioners may access and exchange such data.

Ubiquitous communities may gain a deeper understanding of current evidence-based strategies to tackle persistent pain through the use of relevant digital infrastructure while receiving guidance from subject experts, as highlighted in the five attached scenarios (Appendix 1). This would fuel local and global statistics on chronic pain and lead to the provision of more effective healthcare services. Similarly, policymakers might access such data and allocate proportionate human and financial resources accordingly.

Each scenario presents a different illness from a holistic perspective, and they were developed jointly by all authors. In

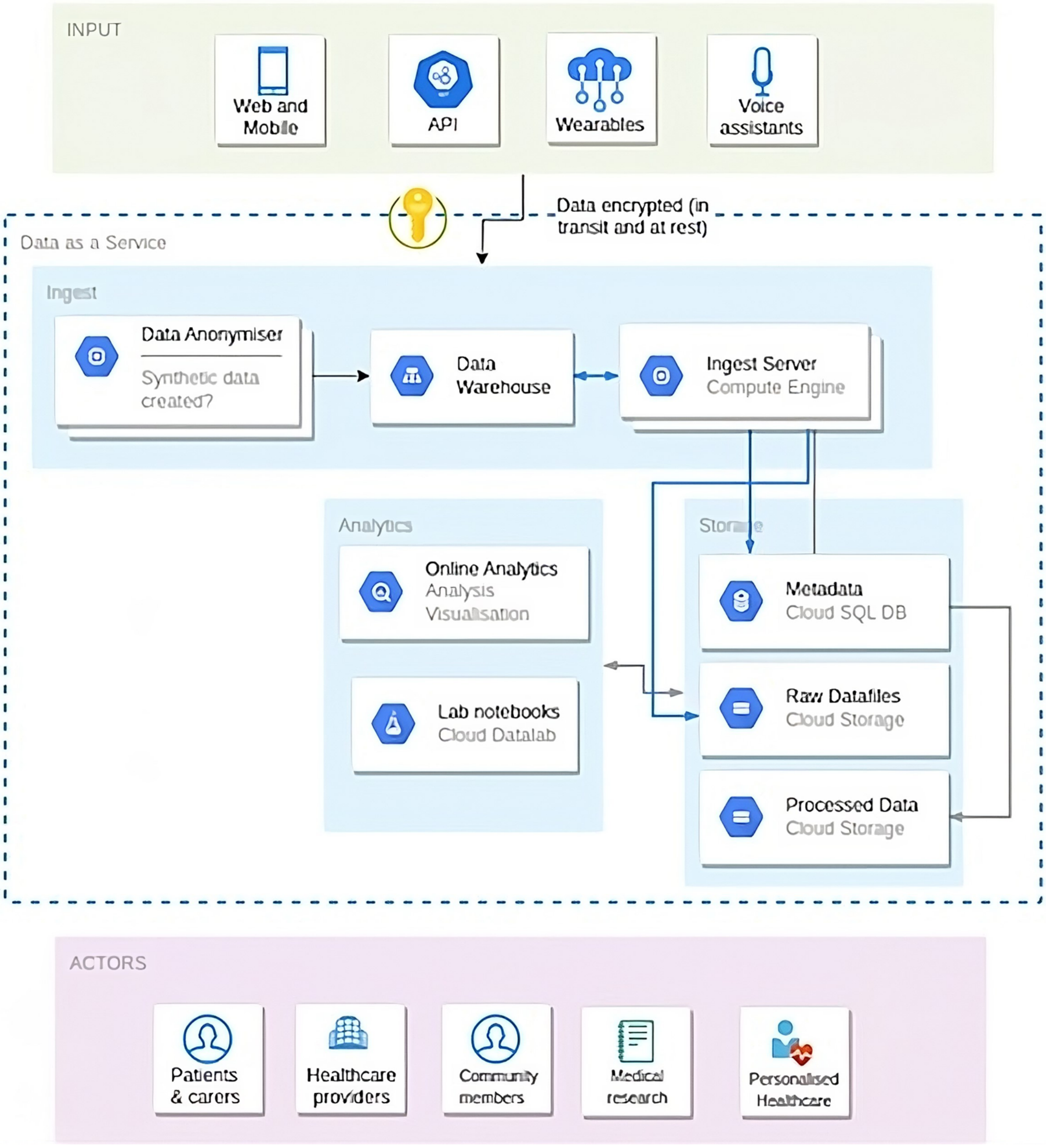

FIGURE 1
Blueprint of information architecture and a data sharing model for open patient data 161 ecosystems.

addition to physical, psychosocial, and spiritual elements, the role of digital technologies is emphasised. Each scenario is complemented with an AI-generated picture of the interested patient, thus amplifying the impact of the narration. The five scenarios are based on the following illnesses: Parkinson's disease, diabetes, knee pain, post-traumatic stress disorder, and neuropathic scar pain following a caesarean section.

8. Conclusions

The successful management of the COVID-19 pandemic based on an open data approach and community engagement paved the way for new avenues in tackling chronic pain and other equally important silent pandemics.

In this perspective paper, we propose an innovative approach for the prevention and management of chronic pain through the adoption of community-driven solutions based on open data. Chronic pain is a complicated and idiosyncratic phenomenon, which is very often de-contextualised from the everyday living experiences of patients and caregivers. Chronic pain is an area where a standardised biomedical approach based on drug administration is very often predominant. Such pain is frequently associated with a lack of control, uncertainty, ineffective treatment, high cost, and a lower quality of life. Open data generated by users, caregivers, healthcare professionals, and digital infrastructure might provide insights on how to effectively reshape healthcare practices on the basis of the daily habits and the real needs and expectations of patients and caregivers and also provide real-time critical mass data for performing more accurate research in the field.

This information might also be used as a form of online support and to provide instant feedback, on the effectiveness of screening and rehabilitation programs, patients' medication compliance, average treatment duration, and behavioural trends.

Including users as active producers of data would help provide community-enabled solutions in tackling chronic pain, which would, in turn, empower them as co-creators of healthcare plans and services.

Today, modern technology makes possible the exploration of innovative solutions based on home monitoring and open data analysis.

In the five attached real-life scenarios, we depict situations where digital infrastructures may be used in cases of patients with chronic pain for sharing clinical information in an accurate and transparent way (41).

Further research is recommended in this area, which should aim at creating bottom-up solutions (i.e., ubiquitous communities—healthcare authorities) that would ideally include the issues of interoperability, data privacy, and digital divide (42, 43).

Data availability statement

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

Author contributions

FM was involved in conceptualisation of the article, writing the original draft, and project administration. EG was involved in conceptualisation, writing the original draft, and reviewing and editing the article. KC was involved in conceptualisation, writing the original draft, and visualisation. AB was involved in conceptualisation, writing the original draft, reviewing and editing, and supervision. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

Publisher's note

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Appendix 1

Scenarios

Scenario 1: Parkinson's disease

Graham is 73; he was diagnosed with Parkinson's disease 2 years ago. John has also a history with silicosis because of his long-term job as a miner, which caused permanent inflammation and fibrosis. Graham can hardly walk now because of an accident that happened many years ago in a mine and needs a walking frame to move from one room to the other.

Graham lives with his son Adam, who is divorced with two daughters aged 10 and 15. Graham's condition has made them very active caregivers. Adam is an IT professional and he has set up an IoT (i.e., Alexa) system at home in order to stay in contact with his father and check what he does during the day when he is alone at home.

Therefore, Graham can be tracked, thanks to a Radio Frequency Identification (RFID) wristwatch allowing Adam to discuss with the personnel at the hospital Graham's mobility and whether his father is performing the daily physical cardio and chest exercises prescribed to improve his psychological condition and wellbeing. RFID has proved to be a very important means of clarifying the levels of Graham's sedentariness and helping to reduce the risk of depression. His family has already explored other means to increase his mobility, such as having a personal trainer or a nurse at home, but Graham likes to spend time alone with his hobbies and gets nervous when obliged to attend an exercise plan under the supervision of others. He likes to spend his time with his granddaughters, but this is not always possible because of their schooling and social endeavours.

Scenario 2: diabetes

Susan is 56 and suffers from diabetes. Her situation is getting more complicated now because of a foot ulcer that is causing chronic pain. She lives on her own as her husband left her 3 years ago when he fell out with the general practitioner supporting Susan. Apparently, he believed in holistic methods of treatment, and he felt that he could not handle the traditional biomedical approaches that Susan chose to follow for her condition.

Susan is a blogger publishing about type 2 diabetes and does a great job in providing information to, and networking for, the patient community about this disease condition. She keeps herself updated with evidence-based research and likes to disseminate knowledge only after she cross-references scientific studies during her meetings with the physician and the manager of the program that she follows. She posts on her blog every week and many people interact with her online.

Online discussions have supported other patients and helped improve their type 2 diabetes condition. Susan has been repeatedly asked for advice by other patients on ways to handle pain, but she feels reluctant to share suggestions on this topic as she is not an expert. Once every year, she organises a meeting for patients in her area to which physicians and nurses are invited. This helps her to gain a lot of attention on social media, and this event is growing in popularity year after year. Thanks to a funded therapeutic protocol, she is participating in a program for monitoring her diabetes, which runs by using experimental sensors for continuous glucose monitoring. Susan has made arrangements for the results of that therapeutic protocol to be disseminated through her blog as well.

Scenario 3: knee pain

Linda is 41 and has been visually impaired since birth. Unfortunately, she suffers from chronic knee pain and several injuries because of a history of falls and accidents. Linda lives with her family, which comprises her husband and two daughters who are 13 and 8 years of age. She loves to go to the Opera, and to satiate this desire, a charity association has agreed to take her by car to the local theatre, while her husband takes care of their daughters.

Linda's health is also challenged by obesity because of an uncontrolled appetite for food, which leads to stomach pain after recurrent binge episodes when she is alone at home listening to audiobooks and operas and eating without control. Linda is enrolled in a special program that involves the following different topics:

(a) She is learning to instruct a tablet equipped with a software specifically designed to help her coping with her visual impairment.
(b) She meets with a self-help group weekly online, discussing ways to deal with her eating disorder.
(c) She gets at-home support from a physiotherapist, who treats her knee arthritis with low-impact exercises to maintain the joints and strengthen her muscles.

Linda wears a sensor that is able to monitor her walking (counting the number of steps, sedentariness, etc.), and it transmits data to the rehabilitation centre, where statistical data about her fitness and physiotherapy programme are stored.

Scenario 4: mental health (PTSD)

Fedir is a 23-year-old Ukrainian suffering from post-traumatic stress disorder (PTSD). His mental health issues started after he was wounded in a conflict as a soldier in the battle of Donbas. He is now following a rehabilitation program, trying to get support for his brain injuries.

He wears a heart monitor as well as a neurofeedback device. However, sometimes Fedir believes that his rehabilitation program is not assisting him at all, and he frequently fears for the safety of his online data. Therein lies his problem. Because of these fears, he removes his sensors, thus ceasing the monitoring process.

Fedir is now following an additional program through weekly meetings with a mental health counsellor, who tries to convince him about the need to not remove his sensors. This is crucial, as data from sensors are transmitted to a centre that runs a research protocol on PTSD involving patients from countries around Europe, and this centre is harvesting data that aim to confirm the most beneficial treatment for this difficult mental condition.

Scenario 5: neuropathic scar pain following Caesarean section

For more than 3 months, Liz, a 39-year-old, has been suffering from neuropathic scar pain following Caesarean section. She lives with her family in the countryside, 45 km away from the nearest town. She has two children, while her husband is a salesman who spends most of his time travelling for work, returning home only on weekends. Unfortunately, Liz cannot count on any other relatives or friends to support her during her daily chores, and she often feels overwhelmed because of her pain. Whenever she experiences a pain flare, Liz gets anxious and she feels that she cannot provide proper care to her children.

Liz's physician lives in the town, but she finds it difficult to talk to the members of the clinic because of the long waiting times whenever she calls the clinic for support. She has been advised to take medication (paracetamol) when her pain gets intense and to book a medical appointment over the phone. The next available slot for a medical consultation is in 3 months' time, and Liz has been exploring a better strategy to manage her pain by looking for available online support, but with limited success. A doctor in the hospital heard about Liz and organised an online medical consultation with her, which went successfully, and this has been repeated once every month since then. He also suggested that Liz start online sessions with mental health experts in her local area to get support for her mental health as well.

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Perspective on salutogenic approaches to persistent pain with a focus on mindfulness interventions

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In this article, we provide a unique perspective on the use of mindfulness interventions in a whole health framework embedded within the theory of salutogenesis and the concept of painogenic environments. We argue that mindfulness is a valuable tool to bridge exploration of inner experiences of bodily pain with socio-ecological influences on thoughts and emotions. We outline research from neuroimaging studies that mindfulness techniques mediate neural processing and neuroplastic changes that alleviate pain and related symptoms. We also review evidence examining behavioural changes associated with mindfulness meditation providing evidence that it promotes self-regulatory activity, including the regulation and control of emotion and catalysation of health behaviour changes; both of which are important in chronic illness. Our viewpoint is that mindfulness could be a core element of salutogenic approaches to promote health and well-being for people living with pain because it rebuilds a fractured sense of cohesion. Mindfulness empowers people in pain to embrace their existence; shifting the focus away from pain and giving their lives meaning. We propose that integrating mindfulness into activities of daily living and individual or community-based activities will promote living well in the modern world, with or without pain; thus, promoting individual potential for fulfilment. Future research should consider the effects of mindfulness on people with pain in real-life settings, considering social, environmental, and economic factors using a broader set of outcomes, including self-efficacy, sense of coherence and quality of life.

KEYWORDS

mindfulness and chronic pain, salutogenesis and persistent pain, painogenicity, mindful approaches to pain, whole health, ecology of wholeness

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Introduction

Painogenicity, described as the tendency of socio-ecological environments to promote persistent pain (1), and salutogenesis, a concept that considers the origins of health as opposed to the origins of disease, have proved useful ways of exploring a healthy settings approach to the challenge of persistent pain in society (2–5). Salutogenesis is premised on the concept of a sense of coherence—the way people make sense of the interaction of their body in the world—and is fundamental to understand why some people develop persistent pain whilst others do not (6, 7). Sense of coherence operates at individual, group (family), organization and societal levels and includes *meaningfulness* of one's life, *comprehensibility* of stimuli arising from the internal and external environments, and *manageability* of these stimuli using resources at a person's disposal, such as health care services and treatments, social networks and peer support, and self-coping strategies to promote mental and physical well-being (8).

Mindfulness involves paying non-judgemental attention to experiences inside and outside of "oneself" on a moment-by-moment basis to aid reconnection of sensations, thoughts and feelings with the outside world in a positive way (9). Our viewpoint proposed here is that mindfulness is a valuable tool to bridge exploration of inner experiences of bodily pain with socio-ecological influences on thoughts and emotions. In this article, we discuss mindfulness interventions within the framework of the theory of salutogenesis and the concept of painogenic environments.

Shortcomings of the biopsychosocial model

The biomedical model, which associates pain with potential or actual tissue damage, has, at least in part, fostered a reductionist and materialist approach to alleviating pain by analysing and diagnosing the status of tissue, rather than synthesising factors affecting a whole-person's lived experience of pain in the complex socio-ecological milieu of the modern era (10–12). In recent decades, the shift towards a broader biopsychosocial model of pain has acknowledged the importance of psychosocial risk factors—employment conditions and socioeconomic status as two examples—which potentially promote pain and hinder recovery resulting in pain management strategies utilising multimodal interventions and multidisciplinary teams. Often, biopsychosocial interventions are delivered as discrete entities targeting specific elements of a person's psychophysiology in a disconnected manner (e.g., surgery, medication, exercise, diet therapy, cognitive behavioural therapy (CBT), acceptance and commitment therapy (ACT), etc.) Thus, some people experience fragmented care to the detriment of their health and well-being. Moreover, there is a treatment-prevalence paradox in which an ever-increasing variety of interventions have not reduced the burden of persistent pain. Calls to shift emphasis towards holistic models of pain supported by integrated health care service delivery are growing (13, 14).

The whole health model

Gaudet advocates a cultural transformation of *the purpose* of healthcare, and other systems impacting on health and well-being, underpinned by the concept of "whole person health" (15). Gaudet argues for a change in the focus of health care by discovering what gives people a sense of meaning and purpose in their lives and building systems that support this. Advocates of Whole Health view a person's life as a journey of "push and pull" within a continuum of health and disease. Thus, Whole Health focuses on factors that create health not just factors that prevent disease.

The concept of wholeness has been discussed by academics for decades; mostly emanating from the "Whole Person Medicine" movement during the 1970's which had its roots in complementary and alternative medicine (CAM) (16). Viewpoints from different CAM protagonists have recently been discussed (17), providing a summary of current thinking from academics endorsing a variety of approaches. Interestingly, it is acknowledged that this model is still falling short of providing effective, integrated care, even after decades of research because "*… in order to successfully transform the existing biomedical model, the Whole Health model must demonstrate validated research outcomes …*" (17) (p. 3). This, according to Langevin, needs to be achieved by moving away from the reductionist approach to biomedical research (18) and there is still much debate on how this can be achieved.

In 2020, Agarwal published a postmodernist, social constructionist treatise on an "ecology of wholeness" which describes the relationship between the biomedical understanding of the body in pain and its relationship with a person's awareness of themselves and their interaction with micro and macro level aspects of material existence with the natural world (19). Agarwal's ecological model of wholeness comprises The Self (i.e., reflexive and embodied) and The Body [i.e., material and discursive (conversational)], in relationship with The Context (i.e., time, change, Illness intrusion, traditional health system, food, nature, body/self-integration) (19). Agarwal's model emphasises the need to consider not only the person within a diagnostic framework, but also the wider ecological (salutogenic) setting (19, 20). Within this framework, patient involvement, education and empowerment are central tenets.

We advocate reconfiguring the health care mindset away from a reductionist and materialist viewpoint towards a whole-person (societal) health lens that focuses on factors that support and empower people to create their own health and wellbeing, i.e., salutogenesis (2, 5).

Pain and salutogenesis

In 1979, Antonovsky introduced the term "salutogenesis", meaning, "the origins of health" (21). It considers the origins of health as opposed to the origins of disease (22). The key to understanding persistent pain within a salutogenic framework is to consider how people can develop meaning from their suffering and translate pain into something positive and meaningful for them through their internal sense of coherence, either as an individual or as part of a group (7). Salutogenesis is influenced by surroundings, socio-economic and environmental factors that can promote or hinder recovery from pain. Its premise is that people can be healthy despite pain. Environments which promote the persistence, severity, or impact of pain, including hindering recovery from pain, have been described as "painogenic" (1). The relationships between the salutogenic framework and Agarwal's "ecology of wholeness" in a context of persistent pain and whole health are illustrated in **Figure 1**.

Painogenicity

The term "painogencity" was introduced to reflect parallels between persistent pain and Boyd Swinburn's concept of

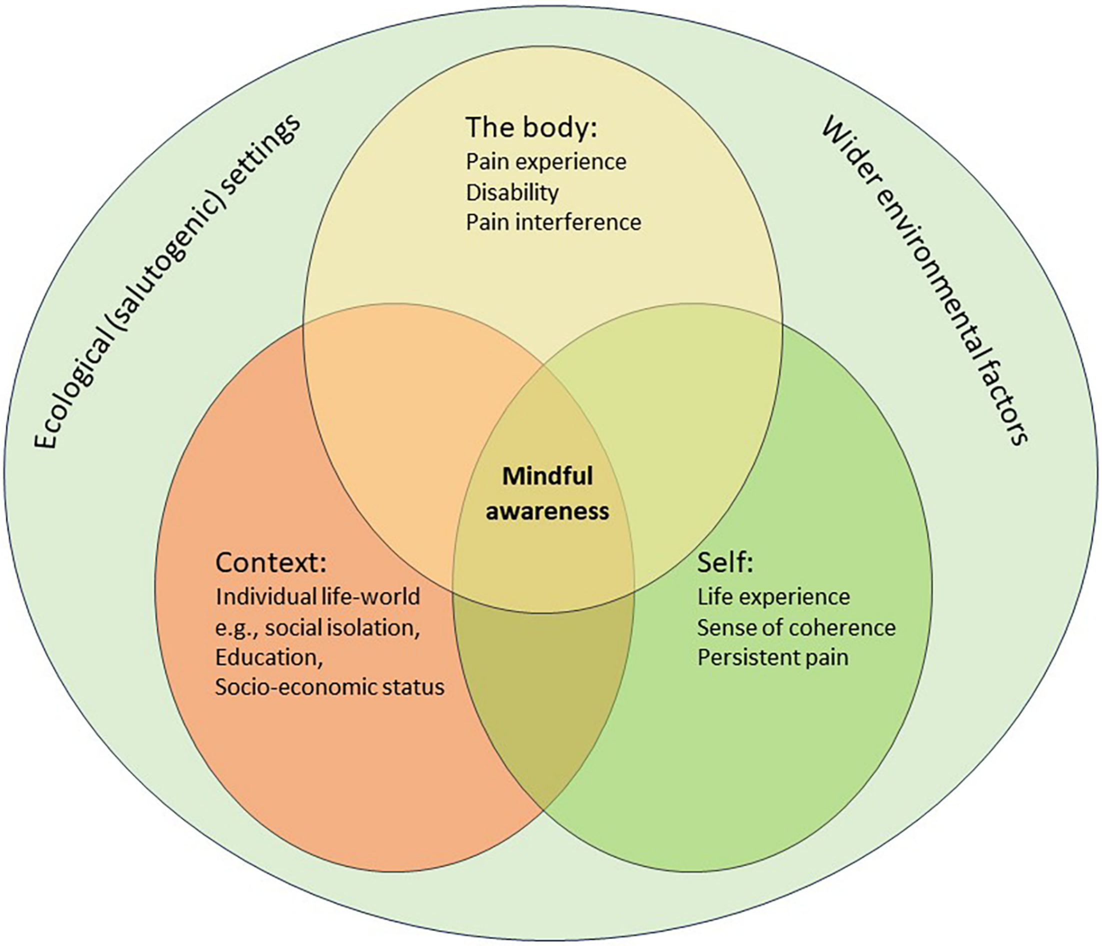

FIGURE 1
A whole-health model of mindful awareness within a salutogenic framework for individuals with persistent pain (19).

obesogenicity (1). Swinburn defined obesogenicity as the sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in people or populations (23). It moved away from an individualistic understanding that obesity was "caused" through individual choice or action towards a wider recognition that social, environmental, and commercial conditions may promote conditions that made obesity more likely. Johnson (1) appraised persistent pain from an evolutionary mismatch-perspective and argued that, like obesity, socio-ecological conditions may promote the persistence of pain i.e., that aspects of modern-day living were painogenic. Thus, painogencity was defined as the tendency of socio-ecological environments (or "settings") to promote persistent pain.

Settings-based approaches and health promotion

Rather than focusing on the manifestation of a behaviour or condition (i.e., pain), academic debate on alternative ways to approach the problem of persistent pain, using interventions embedded within the theory of salutogenesis and a settings approach to health and wellbeing has become more accepted in the discourse (7, 24, 25). It is grounded in the World Health Organisation's (WHO) Ottawa Charter, which prioritised empowering people and communities to increase control over, and to improve, their own health by providing the conditions and resources to do this (26).

Settings-based approaches to health are "upstream" and maximize disease prevention and its impact on health (e.g., pain) by attending to the settings where people actively use and shape their environment and create or solve problems relating to their health. Settings comprise physical boundaries and organisational structures. They include homes, workplaces, schools, villages, towns, cities, hospitals, prisons etc. The goal of a settings-based approach is to maximise health promotion and disease prevention through a "whole system" model of public health via community participation, partnership, empowerment and equity (26, 27). Empowering people to understand and make sense of their lives by increasing their sense of coherence has been shown to decrease the risk of non-communicable diseases for which there are currently programmes acting solely on "downstream" risk factors (e.g., hypercholesterolaemia, hypertension and type 2 diabetes) (28).

Campaigns to enable people to explore their emotional relationship with pain and to offer strategies to foster living better lives with their pain have arisen; e.g., *Live Well with Pain* (https://livewellwithpain.co.uk/), *Pain Café* (https://pain.cafe/), *Flippin' Pain* (https://www.flippinpain.co.uk/), *Pain revolution* (https://www.painrevolution.org/), and others. These strategies include, amongst other things, mind-body techniques that increase a person's sense of coherence, such as mindfulness meditation, yoga, tai chi, relaxation techniques and hypnosis. Of these techniques, mindfulness has risen in popularity since the end of the 20th century with healthcare providers (29). Integrating mindfulness practice into activities of daily living can improve a person's sense of coherence.

Mindfulness

Context

The historical roots of mindfulness date back to the 5th century BC. Mindfulness has been defined as: "…*the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment*" (30). Mindfulness involves people being aware of their situation, without being reactive, judgemental, or overwhelmed by what is happening to them or around them. Mindfulness interventions in various guises have been used to prevent or alleviate maladaptive perceptions of pain, such as catastrophising and associated psychological manifestations such as anxiety and depression (31).

The principles of mindfulness can be readily incorporated into creative activities (e.g., music, drawing, writing, painting, clay making, dance), daily activities (e.g., shopping, washing dishes, gardening, walking) and sport, recreation and exercise activities (e.g., swimming, fishing and yoga), both individually and as a group. The optimal state of mindfulness is of "relaxed alertness", which is associated with better mental health (32). Interestingly, it is likely that people who are able to withstand extreme physical discomfort, such as ultra-endurance athletes (33) or those engaging in extreme sports (34) are able to enter some sort of mindful, or self-hypnotic state to divert their attention away from the physical (and psychological) pain.

Beneficial effects of mindfulness

Comprehensive reviews of evidence suggest that mindfulness alters processing of multiple brain regions leading to a variety of beneficial effects for people with persistent pain (35–37). Briefly, mindfulness practices involving focussed attention (e.g., slow, rhythmic breathing or body scanning techniques), promote calmness and relaxation that increase parasympathetic activity (vagal tone) which ameliorates the hypothalamic-pituitary-adrenal (HPA) axis response to stressors such as pain. This improves physiological status including blood pressure, respiration, heart rate reactivity, fatigue and pain and other bodily sensations (38–41). Mindfulness decouples thalamus–precuneus and ventromedial prefrontal deactivation, effectively inhibiting onward transmission of nociceptive input (42). Mindfulness improves emotional and cognitive well-being in people with persistent pain mediated in part by functional alterations in the insula, amygdala, and hippocampus (35–38, 42–50). Neuroplastic changes occur in the insula associated with interoception and a reduction in negative emotional responses to unpleasant sensations such as pain (40, 51). For some people, patterns of neural activity experienced during mindfulness practise can be replicated at will (52). Thus, better acceptance of painful or unpleasant sensations are achieved through modulation of negative appraisals of interoceptive stimuli and by promoting coping strategies (40, 53, 54).

A review of evidence examining behaviour changes associated with mindfulness meditation provided evidence that the intervention promotes self-regulatory activity, including the regulation and control of emotion and catalysation of health behaviour changes; both of which are important in chronic illness (55). Other behavioural changes such as self-compassion are also thought to occur; encouraging behaviours associated with self-compassion and a reduction in overidentification with painful experiences (56). A meta-analysis also showed beneficial effects on negative self-related rumination, suggesting that it might reduce repetitive focus on symptoms (57).

Clinical research evidence for beneficial effects of mindfulness interventions for people with persistent pain is growing, but based on small, under-powered studies which show statistical significance but fail to demonstrate favourable effect sizes (35, 58, 59).

A systematic review published in 2016 indicated that mindfulness produced small improvements in pain symptoms based on a meta-analysis of 24 RCTs of low quality (60). systematic review of 30 RCTs published in 2017 found that mindfulness produced small improvements in the severity of persistent (chronic) pain compared with various control groups (61), yet a systematic review of 13 RCTs published in the same year found that mindfulness did not improve the severity of persistent pain but did improve psychological aspects of pain, such as depression (62). The methodological quality of RCTs included in both reviews was judged to be low. In 2021, Pei et al., conducted a systematic review of eight RCTs that did not find any statistically significant differences between mindfulness and control groups on the severity of persistent pain, although there were improvements in mindfulness and depression in the short-term (63). Pei et al., suggested a need for evaluations of dose–response to optimise mindfulness technique. We suggest that these systematic review findings are promising and might provide impetus for further research.

Since the COVID-19 pandemic, online and smartphone self-help interventions for pain, including mindfulness techniques have become popular (64), but research findings on the efficacy and effectiveness of these self-help interventions are inconclusive (65). However, these applications potentially represent a cost-effective way of implementing mindfulness interventions.

Reviews and evidence syntheses of mindfulness studies for persistent pain conditions using qualitative methodologies were not found but several small individual studies of varying methodological quality reveal several recurring themes following mindfulness-based interventions. A small analysis of four groups of older adults with persistent low back pain, following an eight-week mindfulness programme revealed benefits such as overcoming fear of pain, a reduction in negative emotions and a reduction in focus on the pain (66). Another demonstrated an improvement in pain-related strategies following group mindfulness and problem-solving (67), and a feasibility study found patients more empowered to look after themselves, and were more self-aware and in the moment following an eight-week Mindfulness-Based Stress Reduction (MBSR) programme (68).

A simplified diagrammatic illustration of the overlap between the key elements of mindfulness meditation in the context of persistent pain is shown in **Figure 2**.

Adverse effects of mindfulness meditation

As with any intervention, an awareness of possible adverse effects is essential but frequently overlooked. The British Psychological Society guidelines on mindfulness-based approaches warns that these interventions should not be expected to confer benefit on everyone (69), although the prevalence of adverse events is thought to be no more likely than it is using other psychotherapeutic techniques (70).

Inducing body-awareness and introspection through mindfulness can vary within and between people and may produce detrimental effects such as autonomic hyperarousal, perceptual disturbances, flashbacks, and even psychosis in those with particularly disturbing past experiences, e.g., childhood trauma or abuse (71, 72). A systematic review by Farias et al. (70), found that adverse events in meditation-based practices included psychosis, delusional events, fear and traumatic flashbacks and a population based survey of 434 people in the US suggested that approximately one third of people had experienced a meditation-related adverse effect such as re-experiencing of trauma, anxiety, emotional sensitivity and functional impairments (73). Surprisingly, approximately 80% of those experiencing adverse effects reported they were still "glad" to have meditated.

It is clear that a "one size fits all" approach to mindfulness meditation carries risks, particularly to people who already suffer from psychiatric illnesses or those who have had previous negative life-experiences (71). The British Psychological Society

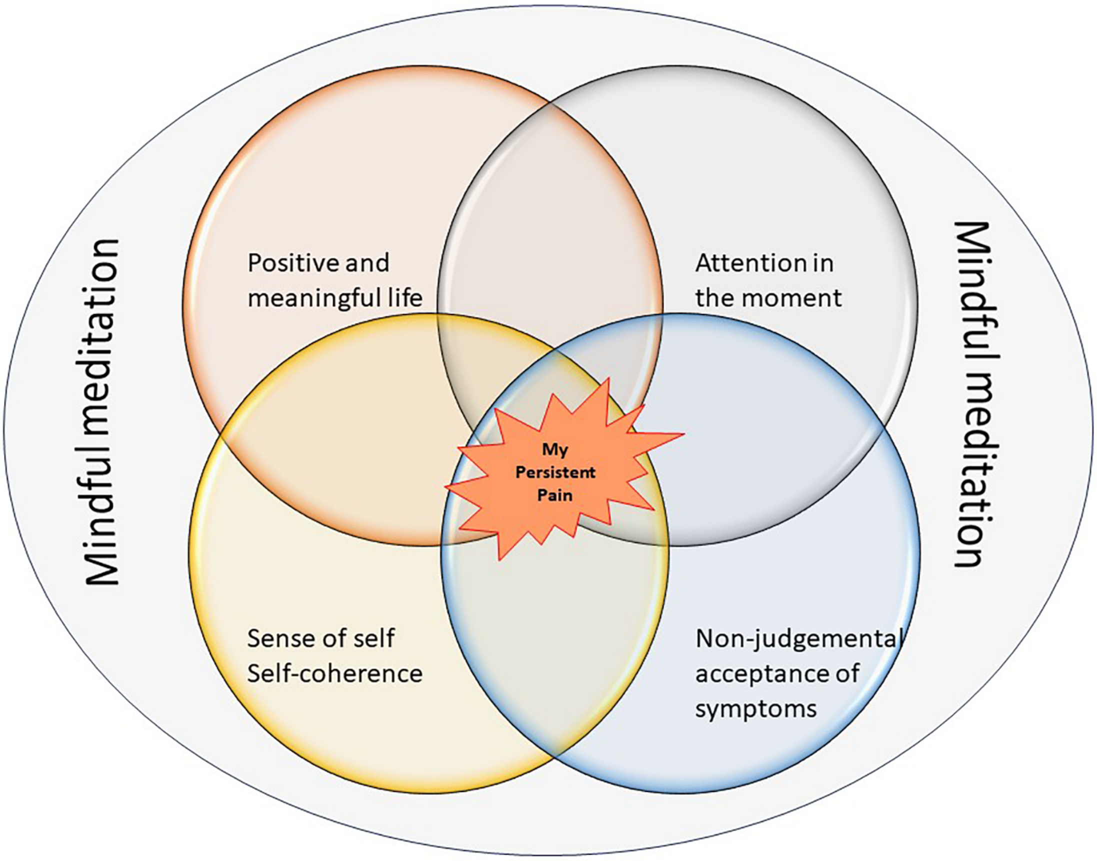

FIGURE 2
Outcomes of mindfulness interventions for persistent pain.

refers to guidance for monitoring and reporting of harm or side-effects in patients with psychosis (74), and this might also be applicable to people with persistent pain, with or without mental illness.

Discussion

Mindfulness to promote the "healing journey"

A salutogenic view of the benefits of mindfulness to promote living well with persistent pain could encompass an ecology of wholeness and the context of a person's "healing journey" (19, 75). Toye et al., (76) conducted a meta-ethnography that synthesized the findings of 195 qualitative studies exploring the experience of people living with persistent, non-malignant musculoskeletal pain that identified key elements of a health intervention to assist people on their "healing journey":

1. Validating pain through meaningful and acceptable explanations.
2. Validating patients by listening to and valuing their stories.
3. Encouraging patients to connect with a meaningful sense of self, to be kind to themselves, and to explore new possibilities for the future.
4. Facilitating safe reconnection with the social world.

Toye et al. concluded that people in pain should be encouraged to move forward *alongside* their pain, rather than focusing on expectations of a cure; a model in which self-value, acceptance and recognition are central. Mindfulness is already being embedded in a variety of biopsychosocial interventions used to alleviate pain, thus promoting re-connection with a meaningful sense of self. This would enable people to explore new possibilities for the future.

Mindfulness within a whole health delivery system

We advocate placing mindfulness at the core of interventions to aid recovery by improving a sense of coherence and empowering people to embrace their existence as a whole, giving their lives meaning and potential for fulfilment. In health care, mindfulness is seen as a psychological tool to aid self-management and is disconnected from many biomedical approaches (e.g., surgery and medication). Mindfulness is often at the core of community support activities e.g., yoga, that are rarely integrated with standard health care service delivery. Mindfulness has potential to develop health and well-being across core theoretical components underpinning interventions to promote the health of individuals, communities and nature (i.e., Whole Health perspective), such as those described by Kemp and Fisher (77); balanced mind, healthy body, connecting with people, connecting with nature, socio-structural factors, and sustaining behaviour change. Thus, we believe that encouraging mindfulness as an integrated lifestyle practice offers opportunities for people to use these techniques as adjuncts for many biopsychosocial interventions. Mindfulness skills could be developed through social prescribing of community-based support services for healthy living, and this could confer benefits in all aspects of life from activities of daily living to life enriching activities such as gardening, arts and crafts, walking, swimming, etc. Locating mindfulness as a lifestyle practice sits more comfortably within a whole-systems approach where people move forward in their journey towards better health through validation, acceptance, empowerment and, ultimately, fulfilment.

Future research

Presently, there is tentative, low quality evidence that mindfulness is beneficial for pain (78). Recently, Moore et al., (79) have raised serious concern about methodological shortcomings of RCTs in the broader field of pain research resulting in low confidence in evidence for many analgesic treatments. The Medical Research Council's guidance suggests that attention be given to how interventions are used in the real world (i.e., their utility) including mediating factors, implementability, acceptability, feasibility of delivery and cost-effectiveness (80, 81). Thus, research evaluating baseline level of mindfulness skills, optimal "dose" and moderating influences of environmental factors may prove informative (31, 82). Attention also needs to be given to how best to capture holistic outcomes within the ecology of wholeness model without fragmenting this "wholeness" into a collection of discrete outcomes that are viewed as disconnected entities.

Conclusion

Pain, especially when persistent, catalyses a loss of identity, a diminished sense of self, retreat from the world outside of the painful body and alienation and detachment from a meaningful life (83). Bullington (83) argues that rehabilitation must open up new possibilities of a life beyond or alongside pain through an enhanced sense of self.

By developing skills to attend, on a moment-to-moment basis, to happenings inside and outside of oneself mindfulness can rebuild a sense of cohesion and "wholeness". In doing so, mindfulness can be used to instil a positive, proactive, approach to promote health through learning of a new sense of self and shifting focus away from the dominant biomedical narrative of deficit and opening new opportunities for a fulfilling life beyond, or alongside pain.

Our viewpoint is that mindfulness could be a core element of salutogenic approaches to promote health and well-being for people living with pain because mindfulness rebuilds the sense of cohesion fractured when pain threatens the future self. Mindfulness underpins an "ecology of wholeness" and could be a strategy used by people to mitigate the detrimental consequences of painogenicity. Greater credence should be given to the findings of research investigating the effects of mindfulness on people with pain in real-life settings that considers the influence of social, environmental, and economic factors using a broader set of outcomes including self-efficacy, sense of coherence and quality of life. This will shift the focus of evidence-gathering and expectations of rehabilitation from efficacy and pain to utility and outcomes associated with valuable and fulfilling lives.

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

CP and MJ contributed to conception of the article. CP wrote the first draft of the manuscript. CP and MJ wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version. All authors contributed to the article and approved the submitted version.

Conflict of interest

In the previous 5 years, MJ has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

The remaining author declares 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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Perspectives on the insidious nature of pain metaphor: we literally need to change our metaphors

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Metaphorical language is used to convey one thing as representative or symbolic of something else. Metaphor is used in figurative language but is much more than a means of delivering “poetic imagination”. A metaphor is a conceptual tool for categorising, organizing, thinking about, and ultimately shaping reality. Thus, metaphor underpins the way humans think. Our viewpoint is that metaphorical thought and communication contribute to “painogenicity”, the tendency of socio-ecological environments (settings) to promote the persistence of pain. In this perspectives article, we explore the insidious nature of metaphor used in pain language and conceptual models of pain. We explain how metaphor shapes mental organisation to govern the way humans perceive, navigate and gain insight into the nature of the world, i.e., creating experience. We explain how people use metaphors to “project” their private sensations, feelings, and thoughts onto objects and events in the external world. This helps people to understand their pain and promotes sharing of pain experience with others, including health care professionals. We explore the insidious nature of “warmongering” and damage-based metaphors in daily parlance and demonstrate how this is detrimental to health and wellbeing. We explore how metaphors shape the development and communication of complex, abstract ideas, theories, and models and how scientific understanding of pain is metaphorical in nature. We argue that overly simplistic neuro-mechanistic metaphors of pain contribute to fallacies and misnomers and an unhealthy focus on biomedical research, in the hope of developing medical interventions that “prevent pain transmission [sic]”. We advocate reconfiguring pain language towards constructive metaphors that foster a salutogenic view of pain, focusing on health and well-being. We advocate reconfiguring metaphors to align with contemporary pain science, to encourage acceptance of non-medicalised strategies to aid health and well-being. We explore the role of enactive metaphors to facilitate reconfiguration. We conclude that being cognisant of the pervasive nature of metaphors will assist progress toward a more coherent conceptual understanding of pain and the use of healthier pain language. We hope our article catalyses debate and reflection.

KEYWORDS
pain, metaphor, linguistic relativity, pain language, enactive metaphor, lived experience, salutogenesis, painogenicity

Introduction

> "Disciplines progress according to the strength of their metaphors, and those metaphors are fated to become so familiar that they transform into illusions, if even thought of at all." (1) p.3

Most people understand metaphors according to classical theories of language, as expressions used for figurative embellishment of objective and literal modes of representation. In 1980, Lakoff and Johnson argued that metaphors were more than a literary characteristic of language delivering "poetic imagination and rhetoric flourish". They claimed metaphors underpinned the way humans *think*; thus, common concepts encoding knowledge were built using metaphoric structure (2). Nowadays, metaphor is considered a basic tool of cognition to comprehend abstract concepts and perform abstract reasoning. In other words, metaphor is fundamental to the way humans frame sociocultural knowledge and structure conceptual systems (3). The Sapir–Whorf hypothesis of linguistic relativity (linguistic determinism) proposes that the structure of a person's native language and culture shapes how they construct their living experience (3, 4, 5, 6, 7, 8). Thus, a person's language and cultural narrative are likely to influence whether a person's living experience of pain is associated with health, illness, suffering, and whether there is potential for recovery and/or living well with pain.

Our viewpoint is that metaphorical language and metaphorical thought contributes to "painogenicity", the tendency of socio-ecological environments (settings) to promote the persistence of pain (9). Painogenicity reflects the sum of influences that the surroundings, opportunities or conditions of life have on the persistence, severity, and impact of pain, on individuals, groups, and communities (9, 10). Painogenicity, acknowledges micro, meso and macro level influences, especially modern-day social, environmental, and commercial conditions, that make pain "sticky" (11). Previously, we have argued that a salutogenic healthy settings approach may ameliorate painogenicity and reduce the burden of persistent pain on society (12). Salutogenesis (Latin "salus" meaning health; Greek "genesis" meaning origin) is defined as the study of factors that support health as opposed to factors causing disease (13). Salutogenesis explores how people cope with stressors in daily life to remain physically and emotionally healthy (14). Central to salutogenesis is the concept of "sense of coherence", a dispositional orientation allowing a person to be resilient to life-stressors to maintain and improve health and well-being, consisting of comprehension, manageability and meaningfulness of their experiences (e.g., pain) (15, 16). Pivotal to salutogenesis are generalized resistance resources to cope effectively with situations (e.g., money, knowledge, coping strategies, social network). Thus, salutogenic approaches focus on building systems that support a person's sense of purpose and meaning in their life. Salutogenesis is underpinned by "whole person health" (17) arising from the "Whole Person Medicine" movement in the 1970's (18). Oliveira advocates a salutogenic approach to the education of individuals and society about pain, including positive aspects of suffering to improve a person's sense of coherence (19). Thus, constructive and positive pain narrative is the foundation of salutogenesis and whole person health.

The aim of this article is to explore the insidious nature of metaphor in pain language and conceptual (biomedical) models of pain and its persistence. We use the lens of linguistic relativity to reveal the insidious nature of pain language and argue a need to reconfigure metaphor to align with contemporary models of pain experience and salutogenic approaches to living well with and without pain. It is not our intention to undertake a comprehensive review but to challenge dogma and raise issues for scholarly debate. The foundation of our article is based on a free text search of PubMed ("[pain (all fields)] AND [metaphor (all fields)]", 04 October 2022, 207 items) and additional literature found therefrom. Our review is narrative and based on literature that we believed was relevant, contradictory, and contentious. We acknowledge that this approach is open to selection and evaluation biases and opinion-based arguments. Readers are encouraged to follow up references for comprehensive coverage of issues. Before discussing the insidious nature of pain metaphors, it is important to contextualise how metaphors shape human reality.

How metaphors shape human reality

What are metaphors?

People use various types of figurative language to express ideas, abstract concepts, inner experiences, and comparisons.

Aristotle defined metaphor as: "*giving something a name that belongs to something else; the transference ("epi-phora") being either from genus to species, or from species to genus, or from species to species, or on the grounds of analogy … metaphors are constituted on the basis of our ability to see the similarity in dissimilars*" (20) p.4 [citing Aristotle (21)].

The Oxford Dictionary defines a metaphor as "*a word or phrase used to describe somebody/something else, in a way that is different from its normal use, in order to show that the two things have the same qualities and to make the description more powerful, for example She has a heart of stone*" (*22*).

Thus, metaphors apply a word or phrase to an object or action to which it is not factually appropriate, to convey one thing as representative or symbolic of something else. For example, "pain is a knife stabbing my leg"—pain is *not actually* a knife; or "there is a gnawing pain in my bone"—pain is not actually gnawing the bone. In metaphor, the properties of one thing are integrated with the other, leaving the observer to interpret the relationship.

Linguistically, metaphors are distinct from other types of figurative language such as:

- Simile—comparing one thing with another thing using the words "like", "as", "so", or "than". Simile makes explicit the fact that the properties of one thing are alike to the properties of another thing (i.e., the two distinct entities are not the same) e.g. “my pain was like a rat, gnawing at my bone” or “my hand feels like it is a burning glove”.

- Metonymy—a word or name used to refer to a thing closely associated with another thing, e.g. referring to the quality of pain as “the gnawing continued”
- Hyperbole—exaggerated statements or claims not meant to be taken literally, e.g. “the pain is a million times worse than other pains I have had”
- Idioms—a group of words that has a different meaning than each word on its own, e.g. “a pain in the neck”—which refers to an irritating person, thing, or activity, rather than a neck that is actually painful.

In terms of utility, linguistic precision is of limited importance in conceptualisation and communication of pain, providing concepts remain correct. For the purposes of this article, we will use the word “metaphor” to encompass all types of figurative language that makes an implicit comparison of two things that are similar but not the same. Precise linguistic terminology will only be used when it affects the specific meaning of arguments, e.g., “Pain is like electric shocks shooting down my leg” will be described loosely as “metaphor” (metaphorical language) rather than its precise linguistic definition as a simile.

Metaphorical thinking

In 1980, Lakoff and Johnson reasoned that metaphors used in everyday conversation enable understanding and expression of abstract concepts, such as feelings or ideas, by the process of making sense of one type of thing in terms of another (2). Lackoff and Johnson stated:

> “Our concepts structure what we perceive, how we get around the world, and how we relate to other people. Our conceptual system thus plays a central role in defining our everyday realities. If we are right in suggesting that our conceptual system is largely metaphorical, then the way we think, what we experience, and what we do every day, is very much a matter of metaphor. But our conceptual system is not something we are normally aware of. In most of the things we do every day, we simply think and act more or less automatically along certain lines. Just what these lines are is by no means obvious. One way to find out is by looking at language. Since communication is based on the same conceptual system that we use in thinking and acting, language is an important source of evidence for what that system is like.” (2) p.3.

Thus, metaphors are a conceptual tool for categorising, organizing, thinking about, and ultimately shaping reality; this is known as the cognitive metaphor theory (3). Since 1980, scholarship on conceptual metaphor theory has developed within the larger disciplines of cognitive linguistics and cognitive psychology. Claims of conceptual ambiguities and challenges to the accuracy of empirical evidence means that cognitive metaphor theory has evolved over time, although the central concept remains irrefutable (23).

Importantly, Lakoff and Johnson demonstrated that metaphorical concepts are formed according to the configuration of a human body interacting with the external environment, i.e., as a 3-dimensional object in space acting consciously within the dimension of time. Consequently, conceptual thinking has developed according to the constraints of being human, i.e., a visually dominant, bipedal, upright, mobile human being living on the surface of a spherical planet under the force of gravity. Human concepts develop according to the human body schema and are characterised by front, back, top, bottom, middle (medial), side (lateral), left, right, inside, and outside, and in relation to moving forward, backwards, up, and down. It is unlikely that these concepts would develop in a sentient organism with a spherical body-schema existing in the gravity-free void of space (24). Consequently, the constraints of embodied human existence restricts and obscures human conceptual thinking.

Metaphor shapes who we are

Perceiving, acting and communicating in metaphorical language shapes mental organization and is realised through embodied neural circuitry that encodes signatures of conceptual domains, as described in the neural theory of metaphors [for review see (25)]. Metaphors are at the core of our lived experience, they govern the way we perceive, navigate and gain insight to the nature of the world, creating and describing new realities (26). Metaphor is a tool to project private experiences (sensations, feelings, and thoughts) onto externally located objects and events to understand one’s own inner bodily state and to communicate this private inner experience to others.

The process of creating coherently organised experience through metaphor involves the use of a source domain that is shared by others (e.g., an enemy) to understand a target (concept) domain (e.g., pain). Thus, the idea that “pain is an enemy” comprises a concept we are trying to understand (e.g., *pain*) and a concept from which we draw a metaphorical expression (e.g., *an enemy*). “Pain is an enemy” is considered a *primary* metaphor because it forms a “rudimentary theme” that spawns secondary metaphors such as “fighting pain”, “battling pain”, “surrendering to pain”, and “pain killers”.

The utility of pain metaphor

Metaphor to understand pain in oneself

Pain is a complex, sometimes formless, bodily experience not directly sharable to others. Humans describe formless sensations and feelings by “projecting” the experience to objects and events that have form in the external world. Thus, people borrow from the world of form and meaning to connect bodily symptoms to objects, enabling symptoms to gain a sense of structure, i.e., they apply a word or phrase to convey one thing as representative or symbolic of something else.

Using language to "project" inner states to entities and events in the external world helps people gain a sense of clarity and control of the meaning of their experience. A thematic analysis of interviews with 23 older adults by Clarke et al. (27) revealed that people use vivid stories, metaphors, and similes, rather than using isolated words, to personalise the meaning of their lived experience of chronic pain, e.g., "two bones rubbing together" or 'the sensation of "running cold water". Nortvedt and Engelsrud (28) found men used dramatic metaphors to describe the impact of phantom pain sensation on relationships with their self (body), others, and the world, e.g., "being invaded by insects" or "skin being scorched and stripped from the body".

In the book *The Language of Pain*, Biro describes metaphors as a powerful means of worldmaking, creating a descriptive language for the often silencing effect of pain (29).

> "In pain, we don't choose metaphor but are forced in that direction because there is no literal language; it's either metaphor or continued absence of speech." (29) p.73

Biro argues that metaphor is the only means available to represent the reality of pain experience.

> "Pain threatens to destroy our language and conceptual abilities, leaving a void. The only way to represent the experience and fill the void is through metaphor." (29) p.75

In this quote, Biro transforms pain into a "thing" that threatens to destroy. Thus, metaphors attempt to objectify the subjective. Bourke describes this as a metaphorical *concretisation of pain* that brings the nature of private experience into the "knowable, external world" of others.

> "Metaphors enable people to move a subject (in this case, pain) from inchoateness [not yet properly developed] to concreteness" (30) p.477.

The idea of pain as a "*concrete thing*" is contentious and exposes ongoing tension about the nature of pain and the use of literal and metaphorical language (31, 32, 33). Bourke contends that pain should be considered as a "kind of event" or "a way of being-in-the-world" (30, 34). To make sense of "unstable pain-events" people constitute and reconstitute their experiences of the body's behaviour during and after social and environmental interactions using metaphorical language. Thus,

> "… bodies are not simply receptacles of sensations, but are actively engaged in the linguistic processes and social interactions that constitute those sensations" (30). p.475.

Metaphors to share pain with others

Explaining the experience of pain is likened to making the invisible visible. Metaphorical expression uses a common understanding of words and non-verbal vocabularies e.g., visual art, music, and rhythmic movement, to communicate pain, and to elicit an empathetic response. Semino (35) summarised psycholinguistic and neuroscientific research that supports the premise that detail, creativity and textual complexity of pain metaphor can influence the nature and intensity of an embodied simulation of pain experience, a proxy of empathy, in listeners.

Metaphoric communication of pain enables the expression of disordered and indescribable inner thoughts and feelings providing emotional release and relief. Shinebourne and Smith (36) suggest that metaphors provide a "safe bridge" to communicate emotions too distressing to express literally. Metaphoric expression enables the repair of broken connections of the internal sense of self and with oneself, culture, and society. Sharing experiences creates a sense of "connective liberation". McFarland et al. (37), argue that living with pain is an "emotional time bomb" and that metaphoric thinking can help to deactivate and reframe inner emotions, and "off-load" the explosive and destructive inner experience of living with pain to oneself and to others.

Metaphor during clinical consultation

In health care settings, scaffolding for a person's sense-making of their bodily experience comes from a variety of sources such as the physical and social environment of the clinic, and the consultation with practitioners. During a consultation, patients describe their internal states using stories flooded with metaphors. Thus, metaphorical dialogue between patient and practitioner is the norm, although neither is fully aware that they are talking in metaphor (just as we have done here by instinctively using the term "flooded").

A thematic analysis of 18 interviews of pain practitioners by Munday et al. (38) revealed that metaphors were used as a communicative tool, a clue, an obstacle and as an adjunct in treatment. Practitioners reported most metaphors used by patients provided insight into the meaning attributed to pain, although some metaphors used by patients were unhelpful for patient recovery. Sometimes interpreting metaphorical meaning in patient narrative was challenging because patients were using metaphors that did not align with the clinician's biomedical paradigm.

Often, healthcare professionals default to structural biomechanistic metaphors when explaining pain, perhaps because it is an easier viewpoint from which to understand the body. However, biomechanistic metaphors may infer, whether intentionally or not, that the body is damaged, fragile, weak, and slow to heal. Metaphorical language can conjure up distressing imagery such as "bone-on-bone" or "wear and tear". People may interpret metaphors literally, believing that vertebral discs "slip", core stability has "gone", or joints have "seized". These metaphorical misunderstandings and incorrect beliefs may reinforce rumination on sensations of pain and stiffness, attention to crepitus, and fear avoidance of movement. Medical imaging used to confirm pathology and anatomical models used to explain pathophysiological processes may inadvertently strengthen negative rumination. The use of a destructive pain metaphor is insidious and generally goes unnoticed.

Insidious metaphor to describe pain?

Destructive metaphor aligns with explanatory models associating pain with actual or potential tissue damage. This reinforces the allure of biomedical, pathoanatomically based remedies. This may impede engagement with first-line health promoting (salutogenic) self-managed lifestyle adjustments of physical activity, diet, and positive psychological state. The use of destructive pain language conjures up metaphors of warfare that dates to antiquity, and are so ingrained that it may be very difficult to change.

Warmongering metaphor for pain

Historical analyses of pain metaphors provide useful insights into how the societal meaning of pain has changed through the ages (30). A prevailing view throughout early history, as described by the Greek physician Galen AD 129–216, was that pain was "of the soul", associated with illness and disease resulting from an imbalance of internal humors.

Díaz Vera (39) appraised metaphorical language in Middle English medical writings from the period 1350–1500 and found that pain was described as a process of commencement, treatment, and cure, rather than a permanent state, i.e., as a type of event [*c.f* (30, 34).]. Often pain was described (metaphorically) as a gas entering the body ("being in motion") to affect bodily organs, or as living entities with hostile intentions e.g., a living creature that grows within the body or as an angry person outside the body. Thus, medieval physicians described "fighting pain" with an arsenal of weapons (treatments); this contrasted with religious treatises and homilies that pain needed to be endured for relief in the afterlife (40).

By the 17th century, warmongering language underpinned beliefs that relief of pain depended on correct medical treatment. The prevailing view was diseases were caused by discrete pathological entities (objects) that were "the enemy" and could be "targeted" (treated) by interventions that "eradicated", "annihilated", "attacked", "battled", and "destroyed". The development of Germ Theory in the late 1800s, engrained warmongering metaphors within the medical discourse and people with disease began to be viewed as "clinical research material" within a "metaphorical medical battlefield". Bourke's historical analysis of metaphorical language within medical texts of the eighteenth and nineteenth centuries reveals the attitudes of many physicians to wage war on diseased tissue with little compassion towards the person in pain (41). Thus, medical practice involved decontextualising a person's lived experience of pain.

By the 20th century, warmongering language was ubiquitous in medical literature, with healthcare practitioners (the soldiers) encouraged to "wage war" on communicable and non-communicable diseases (the enemy) such as AIDS, Covid, cancer, diabetes, obesity, and pain. The success of "an arsenal of weapons" such as antibiotics, vaccination, medication, and surgery has conceptualized the body in metaphors of warfare that are so pervasive they go unnoticed, e.g., "a battle against disease", "winning or losing the fight", "pathogens invading or attacking", "the body"s defences", "doctor"s orders", "the magic bullet" and "fighting disease".

Damage metaphor for pain

Warmongering metaphors easily unite with the metaphor "pain is damage" in common language about; sensations (e.g., "attacks of pain", "stabbing pain"), emotions (e.g., "the horror of pain"), thoughts (e.g., "tortured by pain"), treatments (e.g., "pain killers"), strategies for relief (e.g., "fighting pain") and personnel (e.g., "victims of pain"). Pain assessment tools to capture the quality of pain are dominated by metaphors of damage and warmongering. A case in point is the McGill Pain Questionnaire (MPQ), designed to "measure" sensory, affective, and cognitive dimensions of pain. Patients are invited to describe how their pain "feels" by selecting from a list of words, examples of which include "throbbing", "stabbing", "shooting", "gnawing", "lancinating", "burning", "scalding", "searing", "stinging", "suffocating", "killing", "blinding", "penetrating", "piercing" "tearing" and "torturing". An online survey of 247 people with various persistent pain conditions by Munday et al. (42), found pain metaphors to be characterised by the overarching theme of "damage", with source domains including electricity, insects, rigidity, causes of damage, bodily misperception, and death and mortality. Damage dominates the lexicon of pain.

Leading pain organisations define pain within a framework of tissue damage (e.g., the International Association for the Study of Pain (IASP), the European Federation of International Chapters of IASP (EFIC), American Pain Association, and the British Pain Association). The IASP's definition of pain is "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (43). Pain organisations emphasise the complex relationship between tissue damage and pain experience, i.e., it is not one-to-one; rather pain is a multifaceted sensory, emotional and cognitive experience influenced by ecological, sociological, psychological and biological factors. Thus, serious tissue damage may occur without pain (44), and pain may occur without tissue damage (45, 46, 47), although this is often counterintuitive to patients.

Warmongering metaphor is often used for motivational messaging, e.g., the British Pain Society's 2022 Pain Awareness Month campaign "*I beat cancer. Now I am fighting pain*". There is, however, an insidious side to damage and warmongering metaphors. Fighting pain may encourage unrealistic expectations that recovery is associated with how hard you fight. Fighting fosters an ever-expanding arsenal of weaponry (e.g., painkillers) leading to the medicalization of issues that may be socially rather than biomedically rooted; instigating overdiagnosis and overtreatment (20, 48, 49, 50). Fighting pain could misdirect efforts; for example, by therapy shopping for "quick fix cures" at the expense of interdisciplinary biopsychosocial-based treatment and salutogenic approaches that promote living well with and without pain (51).

Corkhill (52) suggests that "fighting pain to the end" may be a feisty attitude but thoughts of fighting your own body may trigger psychophysiological stressors that may make pain worse. Warmongering language creates "battlefields" rather than "safe havens" and this is not only contrary to the goal of alleviating suffering and aiding recovery, but reveals issues such as "where are the safe havens and how do people get to them?" So, metaphors of damage and warmongering may harm health, well-being, and recovery by:

- Generalising conceptual (mis)understanding of pain as *always* being due to tissue damage resulting in constant vigilance, e.g., of an "attack" of pain
- Fostering thoughts of war, suffering, chaos and being unsafe resulting in fear, worry, anxiety hopelessness and despair, i.e., warzones are not conducive to recovery
- Placing people into a state of persistent fight, flight, freeze or flop, i.e., sympathetically mediated stress
- Encouraging simplified thinking of treatments as weapons to "quick-fix tissue" and practitioners as "soldiers to kill pain"
- Fostering ideas of an end game of winning or losing, leaving no space for play, laughter, curiosity, or healing in the moment

We contend that fighting pain involves placing the self in a civil war against itself, rather than creating peace through arbitration and a sharing of values.

Scarry (53) argues that reducing pain to a sign and symptom of illness, disease, or trauma places the person within a paradigm of disability, disorder, and diagnosis, reinforcing biomedical discourse and decontextualising a person's lived experience. At the core of biomedical discourse is a neuro-mechanistic model of pain conceptualised in metaphor that often goes unnoticed, is insidious in nature, and motivates patients to constantly search for medical solutions. Biomedical discourse was not always the norm.

Erosion of culturally derived metaphors

In many so-called "traditional societies", the language used to describe pain and discomfort has its roots in "biophilic metaphors". These are figures of speech that draw from nature and natural processes to convey abstract ideas or emotions such as phrases that invoke images of the land, weather, or local flora and fauna. Such metaphors were not merely poetic expressions but reflections of deep-seated cultural beliefs and understandings of the human condition (54). Over time, the spread of Western mechanistic medicine in conjunction with the pervasive reach of global media, began to mould and, in some cases, outright replace these indigenous understandings of pain. Research by Halliburton suggests that traditional interpretations of mental illness that reference spirits with names and personalities in Kerala, India, have been replaced by psychological idioms such as "tension", "stress" and "depression"—concepts that, while perhaps more standardised, lack cultural specificity or veracity (55). Halliburton advocates salutogenic approaches that incorporate traditional and biomedical modalities (56, 57, 58).

Our viewpoint is that the erosion of biophilic cultural beliefs and understandings of the human condition may foster a necrophilous mindset. A person with a "biophilic" lens sees growth, function, and the spirited intricacies of living beings, with a love for life, whereas a necrophilous person is "entranced" by static and mechanical aspects of life, drawn to the unchanging, lifeless, and inanimate, seeing living beings as objects, devoid of spirit or agency (59, 60). Interpreting pain through a necrophilous lens replaces the rich tapestry of cultural nuances with a cold, clinical uniformity. We contend that the biophilic spirit of humankind, which thrives on understanding, empathy, and the celebration of life in all its forms, is eroded by this mechanistic view, leading to a world where pain, and by extension, life, is understood not in its vibrant, multi-faceted entirety, but as a mere malfunctioning of physiological machinery.

In fact, biomedical pain language has encroached upon human activity unrelated to potential or actual tissue damage, i.e., unrelated to so-called "physical pain [sic]". This is often termed "psychological pain" or "social pain" and refers to unpleasant experiences such as grief, sadness, anguish, embarrassment, shame, and hopelessness that arise from social situations such as the death of a loved one, rejection from a social group, or bullying. Shneidman (61) devised the neologism "psychache" to describe unbearable psychological anguish, soreness, hurt, "pain" and aching and theorized that unresolved psychache due to an unfulfilled psychological need caused suicide. This demonstrates the pervasive nature of biomedical pain language in the development of scientific concepts of the human condition.

Insidious metaphorical concepts in pain science?

> "There are no metaphor-free zones in science" (62) p.131.

Metaphor shapes scientific knowledge and the development and communication of complex, abstract ideas, theories, and models. Thus, explanatory models of pain are always metaphorical because they develop according to the constraints of human conceptual thinking.

Conceptual models of pain are described using neuro-mechanistic metaphor, comprising detectors (nociceptors), wiring maps (neural pathways), gates (synaptic processing), locks (membrane receptors), keys (neurotransmitters), doors (gated ion channels) and processing centres (ganglion and nuclei). A cornerstone of contemporary thinking from pain science is the so-called "Gate Control Theory" that uses a "gate" metaphor to represent how the flow of neural information (nerve impulses) is modulated (inhibited or facilitated) at synapses in the central nervous system (63, 64).

The search for biosignatures, such as neural correlates, is pivotal to a scientific explanation of how the subjective pain experience arises from the activity of the "stuff" (biological matter) of the body. Neuro-mechanistic explanations of nociception remain a dominant component in the biopsychosocial model of pain and exert a powerful influence on clinical practice (65, 66). Bendelow (67) contends that pain is a subjective, value-laden, sensory and emotional experience that relies on bodily signs and culturally-embedded language that is subject to multiple interpretations, and medicine reduces the complexity of pain to a system of nerve impulses signalling tissue damage. Corns (68) describes this as an "orthodoxy of simplicity" and argues, using the tools of analytic philosophy, that pain is so complex and idiosyncratic that scientific generalisations from mechanistic models may have limited utility [see also (69)]. In an appraisal of "Pain as a metaphor", Neilson contends that the neuro-mechanistic model of pain is oversimplistic, unsophisticated and based on metaphorical short-hand that hinders a more encompassing understanding of pain (1).

Neilson (1) uses the "pain pathway [sic]", included in every textbook of pain, as an example of the insidious nature of biomedical schematic diagrams, the "sine qua non of the medical pain discourse". Neilson states:

> "[The pain pathway] shows a peripheral stimulus sending a signal to central structures (a wire system), the diagram is conceptually as simple as Descartes" thread running from the skin to the brain: no more advanced than the Cartesian model of thread running from the skin to the brain" (1) p. 8.

Neilson contends that an unhealthy focus on neuro-mechanistic metaphor conflates nociception and pain, promoting misconceptions, such as pain being sensed, transmitted, and gated, that contaminate scientific literature. Examples of some common fallacies and misnomers include "pain-sensing neurons" (70), "… abdominal pain transmission …" (71), "Astrocytes contribute to pain gating in the spinal cord" (72). Fundamental conceptual errors remain unchecked in prestigious scientific journals in favour of incorrect metaphorical shorthand, for example, a Research Highlight in the journal *Nature* titled "Nerve cells that carry pain signals" (73). Cohen et al. (31) call for "epistemic discipline" in the use of language and logic in pain medicine to prevent fallacies and misnomers such as reification of pain (treating pain as if it were a physical entity—a "concrete thing").

Neilson argues that the neuro-mechanistic model of pain drives a research agenda generating vast amounts of sophisticated biomedical data that " … *create[s] an illusion of vast medical knowledge that, to a significant degree, is metaphor-based*" (1) p. 3., placing the power of authority to "police the door for pain remedies" to the medical sciences. Neilson states:

> "Mechanisms are emphasised in medical discourse. 'What is pain?' is a difficult question to answer, but opiate and GABA receptors can be identified, tested in experiments, and the results published in articles rich with schematics and diagrams. In this way, the simple is represented simply, demonstrating the secret and dangerous power of visual representations that avoid images of human beings in pain. Standing on the shoulders of schematics, medicine appears powerful and knowledgeable. Yet the schematics are metaphors which perpetuate themselves to the detriment of complex truth. Schematics are visual metaphors that limit understanding because of extreme simplicity." (1) p. 6.

Mechanistic metaphors pervade advertisements for pain treatments. Violet (74) analysed metaphors in commercials of pregabalin for fibromyalgia. A neuro-mechanistic metaphor reduced fibromyalgia to one symptom, pain, that travelled in a "wire", thus reducing the person with fibromyalgia to a body part (disembodied), and pain to a "pulsating scientific aesthetic". This is far from the realism of living with fibromyalgia. In addition, metaphors of "illness as a thief", "fear of isolation" and expectations of "normality" were used to evoke guilt and provoke a desire for pregabalin to aid a return to gendered domestic life before illness [for further discussion of how metaphor can stigmatize people see (75, 76)].

Biomedical orthodoxy and obstinate adherence to materialistic reductionist frameworks of the Standard Model of Physics may have constrained a more encompassing understanding of pain by focussing on deconstructing systems, organs, tissues, cells, molecules, and even subatomic particles at the expense of the "whole person". Conflating pain and nociception contribute to highly convergent research activity grounded in a "comfortable professional consensus", reinforced by attractive biomedical metaphors. There is no doubt that the mechanistic model of pain provides incredible insight into structures and processes but has not explained subjective experience; nor reduced the burden of persistent pain.

We have argued that metaphors used in pain language are negative, destructive and insidious and we advocate reconfiguration of pain metaphors towards constructive, holistic, and person-centred. This requires a paradigm shift away from a simplified biomechanistic pain metaphor toward a salutogenic pain metaphor, reflecting a richer understanding of biopsychosocial processes and subjective phenomenon, and informed by non-biomedical disciplines. Diligence in appropriate use of language and logic is critical to reduce fallacies and misnomers that result in suboptimal patient care and potential harm (31). We acknowledge that such a shift is likely to be very slow. Moreover, it is critical to balance the precision and utility of language used to convey pain concepts, especially when assisting conceptual understanding for the lay person in community-orientated education (77). In the next section, we appraise strategies being used to reconfigure pain language.

Reconfiguring metaphors used in pain language

Constructive pain metaphor

The need to adopt constructive metaphorical language that reflects contemporary understanding of pain experience has been acknowledged, e.g., "*The malleable magic of metaphor*" by Moseley and Butler (78). Moseley and Butler advocate societal strategies to adopt positive pain metaphors within a psycho-educational model that re-contextualizes pain from the primary metaphor "pain is damage" to "pain is protection". This spawns constructive metaphors such as "pain as a gift", "sore but safe", "hurt's not harm" and "pain is an alarm" (78, 79). "Pain is an alarm" and "Pain is a protector" have become dominant metaphors used in public health initiatives and by pain education providers to assist people reconceptualise pain, e.g., Live Well With Pain (www.livewellwithpain.co.uk), Pain Revolution (www.painrevolution.org), Flippin' Pain (www.flippinpain.co.uk), and Neuro Orthopaedic Institute Australasia (Noigroup, https://www.noigroup.com/).

Contemporary constructive metaphors concur with evolutionary theories that pain serves to warn of stimuli that cause potential or actual disruption to the integrity of the body, including stimuli that may hinder tissue healing achieved by making injured body parts "sensitive" (80, 81, 82). Pain commands attention and utilises cognitive resources to elicit behaviours that attempt to minimise physiological disruption to alleviate the pain. In situations where pain persists with no clear underlying condition or out of proportion to any observable injury or disease (primary chronic pain), metaphors of "alarm" and "protection" can be developed and stories created to assist understanding of socio-psycho-bio factors that influence pain and its persistence, e.g., "an oversensitive alarm" and "an overprotective brain" [see (83) for examples].

Metaphorical stories

Storytelling is an essential characteristic of human beings (84). Stories with metaphors that include visual and verbal cues are increasingly being used to aid health communication and literacy, e.g., in acceptance and commitment therapy (ACT). The therapeutic effect of metaphor has been shown to improve when people imagine themselves as a protagonist of a metaphorical story compared with the story presented in the third person (85). Stones and Cole (86) developed a primary metaphor-based visualisation called the "bus of life". The person (reader) is described as on their "bus of life" when, one day, the pain got on as a passenger; the bus can be driven by the pain or by the reader. The "bus of life" metaphor enables a sustained and coherent "big picture" narrative of emotional qualities and meaning and can spawn secondary metaphors, e.g., "direction of travel". If pain drives the bus, a persistent "red *Pain* wheel", indicating a persistent pain cycle, is in control of the direction of travel, whereas if the reader drives the bus, a persistent "green *Gain* wheel" is in control alluding to a virtuous circle (86).

Vilardaga et al. (87) offers other examples of storylines:

- The Football Player and the Robbery Victim to Pain: To describe 3 distinct features of chronic pain, i.e., personal relevance, complexity, and unpredictability of pain—to address hopelessness and lack of connectedness to others.
- Life Navigation System and The Fog of Pain: To introduce the importance of identifying and reconnecting with personal values—to address values clarification and behavioural activation and change.
- Life Rhythms: To introduce the mechanics of behaviour change and the importance of consistent rates of behaviour—to address pacing and behavioural momentum.

Metaphorical images

Padfield (88) reported the benefits of using visual metaphors to facilitate dialogue in clinical consultations. Patients selected a photographic image, from an assortment, that best represented their pain experience, enabling a "shared narrative space" for practitioner and patient to negotiate the meaning of pain. Padfield et al. have found that metaphoric images catalyse memories of experiences to construct meaning, increase disclosure of emotional information from the patient and increase empathetic engagement from the clinician (88, 89, 90).

Stilwell et al. (91) created five paintings of pain-related metaphors from a study of sense-making of pain during communication between patient and clinician. The paintings were then used to catalyse deeper levels of reflection on the language, action, meaning, and experience of pain. This process revealed how practitioners may accidently reinforce overprotection through inadvertent use of threatening metaphors, thus, increasing pain and disability. Stilwell called for practitioners to be sensitive to how pain-related metaphors are used, reinforced, and reconceptualised when co-constructing meanings of pain for patients.

Evidence of benefit and harm

There is a paucity of research that evaluates the efficacy of therapeutic metaphor using randomised controlled clinical trial (RCT) methodology, and we failed to find any systematic reviews of RCTs specifically evaluating therapeutic metaphor for pain. A small study by Bahremand et al. (92) found that metaphor therapy ($n = 10$) was inferior to relaxation training ($n = 13$) at alleviating pain and beliefs of hopelessness in patients with non-cardiac chest pain. Metaphor therapy was delivered in four x 2-hour sessions using two metaphoric stories designed to challenge existing beliefs, followed by discussions about the connection between the metaphoric story and the medical condition, with instructions to mentally rehearse the metaphors daily.

Gallagher et al. (93) found that delivering pain education material through metaphor and story (i.e., via a book of metaphors) assisted reconceptualization of pain and reduced catastrophizing for at least three months when delivered as a precursor to other interventions that target functional capacity. A mixed-methods systematic review of 12 RCTs ($n = 755$ participants) and four qualitative studies ($n = 50$ participants) by Watson et al. (94) demonstrated that allowing patients to tell their pain stories was a key component of success for pain science education. However, Louw et al. (95) found that overall messages of reconceptualising pain were more important than any individual story or metaphor.

A systematic review of six qualitative studies by Stewart and Ryan (96) offers indirect evidence that metaphors help people fashion meaning to pain and this assists expression of pain experience to others. Four therapeutic themes emerged for the value of metaphors for people with pain:

- Expression (relief in finding a way of expressing pain)
- Connection (repairing connections between a sense of self and culture and society)
- Understanding (to make sense of pain experience)
- Control (to express a need to regain control of life with pain).

There was insufficient evidence from the qualitative studies to judge whether the use of metaphor affected pain, function, sleep, or mood, although findings suggested that metaphors improved knowledge and understanding, communication, self-efficacy, resilience, empowerment, and behavioural change.

The possibility of adverse effects associated with the use of therapeutic metaphors has been overlooked in trials to date. Thus, evaluations of the benefits and harms of therapeutic metaphors are needed to inform their value and utility in clinical practice.

Future directions

Concerns have been expressed that the biopsychosocial model of pain perpetuates a reductionist approach, creating artificial boundaries between biological, psychological, and social dimensions, fragmenting a person's sense of coherence, and lived experience of pain (91, 97). Carefully crafted metaphors have potential to reconstruct a person's sense of coherence. Advances in phenomenology and cognitive sciences suggest that sense-making emerges from relational processes distributed across the brain-body-environment providing opportunities to develop metaphors to capture and integrate contextual factors in sense-making of embodied and embedded aspects of pain experience in clinical and non-clinical settings.

A role for enactive metaphors?

Enactivism is a theory for sense-making grounded in the idea that people are embodied and action-oriented beings. Enactivism is defined as "… *a relational and emergent process of sense-making through a lived body that is inseparable from the world that we shape and that shapes us.*" (98) p. 637. Enactive metaphors bring metaphors into existence through actions. Metaphors are expressed *via* movement such as play to facilitate the embodiment of the metaphor through "full-body engagement". Thus, enactive metaphors could aid the conceptualisation, construction, and internalisation of positive meanings of pain.

Enactive metaphors to conceptualise pain

Stilwell et al. advocate the use of enactive metaphors to assist conceptualisation of pain through the lens of "metaphordances"—connecting enactivism to a more dynamic view of metaphor (91, 98, 99). Metaphordance encompasses possibilities available to a person for action ("landscape of affordances") specific to a person's body and experience ("field of affordances") and life-stage and socio-cultural practices (affordance space). Stilwell et al., argue that the landscape of affordances created by society and the healthcare system constrains the field of affordances available to a person living with pain, where agency is already restricted. Thus, activities utilising enactive metaphors have the potential to open up a person's affordances, providing opportunities to conceptualise a more encompassing understanding of pain, providing opportunities to assist people on a "healing journey".

Enactive metaphors to assist health and well-being

Metaphors used in patient consultation, education and rehabilitation are usually delivered by verbal dialogue where the learner "thinks through" mappings from source to target domain, and as a consequence are static, passive and disembodied, i.e., "sitting metaphors" (24). In contrast, enactive metaphors use actions to put metaphors into existence, i.e., acting out understanding as conveyed in the metaphor. Enactive metaphors, delivered via activities such as play-acting or moving in a particular way to facilitate the embodiment of the metaphor through "full-body engagement", reinforce learning through embodied action and help to shape how a person makes sense of their world (24). Enactive metaphors may be particularly relevant in the rehabilitation of people with persistent pain where movement and exercise are core elements of treatment, it fosters active engagement and interaction *via* embodied clinician-patient interaction.

Modern technologies using virtual and augmented realities that merge real and virtual worlds have been used to improve movement in people with fear-avoidance of pain [e.g., immersive dodgeball (100)] and to facilitate movement of artificial limbs using performance feedback [e.g., augmented reality driving of motor vehicles for phantom limb pain (101)]. Such technologies have the potential to bring enactive metaphors to life by integrating perceptions and movements to catalyse learning through body cueing (102). Gallagher and Lindgren provide evidence of the potential of enactive metaphors combined with modern technologies, including virtual reality environments to improve learning in educational settings (24). The use of motion sensing, haptic feedback, and digital imagery can augment movement activities to reinforce enactive metaphors so that the learner becomes part of the system they are trying to understand

(24). Examples include expressing pain through metaphorical movement, or metaphorical sound, and conceptualising pain through enabling an inside-the-body perspective.

We have used enactive metaphors in artist-led workshops to co-create stories of living with persistent pain via creative movement, resulting in improvements in health, well-being and quality of life (103). Community-based pain services that connect people living with persistent pain to pain education and community-based activities, such as artist-lead workshops, may provide opportunities not only for the use of enactive metaphors, but also for holistic support of a person's physical, mental, social and environmental needs. An example of such a service is Rethinking Pain, Bradford and Craven, England (https://rethinkingpain.org/).

Beyond biomedical metaphors

Constructive metaphorical language reflecting contemporary understanding of pain that extends beyond a neuro-mechanistic lens is continuously growing through pain education initiatives by public and privately owned providers. Here, we demonstrate how pain metaphors can be reconfigured to assist people in pain acceptance:

- Pain as a journey: Instead of "Fighting pain" consider "Navigating pain" or "Every day is a different path on my pain journey".
- Pain as weather: Instead of "Pain is a thunderstorm of suffering" consider "Pain is like a cloud, sometimes dark and looming, but eventually moving on" or "Just as there are rainy days, I have painful days, and like rain eventually pain will pass with time".
- Pain as a teacher: Instead of "Pain is like school, restricting my freedom" consider "Pain teaches me resilience" or "Every flare-up is a lesson in understanding my body".
- Pain as waves: Instead of "Shooting pain is a tsunami of suffering" consider "Pain comes in waves, sometimes big, sometimes small. I ride them as they come" or "Like a surfer, I'm learning to ride the waves of pain".
- Pain as a companion: Instead of "Pain engulfs my entire being" consider "Pain is a part of me, not the whole me" or "My pain is a companion on this journey, but not the driver".
- Pain as a window-pane: Instead of "Pain has shattered my entire life" consider "Pain is like a window-pane; sometimes clear, sometimes fogged, but always providing a perspective" or "Like a cracked window-pane, pain distorts but doesn't fully block the view".

We recommend "*The malleable magic of metaphor*" by Moseley and Butler (78) for a synopsis of the development of constructive pain metaphor.

We advocate the development of metaphors mirroring modern concepts of embodied and embedded pain that utilise notions from non-biomedical disciplines (104). This provides opportunities for new perspectives and paradigm shift. For example, informational or quantum metaphors might better resonate with the subjective nature of pain, offering a less rigid objectivity. For instance, quantum superposition, where particles exist in multiple states, can be likened to patients observing all their life's temporal moments as "now". We have used this perspective to develop a framework called Past Adversity Influencing Now (PAIN), showcasing how some people may become "ensnared" by their temporal perception of pain (105). We believe that our PAIN framework offers practitioners a chance to use quantum metaphors to help patients reframe their pain experiences. For instance, suggesting "pain arrives from the past" might prompt patients to reconsider their past experiences in their present, possibly liberating them from their previously "fixed time-lines"—a concept in time travel theories where events are predetermined and unchangeable as an outcome.

Summary and conclusion

In summary, we offer examples of the insidious nature of pain metaphors contributing to painogenicity in society. Metaphors link pain experience personal to oneself, to entities and events in the external world. This enables people to make sense of their own pain and to share the private world of their pain with others. Pain conversation steeped in warmongering and destructive pathoanatomical metaphor is, in some instances, detrimental to recovery. Thus, we advocate reconfiguring pain language towards constructive metaphors that encourages society to adopt a salutogenic view of pain that focuses on health and well-being.

We demonstrated that metaphors are more than figurative language; metaphors are fundamental tools for conceptual mapping, i.e., the way people think. Being cognisant of the pervasive use of metaphor provides an appreciation of their use in explanatory models of pain and assists development of accurate conceptual understanding and healthier language. Explanatory models built on neuro-mechanistic metaphor contribute to fallacies and misnomers about pain and has prejudiced research towards biomedical detail underpinning nociception, in the hope of eradicating pain by "preventing pain transmission [sic]". This has been at the expense of research on the lived experience of pain and has constrained the exploration of non-medicalised strategies for recovery, especially for persistent pain.

In conclusion, it is a metaphorical battle—literally! Metaphors are the building blocks of conceptual understanding and have created the framework on which the science of pain is based. Metaphors spread as memes (i.e., ideas, behavior, or styles that pass from one individual to another by imitation) for acceptance in the societal narrative, constraining diverse thinking and possible alternatives. In the book The Meme Machine, Blackmore states:

> "Memes spread themselves around indiscriminately without regard to whether they are useful, neutral, or positively harmful to us." p.7 (106).

Metaphorical memes of warmongering, damage and mechanistic explanatory models gained access to the pain lexicon many centuries ago and still dominate the public understanding of the persistence of pain. Moving towards a broader eco-socio-psychological understanding of pain persistence [e.g., an ecology of wholeness view (107)] requires compelling and intuitive constructive metaphors that out-compete metaphors dominating modern-day parlance. This vocabulary-based escape route from a biomedically dominated understanding of pain offers new avenues to explore the persistence of pain within a salutogenic framework of health and well-being.

Campaigns to promote the use of positive and constructive metaphors in commercial adverts of pain interventions in corporate and social media are urgently needed. Moreover, as pain transcends all healthcare disciplines, we advocate curricula that develop the knowledge and skills needed to employ positive pain metaphors by healthcare professionals. We hope that this article catalyses debate and reflection on the sinister nature of pain metaphor, to improve conceptual understanding of pain and to purposefully promote living well with and without pain.

Author contributions

MJ conceptualised the article and wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

In the previous 5 years, MJ employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press. CR is a named inventor on a patent for a sensory discrimination training based medical device which could be used in the management of persistent pain conditions. He is also the community pain champion for the Flippin Pain^{TM} campaign which is run by Connect Health Ltd. The consultancy fees for this role go directly to Teesside University, CR receives no personal income for this role. He has received research funding from a number of commercial and non-commercial bodies including: NIHR, Innovate UK, Medtronics Ltd., MediDirect Ltd., 2PD Ltd., The Higher Education Academy, and The Health Foundation. Professional, corporate, and scientific bodies have reimbursed him for expenses related to presentation of research on pain and rehabilitation at conferences/symposia. He has received speaker fees for presentations on pain and rehabilitation.

The remaining author declares 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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Past Adversity Influencing Now (PAIN): perspectives on the impact of temporal language on the persistence of pain

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Persistent pain is a significant healthcare issue, often unresponsive to traditional treatments. We argue for incorporating non-biomedical perspectives in understanding pain, promoting more comprehensive solutions. This article explores how language, specifically time-related terms, may affect the persistence (stickiness) of pain. We delve into how language influences one's experience of the world, especially in understanding pain through spatial metaphors. Notably, time perceptions differ across languages and cultures and there is no absolute construct of temporal pain experience. In English, time is viewed linearly as past, present, and future. We introduce a framework called Past Adversity Influencing Now (PAIN) which includes various temporal phases of pain; Past Perfect, Past Imperfect, Present, Future Imperfect, and Future Perfect. We suggest that past negative memories (emotional memory images) can "trap" individuals in a "sticky" pain state. We speculate that the process of diagnosing pain as "chronic" may solidify this "stickiness", drawing from the ancient Greek idea of "logos", where pain communicates a message across time and space needing recognition. Our PAIN framework encourages examining pain through a temporal lens, guiding individuals towards a more positive future.

KEYWORDS

pain, persistent pain, linguistic relativity, temporal language, linguistics, emotional memory image (EMI)

Introduction

In this article, we explore the influence of temporal (time-based) language on the persistence (stickiness) of pain (1). Although the study of language and pain is not new, we hope to add a novel perspective by appraising the temporality of pain language through the lens of linguistic relativity (2–4), i.e., how language shapes a person's lived experience. We argue that the Sapir-Whorf hypothesis that a person's perception and construction of experience is determined by the structure of their native language and culture, is of critical relevance to the subjectivity of a person's pain (5–7). The words used to represent time, place, space and experience are intricate representations of complex systems of language, and therefore a person's use of the word "pain" may not necessarily resemble their actual experience of pain (8). We model pain experience onto a novel framework termed Past Adversity Influencing Now (PAIN) to consider how temporal language may promote pain persistence by trapping a person within the health practitioner's time frame of recovery, not their own. We explain how the notion of Past Adversity Influencing Now (PAIN) comprising a Past Perfect, Past Imperfect, Present (now), Future Imperfect and Future Perfect may assist pain practitioners in reconfiguring temporal language to accelerate healing and recovery.

Temporality and mental models of reality

Time is a fundamental human experience and a construct of conceptual thinking. Philosophically, debates exist between presentism (only the present moment exists) and eternalism (past, present, and future coexist) (9). In the theory of general relativity, time refers to a dimension intertwined with space. In biology, time is a variable associated with growth, ageing, and circadian rhythms. In psychology, time is considered a perceptual experience of duration, order, and intervals between events, resulting in a subjective experience of "the passage of time". Thus, time may be considered a physical thing (objective) and/or a psychological construct (subjective), and malleable in both instances.

Temporality and language

Language, using linguistic symbols such as words, enables humans to communicate information about abstract thoughts and ideas, and objects and events in the external environment (8). A person's "lifeworld" denotes a person's subjective construction of reality formed within their life circumstances (10), and metaphoric language appears to be critical in shaping perceptions of reality and subjective experience (2–4). People who speak different languages attend to and encode different aspects of the world and think and perceive different features from similar situations; this affects how a person constructs and experiences their reality within the conditions and circumstances of the situation (11, 12). Thus, a person's lifeworld may be malleable through the reconfiguration of their language narrative.

Humans learn a vocabulary of time (temporal language) during physiological development. In English, temporal language maps into the nature of experience, including pain, using a *horizontal* framework as past, present and future. However, people from different linguistic backgrounds conceptualise time using different domains, e.g., horizontal-vertical, left-right, front-back, East-West, distance-quantity, stationary-moving, and limited-open ended (12, 13).

In English language, linguistic constructions for time and space overlap, using metaphors that locate events on a horizontal mental timeline, i.e., front-back metaphors of the future being in front ("looking forward") and the past being behind ("looking back") (14). However, in the Andes language of Aymara, future events are framed as behind and past events in front (15). In Mandarin, time and order may be described using a vertical metaphorical construct of up and down, e.g., shàng (up) instead of last and xià (down) instead of next (11, 16). For English speakers, who write from left to right mental timelines are represented on a left (before/past)-right (after/future) axis, but this is reversed for languages writing right to left, e.g., Arabic and Hebrew. Thus, time is represented in different ways in different languages and in accordance with common spatial metaphors used in the respective language (17). Health practitioners should be mindful of language (conceptual) and cultural diversity when discussing the time course of pain with non-English speakers. In the remainder of this article, we will focus on temporality from the perspective of the English language.

Temporality of pain experience

The intersection between time and pain is typically experienced in a relational context, which is to say, in relation to something else. This might involve contrasting the intensity or quality of pain across different points in time, or it may involve comparing pain within a specific duration but in correlation to another factor. A person's lifeworld is in continuous flow, whereby each thought influences the next moment. Adams describes "timescapes" as a lens through which humans understand their lifeworld, and temporal relations with the world can rupture when a person's relationship with themselves or others in their world changes, for example, through episodes of pain associated with physical trauma (18, 19). When this happens sense making needs to be rebuilt to differentiate cause from effect and this offers future directions that are plausible based on an understanding of the past and present (18, 19). From this perspective, a person's experience of pain can be shaped not only by their personal temporal understanding but also through the interaction with the temporal experiences of others within the same culture (20). This suggests that changes in the language relating to time and pain might have effects that reach beyond the individual, potentially impacting a group-level experience. This is due to the nature of pain, which is inherently social and relational. Thus, the influence of shared temporal experiences must be considered alongside individual factors in understanding and managing pain (21).

Temporal language is the process of time-framing events in sentences using transitional words and phrases that indicate the order, direction, and flow of ideas, meaning, context or events. Transitional words and phrases that function to define, limit, and restrict time (temporal connectives) tell the listener or reader *when* something (an action) is happening and enable the meaning and context of information to flow. Common examples include first, second, now, then, before, after, later, eventually, finally, to begin with, in a moment, and suddenly.

Grammar is the system and structure of a language. In traditional English grammar, tenses are used to reference time, i.e., a tense is the arrangement of a verb that enables the expression of time. Verb tenses describe something happening now (present), had happened (past), or will happen (future) and comprise the following forms (aspects): Simple, Continuous (Progressive), Perfect, Perfect Continuous (Perfect Progressive). A perfect tense refers to completed actions or states, and a continuous (imperfect) tense describes incomplete actions or states that are continuous or repeated (e.g., "was doing"). Thus, twelve basic English tenses arise:

- Present Simple, Present Continuous, Present Perfect, Present Perfect Continuous
- Past Simple, Past Continuous, Past Perfect, Past Perfect Continuous
- Future Simple, Future Continuous, Future Perfect, Future Perfect Continuous

Perfect (completed) and imperfect (continuous) aspects of tenses offer supplementary steps within a person's structure of time and help to chart a person's pain history. Past Perfect tenses refer to past actions or states that were completed (resolved) before another action started. Past Continuous tenses refer to past actions or states that were ongoing (unresolved) before another action started. Thus:

- Past Simple: Describes an activity that started in the past—"I was in pain".
- Past Continuous: Describes an unfinished (ongoing) activity in the past—"The pain was hurting when … [I saw a doctor]"
- Past Perfect: Describes an action that was completed in the past —"I had pain in 2021 before… [I saw a doctor]" or "I had never been in pain before … [I saw a doctor]" or "I only recovered because … [I saw a doctor]"
- Past Perfect Continuous: Describes an action that started in the past and continued until another time in the past —"I had been hurting until [I saw a doctor]", "I wanted to see a doctor because I had been hurting all day at work", and "How long had you been hurting before … [you saw the doctor?]"

The Past Perfect Continuous tense is a useful way to suggest cause and effect.

The Past *Imperfect* tense describes an unfinished action and is also known as the past continuous or past progressive. In the context of this article, and from a perspective of utility, *imperfect* is a word that not only conveys unfinished actions but also imperfect "situations" that may influence the present (now), including thoughts about the future.

Mapping pain onto a simplified temporal framework of perfect and imperfect tenses reveals the relationship between unfinished (ongoing) situations from the past (i.e., adverse events), and bodily pain, including thoughts about the future, which can only exist in the present (i.e., now).

When applied as a verb "pain" necessitates a detachment of a person's identity (not necessarily from their physical body, but more so from their ego). For example, "The wound pained me." inherently creates a distinction between the individual and the wound, with the wound becoming an object that can be acted upon through an external attribution to the wound causing the discomfort. This contrasts with phrases like "My pain makes me suffer". where the pain is internalised and objectified and becomes part of one's perception of self, the personal "my/me/ego". In Buddhism, pain is seen as the fuel for transcendence and thus the ego is let go (22).

Nominalisation of pain experience

In linguistics, "nominalisation" is the process of converting verbs, adjectives, or other word types into nouns. Nouns are crucial as they name or identify entities or ideas, shaping our understanding of the world. By using universally understood nouns, we foster shared comprehension. Nominalisation allows us to assign existence or identity to actions, qualities, and concepts, differentiating them from others.

The nominalisation of pain generally goes unnoticed. In everyday conversation, the word pain is used to convey an experience of an inner state of the body that lacks distinctiveness [for debates on the *nature* of pain see (23–27)]. The common viewpoint, that pain is representational of something in the world, e.g., bodily adversity, harm, tissue damage etc., is contested by an alternative viewpoint, less widely accepted, that pain is a free-floating sensation, and not *about* [representational of] anything [for review see (23)].

Pain is a subjective experience *and* the topic (object) of that experience. Biomedical science investigates pain via a materialistic and reductionist paradigm that uses equipment to detect a *concrete* (physical) thing, e.g., chemical, or neural substrates as direct or indirect markers (signatures) of pain. Cohen et al. argue that pain is not a "thing" (28) and Bourke argues that pain is "a type of event" (29). Even when arguing that pain is not a thing, pain becomes nominalised! The examples provided in the caption of **Figure 1** reveal the nominalisation of pain, i.e., the English language allows a person *to hurt* (verb) but not *to pain.* In this instance pain is not expressed as a verb. In the English language, pain has become a noun, representative of a "thing", and we contend that this may influence the stickiness of pain. There is, however, the use of "pained" where pain is used as a transitive verb, although this is seldom used in modern-day speech. In the English language, nominalisation of pain has the potential to create time-related dimensions of pain that convey fallacies, misnomers and pain narratives that are more insidious than depicted in the caption for **Figure 1**. For example, "my diagnosis is chronic pain" may inadvertently shape a person's belief of no hope for recovery, when this might not be the case, fostering a pessimistic view of future health.

By reflecting on the nominalisation of pain and temporal markers of pain experience, opportunities arise for scholars, patients, and practitioners to participate together in a process of discovery of how Past Adversity Influences Now (PAIN). For example, we postulate that, in some people, nominalisation "freezes" a person's living experience of pain in the present, thus "blocking the flow" of a person's reality. This "locks" pain in a lived experience of the past and in so doing collapses future possibilities into a reality that retains the adversity of an imperfect past. This stagnant state of mind and body may create worry, rumination and catastrophising, a significant psychological factor related to the persistence of pain and disability (30–33). The interplay of biological, social, and psychological disturbances that contribute to chronic pain unresponsive to treatment has the nickname "stickiness" (1, 34).

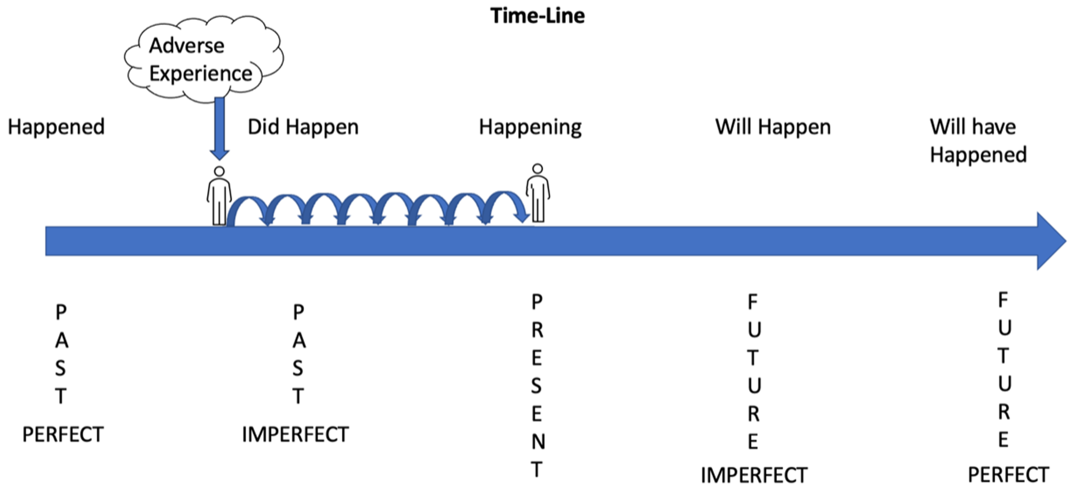

FIGURE 1
Pain experience and temporal language.

Past imperfect tenses set the context of what *was* happening while another event occurred. For example:

- “I was studying when a stabbing pain started in my leg”. (ongoing action of studying)
- “I was playing rugby when I noticed my arm hurting”. (ongoing action of playing rugby)

Past imperfect tenses also describe habitual actions or states such as repeated actions or ongoing situations. For example:

- “Every day, I was complaining of pain”. (habitual action of complaining)
- “She was always talking about her pain”. (habitual action of talking about pain)

Past adverse experiences influence thoughts, expectations and predictions of the “now” (present) resulting in stickiness of pain expressed via future tenses:

- Future Imperfect Simple—“I will hurt tomorrow”.
- Future Imperfect Continuous—“I will be hurting tomorrow”
- Future Imperfect—“I will have no pain tomorrow”.
- Future Perfect Continuous “On my next birthday I will have been hurting for 7 years”.

If a person is in the present and says “I will have no pain tomorrow” their language is Future Imperfect because they are remaining in the present to look forward at an action that is incomplete. If a person is in the present and says “I can’t wait until my next birthday to look back on how my pain cleared” their language is Future Perfect because they have gone past the incomplete action to a point in the future to look back at the completed action. Hence, “By then I will have had” is constructive language because it completes an imperfect or incomplete action and creates a perfect future seen as the problem has been resolved.

Past Adversity Influencing Now (PAIN)

A person experiences sensations and emotions, including pain, only in the current moment. While pain is experienced in the present, it is influenced by past events and potential future occurrences. Pain emerges from the integration of sensory, emotional, and cognitive elements of present moment physiological processes, along with memories of past experiences, both conscious and unconscious. A discussion of the nature and formation of memories is beyond the scope of this article; suffice to say that the conventional synaptic and bioplastic model of memory (35) has limitations and has been challenged (36).

When discussing a person’s pain, practitioner and patient are often unaware of the power that time-based narrative brings to bear on their respective realities of experiences and situations. Health practitioners and their patients discuss pain within a temporal construct of the past, “What happened to cause pain”, present “How does pain affect you now”, and future “What should be done to effect recovery”. This time-based narrative creates a sequential construct whereby pain experienced in the “now” (Present Pain), matches expectations with what happened in the past (Past Perfect), and a prediction that pain will resolve (Future Perfect—positive prognosis). For example, a transient inconsequential pain now (Present Pain) described as “I had stubbed my toe” (Past Perfect), is expected to disappear within seconds “Ouch! the pain will disappear in a moment” (Future Perfect), and it usually does. Likewise, a person reporting that the intensity of their pain is decreasing with medication and no longer interferes with activities of daily living (Present Pain) due to an accident two weeks ago (Past Perfect) will expect their pain to disappear in a few weeks more (Future Perfect).

An imperfect past contributing to an imperfect present and future

Imagine pain persists beyond the expected duration of healing; “An accident happened a long time ago, yet I’m still in pain despite the medication”. Temporal language may become structured as “I was arguing with my partner when the accident happened, and I am still in pain today” (Past Imperfect). When pain remains unresolved, despite treatment, a temporal narrative of “I have been in pain (hurting) for nearly two years, and I will just have to learn to live with this pain” (Future Imperfect) emerges. The person’s temporal language is simple, easy to follow and leads to a logical conclusion. Based on the experience of living a long time with ongoing (unresolved) pain (Past Imperfect) the patient expects that pain (Present Pain) will always be there (Future Imperfect), i.e., the person's pain becomes "sticky".

Emotional Memory Images (EMIs) and PAIN

In 2021, we proposed a model of psychophysiological "dis-ease" whereby stress responses from first-time, novel, and unprecedented traumatic emotional experiences are rapidly learnt and then retriggered later in daily life when a person encounters a reminder of the original traumatic experience (37). Central to our proposal was the concept of Emotional Memory Images (EMIs) coupled to the hypothalamic-pituitary-adrenal (HPA) axis and stress like responses, e.g., flight, fight, freeze, tonic immobility, and quiescent immobility (38, 39). We defined EMIs as "Trauma induced, non-conscious, contiguously formed multimodal mental imagery, which triggers an amnesic, anachronistic, stress response within a split-second". (39). We argued that EMIs are re-triggered by encounters broadly akin to the original experience, continually revivifying the past and contributing to states of psychophysiological dis-ease, influencing the persistence of pain (40–42). Importantly, the anachronistic nonconscious nature of EMIs renders the person amnesic to the original traumatic experience and bereft of reasons why they experience persistence of pain (**Figure 2A**). Thus, clearing (unlearning) EMIs may alleviate, at least in part, autonomic stress-like responses associated with past adversity, thereby reducing allostatic load (43).

We described a therapeutic approach, Split-Second Unlearning (37), whereby practitioners screen for micro-expression(s) signifying an in-the-moment stress response representative of the presence of an EMI. The practitioner makes the patient aware of these micro-expressions and encourages curious exploration of the influence of EMIs on temporal positions of their condition (pain experience) so that the patient can learn to separate the EMI from the stress, clearing the EMI, metaphorically or literally, and alleviating discomfort (**Figure 2B**). For case vignettes see (37, 39, 40).

Curiously moving time to positively impact PAIN

There is a wealth of evidence that time and pain are intrinsically linked (44). Bodily pain slows down the perception of time (45) and the temporal state of mind shapes pain experience for better (placebo) or worse (nocebo) (46, 47). Therapeutic interventions such as cognitive behavioural therapy (CBT) mindfulness and eye movement desensitisation and reprocessing (EMDR) have temporal components within the methodology designed to positively influence the relationship between time and pain (48–51). Indeed the core tenet of mindfulness is to focus one's attention on the present moment (52). The psychological aspect of pain is driven by the perception of what was, what is and what shall be, and we contend that EMIs act as placeholders bringing past pain into the present and advocate approaches that address nonconscious motivational traits detrimental to recovery.

Our Split-Second Unlearning model of psychophysiological dis-ease (37) was developed from the principles and practice of Neurolinguistic Programming (NLP). The field of NLP describes nonconscious motivational traits called metaprograms that show specifically how much time is needed before an individual will decide on something, such as positive change in attitude and behaviour (53). Strategies used by people to decide on something are:

- Automatic—a person is immediately convinced of an idea/situation.
- Number of times—It usually takes a person a few goes before they are convinced (e.g., "Third time lucky").
- Period of time—It can take a month or more for a person to be convinced as they need time to pass before they can accept or decide something.
- Consistent—No matter how much time a person is given they are still not convinced.

Temporal language that aligns with a patient's decision strategy can be used as a motivational tool to influence health outcomes (54). Examples include,

- "You'll be up and about in no time at all"—Automatic
- "It may take 2 or 3 days of exercise before you begin to notice how much better you are feeling"—Number of times
- "You're going to need some time before you start feeling any improvement … [the practitioner pauses for 1 min] … and now that you've had time what are you beginning to notice?"—Period of time
- "The thing is Mr Brown even when you are back walking 15 miles a day you will still have doubts about whether the pain will stay away for good!"—Consistent

Self-reports of pain include a level of nonconscious bias (55). For example, a person's measure of time can become distorted as they judge their experience as being longer than it actually was (56, 57). Pain assessment tools inherently focus on past and present pain. The McGill Pain Questionnaire (MPQ) asks patients to rate their pain "felt during the past week", and this may inadvertently reinforce and even intensify pain by reviving dormant memories (58, 59). Asking patients to complete pain body maps, denoting pain as a static experience may also contribute to stickiness. Moreover, self-reports may fall foul of the "peak-end rule", a psychological heuristic (mental shortcut) to quickly solve problems and make judgements (60), whereby people report pain from the peak (most intense) and the end (most recent) of their pain experience (61).

Types of cognitive heuristics that draw on the past when reporting pain experience may include:

1. Availability Heuristic: Judgments based on the most *recent* episode of pain.
2. Anchoring Heuristic: Judgements based on the *initial* episode of pain, when pain first appeared.
3. Representativeness Heuristic: Judgements based on the similarity of pain to *previous* typical pain experiences.

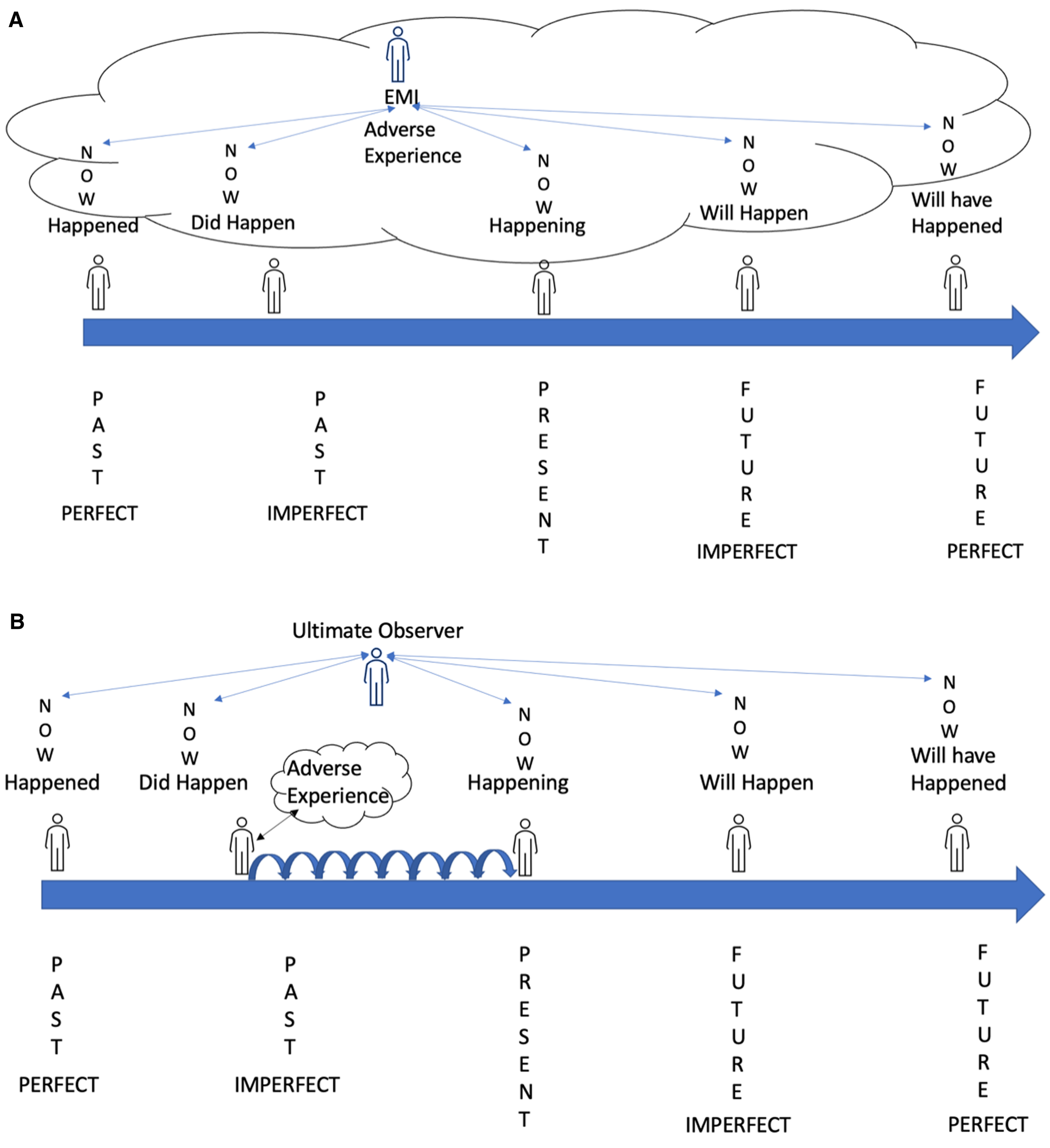

FIGURE 2
(A) Emotional memory images and temporal language. (B) Curious exploration of the temporal positions of pain experience.

4. Familiarity Heuristic: Judgements based on *previous* pain behaviour that was successful under similar circumstances, such as gaining access to pain medication during a clinical consultation.

These heuristics not only shape patient expectations and coping strategies, but also influence healthcare providers' communication and treatment plans (62–64) [see also (65) for a greater insight into the temporal aspect of pain]. Greater awareness of how these unconscious and conscious considerations of past experience influence a person's experience of the present ("now") can be used in clinical practice to curiously move time to positively impact PAIN.

Careless use of temporal language in clinical practice

There is increasing awareness of the need to use positive and constructive pain language (66), yet less attention has been given to the insidious nature of *temporal* pain language that may be detrimental to patient outcomes. In our article, for example, we default to conventional pain nomenclature that suggests permanence, such as "persistent pain", "chronic pain", and "intractable pain", potentially leading patients to feelings of anxiety, depression, and fear-avoidance of activities that may intensify pain, resulting in physical and emotional deterioration. Moreover, "persistent", "chronic", and "intractable" may skew the attitudes of healthcare professionals towards symptom management rather than broader causes that may assist recovery, and influence language used in clinical consultation. Examples include,

- "You will have to learn to live with it"
- "There's nothing more we can do"
- "You'll be on this medication for life"
- "You will have to learn to pace yourself".

These examples show how the practitioner condemns the patient to a reality of pain and suffering that did not exist before the practitioner spoke. However, the statements do not hold logically as there is no knowing what the future holds.

An awareness of the danger of careless use of temporal language can be traced back to ancient Greek philosophers such as Aristotle and Plato. Both Aristotle and Plato discussed the concept of "logos" (67, 68). For Aristotle "logos" was one of three persuasive modes, alongside "ethos" and "pathos". It denotes logical appeal in persuasion. Both Aristotle and Plato emphasised its importance but with varying interpretations. For Aristotle, it was a principle in human thought and nature. An example: in diagnosing "sticky pain", while it appears illogical, practitioners aim for a logical explanation. Plato viewed "logos" as a cosmic truth, whereby pain is a message awaiting acknowledgement. Here pain is considered more of an emotional than sensory experience, that belonged in the soul. If pain stickiness is driven, at least in part by emotional memories as proposed in our framework of PAIN and Split-Second Unlearning theory, then the logos of both philosophers will stand, switching focus from a mechanistic biomedical model of pain in the brain to a model of pain that encompasses a metaphysical mind.

It is possible to learn new ways to talk about time by learning new metaphors and in doing so it is possible to reconfigure space-time associations and non-linguistic representations of time (69). We encourage practitioners to experiment with temporal metaphors that embrace the logos of Plato and Aristotle to help the person break free from the confines of a mechanistic biomedical model. That is, to explore time-based metaphysical metaphors for a metaphysical mind rather than a mechanistic brain. For example:

- "When the mind is willing healing can happen very quickly"
- "You will know when the time is right for you, to begin again"
- "Some patients get this and transform their lives immediately, some take a few days longer, and others can take up to a month or so before they really begin to feel the benefits, there are even those who feel the benefits and will never admit to it coming from this work and that's okay, too".

The final statement utilises all the temporal decision-making metaprograms and may be used to address all patients.

Conclusion

Early life adversities negatively affect health and increase the risk of an episode of pain persisting (70). We contend that adverse experiences may trap individuals in their perception of time, making pain "sticky", and describe this phenomenon as a "Past Imperfect" when one's past negatively impacts their present outlook and future expectations. Linguistic studies reveal that English speakers represent pain in a temporal manner, specifically in a horizontal space. We have conceptualised this as "Past Adversity Influencing Now" (PAIN), suggesting that prior negative experiences can keep individuals trapped in a specific time perception, which affects their pain experience. Different languages and cultures have varied mental models of time, and existing representations can change, providing a path to healing. Contemporary views in pain management suggest that conventional pain treatments might not always benefit patients. Instead, exploring the linguistic aspects of pain might offer more holistic healing. Health professionals are encouraged to use language as a tool to help patients explore their pain experiences. Interdisciplinary research, combining linguistics, psychology, and medical science, is essential for a comprehensive understanding of pain.

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

Both authors contributed equally to the conception and writing of the review. All authors contributed to the article and approved the submitted version.

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Conflict of interest

In the previous 5 years, MJ employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

The remaining author declares 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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Incorporating personal narratives in positive psychology interventions to manage chronic pain

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In this perspective paper, we argue for incorporating personal narratives in positive psychology interventions for chronic pain. Narratives refer to the telling and retelling of events. Narratives detail accounts of events and provide rich, in-depth information on human interactions, relationships, and perspectives. As such, narratives have been used to understand people's experiences with pain and pain coping mechanisms—as well as to facilitate therapeutic outcomes. Furthermore, narrative research has shown that narration can help restore and promote relief, calm, hope, self-awareness, and self-understanding in chronic pain sufferers. Positive psychology interventions have been successful in improving the lives of people living with chronic pain, but these psychology interventions do not typically incorporate personal narratives. Still, narrative, and positive psychology scholarship foci overlap, as both aim to enhance people's quality of life, happiness, and well-being, and to promote the understanding of psychosocial strengths and resources. In this article, we provide a rationale for incorporating personal narratives as an agentic form of positive psychology intervention. To that aim, we outline areas of convergence between positive psychology and narrative research and show how combining positive psychology exercises and narration can have additive benefits for pain sufferers. We also show how integrating narration in positive psychology intervention research can have advantages for healthcare research and policy.

KEYWORDS
personal narrative, chronic pain, positive psychology, agency, healthcare

Introduction

Chronic (persistent or long-standing) pain is defined by the World Health Organisation and by the International Association for the Study of Pain as pain persisting or recurring for longer than 3 months (1, 2). It is estimated to affect more than 20% of the adult population contributing significantly to the global burden of disease with significant impact on mortality and disability across human societies worldwide (3). Chronic pain is associated with reduced functional capacity, low sense of wellbeing, impaired social interactions, medication over-prescription, illegal substance use and abuse, mood disorders, suicidal ideation and suicide attempts; this results in low quality of life (4).

It is widely acknowledged that a multidisciplinary person-centred biopsychosocial approach using pharmacotherapy, restorative therapies, behavioural treatments, complementary and integrative therapies, and self-care is optimal to manage chronic pain (5). It is recommended that safe, less invasive treatments should be indicated first (5–8), yet biomedical interventions (i.e., surgical and pharmacological) still dominate clinical practice, despite evidence of unfavourable risk benefit profiles (5, 9, 10).

The biopsychosocial model of pain, evolved from Melzack and Wall's theory of pain (11) and Engel's new model for medicine (12) over 40 years ago [for a historical account see (13)]. The biopsychosocial model describes a dynamic interaction of biological (e.g., tissue injury, genetics, neurobiology, sex differences, physical health conditions), psychological (e.g., thoughts, beliefs, attitudes, emotions, coping patterns), and social (e.g., poverty, access to welfare, stigma, discrimination) influences to explain between and within person variability in pain experience, including cognitive appraisal of symptoms. Biopsychological approaches to the management of pain are incorporated within an interdisciplinary model of care, emphasizing holistic patient-centred strategies, that combine pharmacotherapy, physical therapy, cognitive-behavioural counselling and other psychotherapeutic modalities, progressive muscle relaxation, risk-reduction training, biofeedback training, social support groups and networking (14, 15).

In this article, we explore the psychological aspect of the biopsychosocial model of pain and advocate the inclusion of personal narratives as part of psychological interventions used in chronic pain management. Specifically, we advocate a positive psychology approach to personal narration and outline areas of convergence between positive psychology and narrative research. We show how combining positive psychology techniques and narration can have synergistic benefits for pain sufferers, and how narration can have advantages for healthcare research and policy.

Personal narratives and healthcare

Narratives are personal stories through which humans tell and retell events (16). Narratives describe events but also become part of the events. Narratives merge with the narrator's reality but may not be accurate depictions of events and may or may not be linear in time and place. Narratives provide rich, in-depth insights on human experiences, interactions, relationships, and behaviours; they are a tool for sense-making and meaning-making (17).

In recent years narrative literature in healthcare has been used to gain insight to the attitudes of individuals about treatments, therapy, barriers preventing treatment, and unaddressed means for enhancing overall quality of life (18). Research evidence suggests short/medium term benefit of using narrative as part of therapy and there are calls for narrative to be included in health care policies (19, 20).

Therapeutically, personal narratives have been shown to support personal values, identity formation, positive emotions, resilience and purpose (21). For example, encountering a negative event such as a life-threatening diagnosis, can turn into a positive story of experiencing redemption via personal courage and realisation of deeper meaning and a new purpose in life. This can increase self-worth and resilience (22, 23).

Personal narratives and pain management

Pain is a private, complex, organic, multidimensional experience that is idiosyncratic in nature (24, 25). People living with persistent pain experience difficulties constructing meaningful explanations for their pain and suffering (26, 27). People struggle to articulate their personal pain story in a way that is understood, heard, or taken seriously by others, including health care professionals (28–31). In clinical consultation, patients are often forced to express pain through assessment tools that collapse the multi-faceted nature of pain into simplified generalisations or into individual, disconnected, items that fragment pain experience (31). Being unable to express pain through personal narrative results in decontextualise care that is detrimental to health and well-being (32).

Human social groups bond through gossiping and storytelling (33, 34). The act of storytelling personally significant events and contemplating towards lessons learnt and future actions, confers benefit for people living with chronic pain (35). Evidence suggests that personal narrations can improve wellbeing when linked to positive expectations of longer-term recovery, such as relief from pain and improvement in functioning (36). An appraisal of the value of personal story for people living with chronic pain by Hovey et al. suggested that narratives help people interpret their pain and their new lived experience with pain (37). Personal narratives with optimistic content have been associated with beneficial outcomes including enhanced psychological states such as acceptance of areas beyond personal control, positive reinforcement, progress to new achievements, new personal meaning, and motivation to continue exercise, which improve health, well-being and quality of life (35, 38).

Positive psychology for pain management

Equally, recent findings support the ability of positive psychology interventions to improve quality of life and the severity and impact of pain. The operational mechanism of positive psychology intervention is relatively simple. During pain, negative emotions may exist to instigate behaviours to protect tissue from actual or potential harm (39). However, adhering to action preventing negative emotions may exacerbate negative thinking and destructive behavioural patterns (i.e., heightened worry and avoidance of movement), with pain becoming chronic and increasingly devastating (40). Engaging in frequent positive psychology exercises seems to offset the links between pain and negative emotions (e.g., fear, anxiety and sadness) and cognitions (e.g., rumination, worry, helplessness and catastrophising), eliciting positive sentiments instead (41).

A systematic review of 16 RCTs by Braunwalder et al. (42) provides tentative evidence that positive psychology interventions, delivered as online self-help or guided face-to-face interventions are efficacious to alleviate chronic pain. Thus, simple, regular, positive psychology exercises, may help to reduce the severity and impact of chronic pain. Examples of positive exercises that encourage strengthening and enjoyment of social connections and human relationships to improve perceived pain, emotional states and physical function include performing good deeds to other people, reflecting on blessings, appreciating life circumstances, feeling grateful, and pursuing meaningful and significant goals in daily living (42, 43).

Positive psychology interventions aiming to alleviate chronic pain and its consequences in daily living are usually delivered online and asynchronously (without the presence of a specialist) providing a cost-effective technique (42). Successful implementation requires participants to dedicate personal time and effort to execute these exercises repetitively, based on self-selected pace and personal understanding.

Practitioners define the nature of the intervention to meet desired outcomes (i.e., improved social connection), although sometimes participants are given an opportunity to select which type of positive psychology technique they wish to use (44). For example, in a study by Muller et al. (43) participants had the option to engage in one or more of four types of positive psychology exercises; relationships, kindness, gratitude, optimism. Through this methodology design, autonomy of choosing a positive psychology exercise seems to be enhanced. Positive psychology intervention seems contrary to the concept of “agency” as defined by Seligman (45). Seligman (45) defines agency as the power behind each person’s belief that can change the world, or more precisely here, change an individual’s sense making of the world. Agency relates to the efficacy to act, based on self-defined criteria, with optimism and inspiration being integral to the will to control one’s own fate irrespective of life’s adversities (45). Clearly, agency requires personal freedom to implement self-defined priorities in one’s life. Such degree of freedom seems to be missing from existing positive psychology techniques aiming to support wellbeing indices in chronic pain. This is based on the philosophical, epistemological and practical background of positive psychology, which can be significantly enriched with an emphasis on agency and personal responsibility (46).

Personal narratives in positive psychology interventions to manage pain

We advocate the use of personal narratives as an innovative positive psychology technique through protocols that support personal agency and autonomy for the participants. Positive psychology interventions provide encouraging results when used for people living with chronic pain (42), and this is achieved by improving components of the Positive emotions, Engagement, valued/supported Relationships, Meaningfulness and Achievement (PERMA) model (47). Personal narratives empower individuals with greater ownership of the direction, pace and content of sense making through exploration of *personal* memories, that make autobiographical sense, through the realisation of dispositional traits and how these may adapt under current circumstances. Hence, personal narratives define identity in various ways but most importantly, via the capacity to keep a unique agentic and personally-defined narrative, using dispositional traits under certain socio-cognitive, developmental, and environmental requests (23). Applying personal narratives to a previously challenging or traumatising event improves quality of life and daily functioning (48, 49). However, the use of personal narrative has not been integrated with positive psychology techniques that have shown capacity to support positive emotions by improving engagement, purpose, achievement, and human relationships.

One way to combine agency and positive psychology techniques is starting with the examination of personal beliefs and values through the use of the Values In Action (VIA) Inventory of Strengths instrument (VIA-IS instrument, http://www.viacharacter.org/ (50), updated in 2019 to the VIA Inventory of Strengths-Revised [VIA-IS-R (51)]). The original VIA-IS was a 240-item questionnaire and the VIA-IS-R consists of 196 items (52) measuring 24 key character strengths (e.g., creativity, bravery, teamwork) based on 6 distinct virtues (wisdom and knowledge, courage, humanity, justice, temperance, transcendence).

The VIA-IS instrument is used to profile personal strengths to aid integration of these character strengths into daily living, by setting goals and acting purposefully to enhance well-being, improve self-acceptance, and boost life-satisfaction (53). The results of the VIA-IS questionnaire are applied to a three-step process, Aware-Explore-Apply, to create a framework to navigate how identified strengths can improve happiness, boost relationships, and contribute to a better outlook for the future (54). After recognising preferred virtues and personal strengths, individuals are invited to narrate their personal story based on significant past events, and by looking at their present and future lives, with special reference to experiences that contain those preferred virtues and strengths. We provide a possible intervention schedule in **Table 1**.

The life story interview

We advocate the use of a “life story interview” in the form of a personal written narrative, to facilitate this process (55). The life story interview relates to a metaphor based on which major life events are contributing to the main chapters of one’s life. After defining those, the individual considers the high, the low and the turning point, as well as the positive experience and wisdom that derives from each one of those important life events. The ultimate phase relates to the individual’s aspiration regarding the next chapter of their life story, personal hopes and future life project that is expected to be in accordance with the report of the already completed VIA-IS questionnaire. Personal agency is manifested here on three levels:

1. The exploration of personal values and strengths,
2. The availability of ample time and self-selected pace to complete one’s life story interview, and
3. The future life project and its numerous options for the individual.

TABLE 1 Stages and meetings of a positive psychology with personal narrative intervention.

Suggested Intervention Protocol. Meetings can be in person and/or online via teleconferencing platforms	
Meeting 1 (Counsellor)	30 minutes meeting with a specialist counsellor to discuss the stages of the suggested protocol starting with stage 1 (VIA-IS Questionnaire). The goal of the session is to respond to the question "*What will I get from the VIA-IS questionnaire?*"
Stage 1 (Independent)	Completion of VIA-IS Questionnaire (https://www.viacharacter.org/) at the person's chosen time and place
Meeting 2 (Counsellor)	30 minutes meeting with a specialist to discuss Stage 2 of the life-story interview protocol and how it works. The goal of the session is to respond to the question "*What will I get from the life-story interview?*"
Stage 2 (Independent)	The life-story interview. The goal of this stage is for the person to appreciate significant events, challenges, and accomplishments in life. Allow up to 15 days for the person to complete Stage 2 at their chosen time and place.
Meeting 3 (Counsellor)	60 minutes meeting with a specialist to go through the three-step Aware-Explore-Apply process to explore the results of the VIA-IS questionnaire. Realisations from the life-story interview are discussed and preparatory work is undertaken for the design of the final stage of the life-story interview (future life). There are 2 objectives; (i) to be aware and explore ways personal strengths have been shaping previous significant events and accomplishments in life highlighted in Stage 2 via the life-story interview, and (ii) realise and decide on which personal strengths to activate to derive personal fulfilment, success, and control in daily living. The goal of the session is to respond to the question: "*How can I use my personal strengths to energise my life?*"
Stage 3 (Independent)	Creation of the future life. The goal of the stage is for the person to clarify how stages 1 and 2 can support a personally fulfilling life by responding to the question "*How can I shape my future?*". Allow up to 15 days for the person to complete Stage 3 at their chosen time and place.
Meeting 4 (Counsellor)	60 minutes meeting with a specialist to go through the whole experience of the intervention protocol and shape personal behaviours (e.g., future plans, actions, realisations). The goal of the session is to respond to the question "*What are the my realisations from this experience?*"
Meetings 5, 6 and 7 (Counsellor)	30 to 60 minutes monthly or bi-monthly meetings with a specialist to check progress and support the person activate their new plan. The goal of each session is to respond to the question "*How am I progressing based on the goals I have set?*"

TABLE 2 Example of how positive psychology with personal narrative can change a person's outlook.

Negative narrative of an individual with persistent pain
The pain is always there. It's a dull ache that never goes away, and it's always worse in the morning. It's hard to get out of bed, and it's even harder to do anything productive. I used to be so active, but now I just sit around all day. I've lost touch with my friends, and I'm starting to feel like I'm losing my mind. I've been to the doctor, but they can't find anything wrong with me.
They say it's just chronic pain and there's nothing they can do. I'm starting to think they're right. I'm just going to have to live with this pain for the rest of my life. I'm starting to detach from my social connections. I don't want to see my friends because I don't want them to see me like this. I'm tired of being the friend who's always in pain. I'm tired of being the friend who can't do anything fun. I'm just tired. I'm starting to feel like I'm all alone in this. I don't know anyone else who understands what I'm going through. I feel like I'm losing my grip on reality. I'm starting to wonder if this pain is ever going to end. I'm scared. I don't know what to do. I just want the pain to stop.
Positive narrative of an individual with persistent pain
I was diagnosed with chronic pain when I was 45 years old. It was a devastating diagnosis, and I didn't know how I was going to cope. I had always been an active person, and I loved to play sports and go hiking. But now, I was in constant pain, and I couldn't do the things I loved. At first, I was really depressed. I felt like my life was over. But then through a suggested intervention, I started to realise and apply my strengths in my daily living. This allowed me to take important decisions about my future and my options to shape my life according to my preferences.
I'm not afraid of a challenge. I'm also a positive person, and I always try to find the silver lining. So, I decided that I wasn't going to let chronic pain define me. I was going to find a way to live a happy and fulfilling life, even with pain. It hasn't been easy. There have been times when I've wanted to give up. But I've always found a way to keep going. I've learned to manage my pain, and I've found new ways to be active. I've also found a great support system of friends and family who have helped me through the tough times. I'm not cured, and I may have chronic pain for many more years, but I've learned to live much more positively with it, and I'm not going to let it stop me from living a fulfilling life. Here are some of the personal strengths that have helped me cope with chronic pain; **resilience**—I don't give up easily, **optimism**—I try to find the silver lining, even in the darkest of times, **adaptability**—I've learned to adapt to my pain, and I've found new ways to be active and enjoy life, and **social connection**—I have a great support system of friends and family who have helped me through the tough times.

Based on significant events and challenges, and through the comparison of already performed behaviours versus personally valued actions, each individual has an increased chance to realise areas of reduced control and opportunities for personal growth. It also allows for contemplating continuity of personal identity based on valued activities and actions (53).

With an aim to reverse the negative experiences of chronic pain, the goal of the life story narrative technique is to create personal and agentic experiences of redemption leading to a revitalised connection to personal meaning, engaging behaviours and flow, synergetic relationships, personal activation, optimism, and increased resilience (see example in **Table 2**). Similarly to other positive psychology interventions, this technique can be implemented repetitively (thematically and until long-term resilience is established), online and in an asynchronous way, providing a low-cost alternative to expensive pain treatments.

Narratives in healthcare pain policy development

The National Institute for Health and Care Excellence (NICE) guidelines on chronic pain highlight the importance of person-centred assessment and management (7). The NICE guidelines emphasise the need to support individuals' control and autonomy over their condition and social/psychological circumstances, while using an active exploration of personal strengths to improve management of chronic pain. Even though these guidelines propose a holistic approach to the management of chronic pain (i.e., psychological, social, and pharmacological) they endorse psychological approaches that are relatively expensive and time consuming (i.e., Acceptance and Commitment Therapy (ACT) and Cognitive Behavioural Therapy (CBT)). Positive psychology with personal narrative aligns with a whole-person-centred biopsychosocial paradigm of care and empowers people to take an active role in their healing journey to foster adaptive, resilient and autonomous lifestyles against adversities linked to chronic pain (19).

The cost of interventions using personal narratives within a framework of positive psychology is likely to be competitive compared with existing psychological approaches e.g., four hours to learn how to self-administer a positive psychology approach to personal narration (**Table 1**) compared with 6–20, one hour clinically supervised sessions of CBT. For these reasons we call for evaluations of positive psychology with personal narratives to provide robust research evidence to enable health policy and clinical decision makers to judge the cost-benefit-safety profile.

Conclusion

A positive psychology approach to personal narration sits within a whole-person paradigm capturing a holistic and biopsychosocial multidimensional method of care (56). Following our appraisal of extant literature, we conclude that integration of personal narratives within a framework of positive psychology offers an innovative agentic technique to assist the psychological states for people living with chronic pain in clinical and non-clinical settings. A recent systematic review provides tentative evidence that positive psychology interventions are efficacious for chronic pain. There is a paucity of research on which to judge the efficacy of integrating personal narrative into positive psychology interventions. Thus, we recommend a scoping review and evidence gap map to inform the direction of future research. We hope that this article stimulates further debate on the topic.

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

EG: Conceptualization, Writing – original draft, Writing – review & editing. MJ: Conceptualization, Writing – review & editing.

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Conflict of interest

In the previous 5 years, MJ's employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

The remaining author declares 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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Multidimensional visualization and analysis of chronic pain variables of patients who attended a chronic pain program

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Psychologically-based chronic pain variables measure multiple domains of the pain experience such as anxiety, depression, catastrophizing, acceptance and stages of change. These variables measure specific areas such as emotional and cognitive states towards chronic pain and its management, acceptance towards the chronic pain condition, and an individual's readiness to move towards self-management methods. Conceptually, these variables appear to be interrelated to each other, and also form groupings of similar underlying themes. Groupings that have been previously discussed for these variables include positive and negative affect, and improved and poor adjustment. Psychological experience of chronic pain as a whole is mostly understood through conceptually consolidating individual scores across different measures covering multiple domains. A map of these variables in relation to each other can offer an overview for further understanding and exploration. We hereby visualize highlights of relationships among 11 psychosocial chronic pain variables including measures examining physical and somatic aspects, using three-dimensional biplots. Variables roughly form two groupings, with one grouping consisting of items of negative affect, cognition, and physical state ratings, and the other grouping consisting of items of acceptance and the later three stages of change (contemplation, action, maintenance). Also, we follow up with canonical correlation as a complement to further identify key relationships between bimodal groupings. Key variables linking bimodal relationships consist of catastrophizing, depression and anxiety in one grouping and activity engagement in the other. Results are discussed in the context of existing literature.

KEYWORDS

chronic pain, visualization, biplot, canonical correlation analyses (CCA), outcomes—health care

Introduction

The biopsychosocial model conceptualizes pain from three perspectives, the physiological, psychological and sociocultural and their interactions (1). The psychological portion of the model further comprises individual factors such as affect, cognition, acceptance and stages of change. Affective factors include anxiety, depression, and catastrophizing, which are negative in quality (2). Multiple anxiety and trauma-related disorders such as panic and posttraumatic stress (PTSD) are associated with chronic pain and pain-related impairment (3, 4). The presence of pain or depression negatively influences treatment outcomes of the other, and these two factors may also interact with each other to negatively influence pain outcomes (5). Anxiety, together with depression increases odds of disabling pain, even with anxiety or depression in remission (6).

Anxiety and depression can interact with cognitive factors such as catastrophizing, which is a mediator for both anxiety and depression, and has also been found to predict depressive symptoms (7–9). Conversely, anxiety and depression can potentiate catastrophizing (10).

In addition to affective factors, chronic pain experiences have been captured through variables with positive qualities including pain acceptance and stages of change. These are related to improved functioning (11), and are intertwined with negative affect and cognition. The pain willingness (PW) and activities engagement (AE) subscales of the Chronic Pain Acceptance Questionnaire (CPAQ) are negatively associated with depressive symptoms and pain intensity and positively associated with functioning and work (12, 13). Acceptance is a mediator for the effect of pain on catastrophizing (14). In a study that examined the effects of a multidisciplinary CBT-based intervention on pain intensity and interference, only catastrophizing and AE were significant predictors of changes in pain and interference (15). Catastrophizing also has a notable influence on the relationship between acceptance and chronic pain adjustment (16).

The Pain Stages of Change Questionnaire (PSOCQ) is also intermingled with pain affect. Patients with chronic pain have different beliefs regarding pain management, and changing behaviour might be related to changes in stages of readiness (17, 18). Anxiety and depression significantly predicted the pre-contemplation subscale of the PSOCQ (19) in patients with chronic pain assessed at multidisciplinary pain clinics. Lower depression scores were associated with decreased scores in pre-contemplation and increased scores in maintenance pre- to post-treatment from interdisciplinary pain management programs (20, 21). Also, reductions in pre-contemplation and increases in action/maintenance were associated with improvements in functioning and pain (20). Change scores in pre-contemplation before and after pain neuroscience education were positively related to change scores in pain catastrophizing (22). In patients with fibromyalgia, increase in contemplation was associated with increase in catastrophizing, and post-treatment, depression was associated with contemplation in pain clinic patients (23). For patients in the action/maintenance stages, higher scores on weekly positive affect were associated with lower weekly pain perception (24).

These different measures make up two groups of factors: one consisting of negative affect/poor adjustment to chronic pain (depression, anxiety, catastrophizing), and the other consisting of positive affect/improved adjustment to chronic pain (CPAQ, PSOCQ) (11). Pain management aims at decreasing negative affect/poor adjustment and increasing positive affect/improved adjustment. These two groups may be bivalent, consisting of negative affect/poor adjustment and positive affect/improved adjustment (25). However, according to the Dynamic Affect Model, the differentiation between positive and negative affect is not as clear during stressful events such as pain and this may show variation between people as well. In chronic pain, which is a stressful event, there is more overlap between positive and negative affect (26). This study aims to explore the relationship between positive and negative factors, how these conceptual groups are reflected in practice, and which factors are key in the connection between the positive and negative.

Methods

Data were collected as described in Li and Hapidou (27). In short, participants were adults attending a four-week chronic pain management program from 2007 to 2017. The program has been described in Williams et al. (21). The University and Hospital Ethics Board reviewed the study protocol and determined ethical approval for retrospective data analysis was not necessary.

Brief description of the sample

The average age (SD) of the participants was 44.20 (10.28), with 49% males and 51% females. Their educational level was 13.35 years (3.24) and their pain duration was 64.99 (76.20). The majority, 80%, were Canadian-born and 65% were employed. The majority of patients had musculoskeletal pain.

Previous data analysis demonstrated highly significant changes between admission and discharge ($p < 0.001$) on the variables administered in the program such as pain intensity, depression, catastrophizing, anxiety, stages of change and pain acceptance (27).

Data analysis

Principal component analysis (PCA) examined the structure and relationship of psychometric variables at admission and discharge (28). Then, the principal components were scaled and plotted on three-dimensional variable biplots for visualization. Biplots allow visual representation of the relationships among variables. A variable biplot focuses on relationships among variables (29).

The angle between the variable vectors represents correlation between the variables, and the length of the vector represents the variance of the variable (30).

A three-dimensional biplot includes the first 3 eigenvectors, and can capture the dimensions to a greater degree as compared to a two-dimensional representation (31).

The lengths of the vectors in the biplot were calculated as follows: the first 3 principal components in the admission and discharge datasets were scaled by the square root of their respective eigenvalues (32).

Canonical correlation analysis was conducted on both admission and discharge datasets, dividing the variables into two conceptual sets: negative affect/poor adjustment, positive affect/improved adjustment (33, 34). Canonical correlation can be used as a complement to PCA to further examine and concur structural relations (35).

Statistical analysis was conducted using R Statistical Software (v4.1.1) and RStudio (v2021.09.0.351) (36, 37). Biplots were created using the plotly package (v4.10.0) (38).

Kaiser–Meyer–Olkin test and Bartlett's test of sphericity were conducted using the psych package (v2.1.9) (39). Canonical correlation analysis was conducted using the CCA package (v1.2.1) and significance tests were conducted using the CCP package (v1.1) (40, 41).

Results

Principal component analysis (PCA) was performed on admission and discharge datasets from a total of 927 patients with chronic pain who attended a four-week interdisciplinary chronic pain management program.

There were complete data on the 11 variables from 780 patients in the admission dataset, and from 797 patients in the discharge dataset.

Outliers were calculated with Mahalanobis distances, with criterion at $p < 0.001$ (28). After removing outliers, there were 770 patients in the admission dataset and 788 patients in the discharge dataset.

Variables were overall normally distributed as assessed by their graphed distribution (28).

Assumptions of linearity between 2 variables within the admission and discharge set were also met, as assessed by bivariate scatterplots (28).

The large samples were adequate for analysis. The Kaiser-Meyer-Olkin test was 0.83 for the admission dataset, and 0.89 for the discharge dataset (42).

The determinant of the correlation matrices for admission and discharge were non-zero and there were enough correlations between the variables to conduct dimensional analysis (43). Bartlett's test of sphericity for the admission dataset was 3120.79 ($p < 0.001$) and 4,330.22 ($p < 0.001$) for the discharge dataset (44).

There were two moderately high correlations, between the action and maintenance subscales of the PSOCQ (correlation = 0.73 for admission, correlation = 0.75 for discharge) (See **Tables 1**, **2**). There were no correlations above 0.90. For the purposes of structural and dimensional analysis, presence of higher correlations will not affect the strength of the analysis (28).

The first 3 principal components in the admission dataset and the discharge dataset were plotted in 3-dimensional biplots (See **Figures 1**, **2**). Principal components and eigenvalues are shown in **Tables 3**, **4**. Admission and discharge structures were similar, with roughly two groupings. One grouping consisted of somatic symptoms, anxiety, depression, catastrophizing, pain intensity and pre-contemplation. The other grouping consisted of activity engagement, action, maintenance, and contemplation. The vector for pain willingness leaned towards the second grouping. Vectors within the groupings became more tightly correlated at discharge as compared to admission, as shown by the distance between their vectors in the biplot.

Canonical correlation was performed between the two sets of variables representing negative affect/poor adjustment (somatic symptoms, anxiety, depression, catastrophizing, pain intensity) and positive affect/ improved adjustment (CPAQ, PSOCQ). For admission, the first canonical correlation was 0.68, the second was 0.20, the third was 0.12, and the following two correlations were close to zero. The F-test was F (30, 3080.00) = 18.65, $p < 0.001$ for all 5 canonical correlations. After removing the first canonical correlation, the F-test value was F (20, 2521.59) = 2.41, $p < 0.001$. Removing the second canonical correlation and subsequent removals produced F-tests that were not significant. Therefore, significant relationships between the two groupings were captured by the first two pairs of canonical variates.

Table 5 shows standardized canonical variate coefficients, correlations between the variates and canonical variates, proportion of variance, redundancy and canonical correlations for the admission data. From total proportion variance and redundancy, the first pair of canonical variates were moderately related, and the second pair of canonical variates were weakly related.

All variables in the negative affect/poor adjustment set were correlated with the first canonical variate, with all correlations of

TABLE 1 Correlation table of variables in admission dataset.

Admission	1	2	3	4	5	6	7	8	9	10
1. Pain Intensity	1									
2. Depression	0.29***	1								
3. Catastrophizing	0.33***	0.64***	1							
4. Anxiety	0.26***	0.72***	0.58***	1						
5. Somatic Symptoms	0.21***	0.59***	0.48***	0.57***	1					
6. Activity Engagement	−0.26***	−0.50***	−0.49***	−0.44***	−0.33***	1				
7. Pain Willingness	−0.23***	−0.35***	−0.47***	−0.30***	−0.27***	0.33***	1			
8. Pre-contemplation	0.21***	0.33***	0.45***	0.25***	0.22***	−0.29***	−0.34***	1		
9. Contemplation	−0.02	−0.05	−0.05	−0.04	0.05	0.08*	−0.15***	−0.21***	1	
10. Action	−0.09**	−0.24***	−0.28***	−0.16***	−0.10**	0.36***	0.09*	−0.30***	0.25***	1
11. Maintenance	−0.13***	−0.28***	−0.31***	−0.22***	−0.15***	0.43***	0.11***	−0.24***	0.16***	0.73***

Pain Intensity = Pain Intensity Scale; Depression = Center for Epidemiological Studies-Depressed Mood Scale; Catastrophizing = Pain Catastrophizing Scale; Anxiety = Clinical Anxiety Scale; Somatic Symptoms = Patient Questionnaire of the PRIME-MD; Activity Engagement = Chronic Pain Acceptance Questionnaire – Activity Engagement; Pain Willingness = Chronic Pain Acceptance Questionnaire – Pain Willingness; Pre-contemplation = Pain Stages of Change Questionnaire – Pre-contemplation; Contemplation = Pain Stages of Change Questionnaire – Contemplation; Action = Pain Stages of Change Questionnaire – Action; Maintenance = Pain Stages of Change Questionnaire – Maintenance.

*<0.05.

**$p < 0.01$.

***$p < 0.001$.

TABLE 2 Correlation table of variables in discharge dataset.

Discharge	1	2	3	4	5	6	7	8	9	10
1. Pain Intensity	1									
2. Depression	0.35***	1								
3. Catastrophizing	0.34***	0.66***	1							
4. Anxiety	0.31***	0.74***	0.65***	1						
5. Somatic Symptoms	0.29***	0.65***	0.53***	0.64***	1					
6. Activity Engagement	−0.28***	−0.55***	−0.56***	−0.48***	−0.43***	1				
7. Pain Willingness	−0.18***	−0.33***	−0.54***	−0.33***	−0.26***	0.27***	1			
8. Pre-contemplation	0.26***	0.43***	0.56***	0.36***	0.33***	−0.45***	−0.30***	1		
9. Contemplation	−0.20***	−0.21***	−0.20***	−0.16***	−0.13***	0.30***	−0.06	−0.41***	1	
10. Action	−0.32***	−0.40***	−0.39***	−0.30***	−0.29***	0.46***	0.08*	−0.53***	0.59***	1
11. Maintenance	−0.30***	−0.44***	−0.39***	−0.33***	−0.31***	0.48***	0.08*	−0.54***	0.56***	0.75***

Pain Intensity = Pain Intensity Scale; Depression = Center for Epidemiological Studies-Depressed Mood Scale; Catastrophizing = Pain Catastrophizing Scale; Anxiety = Clinical Anxiety Scale; Somatic Symptoms = Patient Questionnaire of the PRIME-MD; Activity Engagement = Chronic Pain Acceptance Questionnaire – Activity Engagement; Pain Willingness = Chronic Pain Acceptance Questionnaire – Pain Willingness; Pre-contemplation = Pain Stages of Change Questionnaire – Pre-contemplation; Contemplation = Pain Stages of Change Questionnaire – Contemplation; Action = Pain Stages of Change Questionnaire – Action; Maintenance = Pain Stages of Change Questionnaire – Maintenance.

*<0.05.

**p < 0.01.

***p < 0.005.

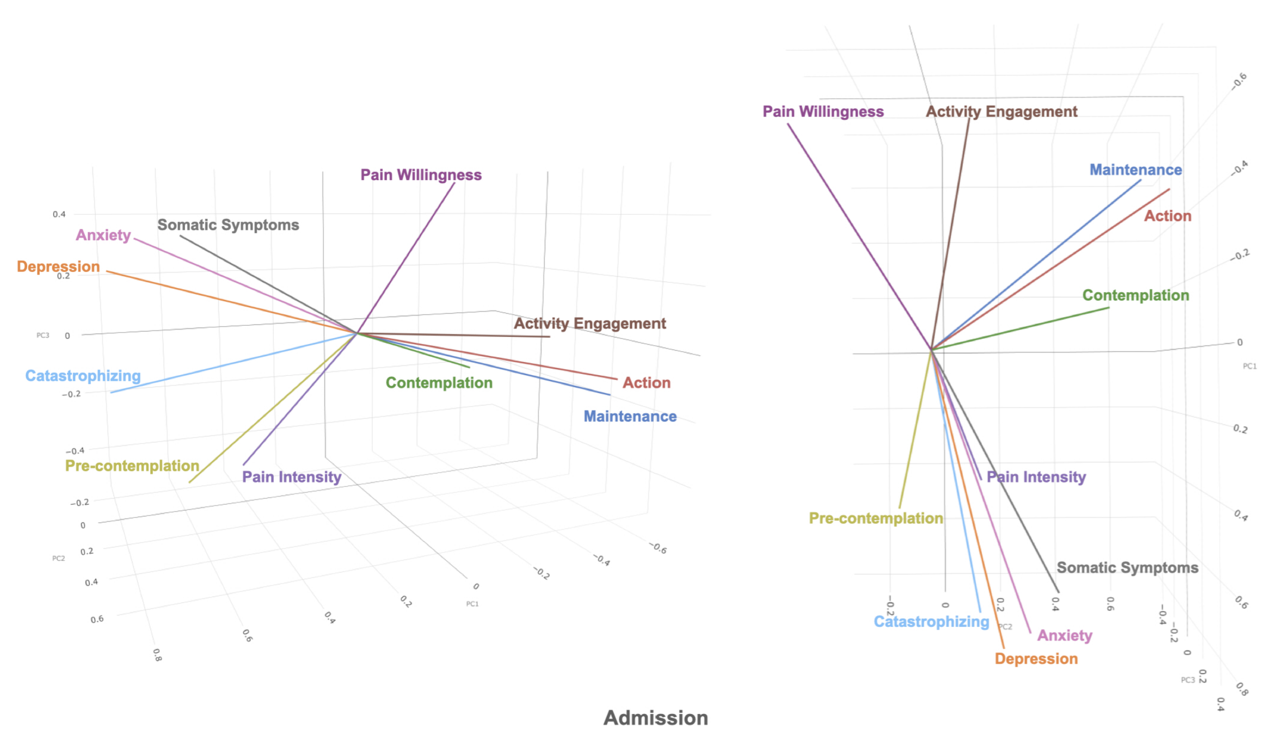

FIGURE 1
3-dimensional biplot of principal component 1, 2, and 3 (shown as PC1, PC2, PC3 in figure) of admission dataset.

these variables above 0.3 (28). The strongest correlations were catastrophizing (0.95) and depression (0.82). Except for contemplation, all variables in the positive affect/ improved adjustment set were correlated with the first canonical variable. The strongest correlation was activity engagement (−0.81). The first canonical variate indicated that increases in catastrophizing, depression, pain intensity, anxiety, and somatic symptoms were associated with decreases in activity engagement, pain willingness, action and maintenance and increase in pre-contemplation.

The second canonical variate consisted of depression (0.43) and anxiety (0.61) in the negative affect/poor adjustment set, and activity engagement (−0.56) and pre-contemplation (−0.47) in the positive affect/ improved adjustment set. The second canonical variate showed that decreased depression and anxiety were associated with increase in activity engagement, and pre-contemplation.

For discharge, the first canonical correlation was 0.76, the second was 0.30, the third was 0.16 and the following two

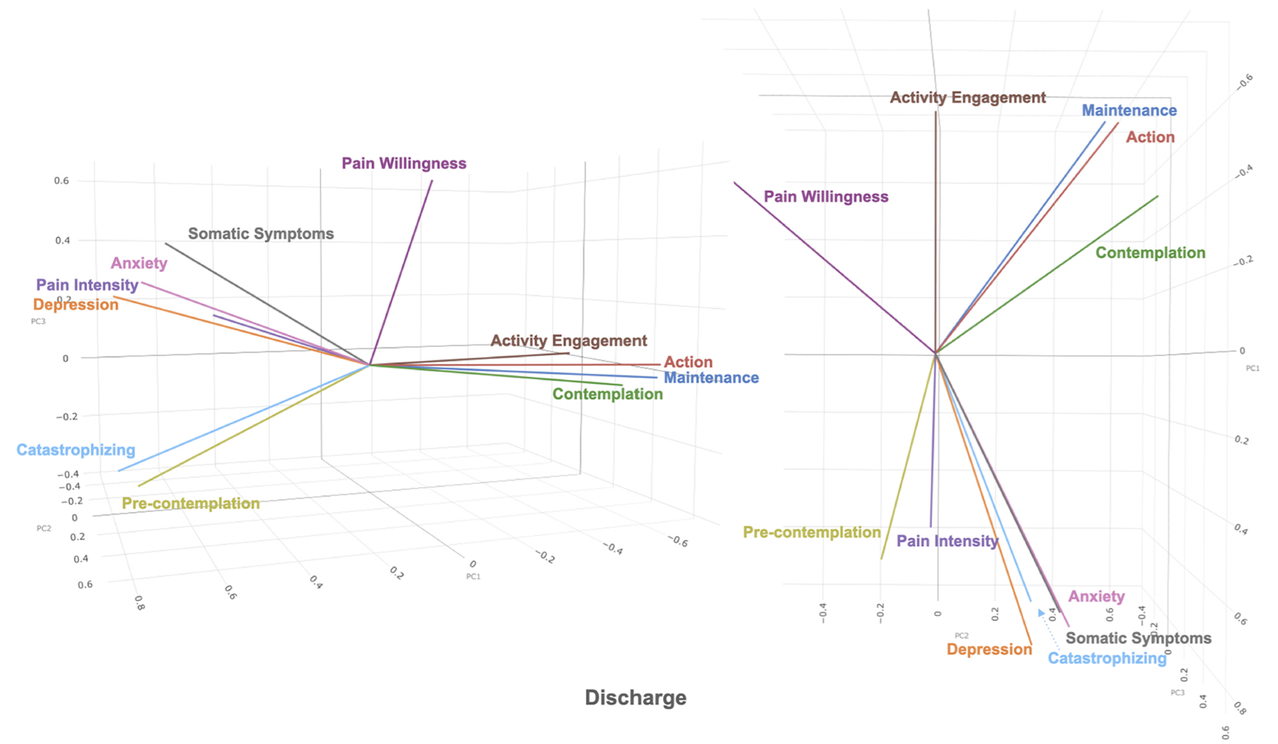

FIGURE 2
3-dimensional biplot of principal component 1, 2, and 3 (shown as PC1, PC2, PC3 in figure) of discharge dataset.

TABLE 3 Principal components of admission and discharge datasets. Principal components consist of eigenvectors scaled by the square root of eigenvalues.

Admission	Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
	Pain Intensity	0.44	−0.14	0.37	−0.12	−0.79	0.12	−0.03	0.01	−0.03	0.00	−0.01
	Depression	0.82	−0.21	−0.25	−0.09	0.02	−0.01	0.01	−0.18	−0.10	0.38	0.16
	Catastrophizing	0.82	−0.14	0.10	−0.04	0.09	0.00	0.00	−0.22	0.49	−0.07	−0.02
	Anxiety	0.75	−0.28	−0.34	−0.14	0.00	−0.04	0.00	−0.26	−0.25	−0.27	−0.13
	Somatic Symptoms	0.64	−0.36	−0.35	−0.08	0.06	0.30	−0.12	0.47	0.07	−0.03	−0.01
	Activity Engagement	−0.71	−0.12	0.04	−0.18	0.09	0.52	−0.32	−0.25	−0.01	−0.01	0.05
	Pain Willingness	−0.54	0.30	−0.52	−0.26	−0.25	0.20	0.41	−0.06	0.12	0.00	0.00
	Pre-contemplation	0.56	0.16	0.51	−0.29	0.32	0.28	0.35	0.04	−0.13	−0.03	0.03
	Contemplation	−0.13	−0.54	0.03	0.75	−0.02	0.24	0.25	−0.07	−0.02	0.01	−0.03
	Action	−0.49	−0.73	0.05	−0.23	0.00	−0.18	0.11	0.03	0.02	−0.14	0.32
	Maintenance	−0.53	−0.66	0.12	−0.35	0.08	−0.10	0.07	0.02	0.03	0.17	−0.31
Discharge	**Variable**	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**	**PC6**	**PC7**	**PC8**	**PC9**	**PC10**	**PC11**
	Pain Intensity	0.50	−0.01	0.17	−0.85	−0.03	0.05	−0.07	0.02	−0.02	−0.01	0.00
	Depression	0.81	0.28	0.24	0.10	0.04	−0.01	0.01	−0.19	−0.23	0.32	−0.08
	Catastrophizing	0.81	0.31	−0.22	0.02	0.03	0.02	−0.12	−0.13	0.32	0.00	−0.26
	Anxiety	0.75	0.38	0.28	0.11	0.11	−0.12	−0.09	−0.25	0.01	−0.24	0.23
	Somatic Symptoms	0.68	0.34	0.38	0.12	0.17	0.06	0.14	0.45	0.05	−0.02	−0.03
	Activity Engagement	−0.73	0.00	0.01	−0.13	0.63	0.01	0.16	−0.13	0.03	0.02	−0.05
	Pain Willingness	−0.43	−0.50	0.64	0.12	−0.04	0.28	−0.20	−0.10	0.12	0.01	−0.07
	Pre-contemplation	0.71	−0.19	−0.38	0.08	0.21	0.44	−0.22	0.06	−0.10	−0.01	0.11
	Contemplation	−0.48	0.67	0.00	−0.04	−0.20	0.41	0.30	−0.12	0.04	−0.01	0.04
	Action	−0.69	0.55	0.03	0.00	0.02	0.01	−0.29	0.05	−0.24	−0.17	−0.22
	Maintenance	−0.71	0.51	−0.01	−0.04	0.04	−0.06	−0.32	0.10	0.16	0.23	0.20

Pain Intensity = Pain Intensity Scale; Depression = Center for Epidemiological Studies-Depressed Mood Scale; Catastrophizing = Pain Catastrophizing Scale; Anxiety = Clinical Anxiety Scale; Somatic Symptoms = Patient Questionnaire of the PRIME-MD; Activity Engagement = Chronic Pain Acceptance Questionnaire – Activity Engagement; Pain Willingness = Chronic Pain Acceptance Questionnaire – Pain Willingness; Pre-contemplation = Pain Stages of Change Questionnaire – Pre-contemplation; Contemplation = Pain Stages of Change Questionnaire – Contemplation; Action = Pain Stages of Change Questionnaire – Action; Maintenance = Pain Stages of Change Questionnaire – Maintenance.

TABLE 4 Eigenvalues of principal component analysis of admission and discharge datasets.

Admission	Principal Component	Eigenvalue	Proportion Variance	Cumulative % Variance
	1	4.14	37.64%	37.64%
	2	1.68	15.25%	52.89%
	3	0.99	9.02%	61.91%
	4	0.97	8.85%	70.76%
	5	0.82	7.42%	78.18%
	6	0.60	5.44%	83.62%
	7	0.48	4.41%	88.02%
	8	0.44	4.02%	92.05%
	9	0.35	3.19%	95.24%
	10	0.27	2.49%	97.73%
	11	0.25	2.27%	100.00%
Discharge	**Principal Component**	**Eigenvalue**	**Proportion Variance**	**Cumulative % Variance**
	1	5.00	45.47%	45.47%
	2	1.74	15.81%	61.28%
	3	0.90	8.19%	69.47%
	4	0.80	7.25%	76.72%
	5	0.53	4.86%	81.58%
	6	0.47	4.23%	85.81%
	7	0.43	3.91%	89.72%
	8	0.38	3.48%	93.20%
	9	0.27	2.43%	95.63%
	10	0.24	2.22%	97.85%
	11	0.24	2.15%	100.00%

TABLE 5 Canonical correlation analysis of the admission dataset. Variables grouped by negative affect/ poor adjustment (Pain Intensity, Depression, Catastrophizing, Anxiety, Somatic Symptoms) and positive affect/ improved adjustment (Activity Engagement, Pain Willingness, Pre-contemplation, Contemplation, Action, Maintenance).

Admission	First Canonical Variate		Second Canonical Variate	
	Correlation	Function Coefficient	Correlation	Function Coefficient
Negative Affect/ Poor Adjustment Set Variables				
Pain Intensity	0.47	0.15	0.07	0.06
Depression	0.82	0.32	0.43	0.49
Catastrophizing	0.95	0.69	−0.24	−1.05
Anxiety	0.69	0.03	0.61	0.91
Somatic Symptoms	0.55	−0.01	0.22	−0.09
Proportion of Variance	0.52		0.13	Total = 0.65
Redundancy	0.24		0.01	Total = 0.25
Positive Affect/ Improved Adjustment Set Variables				
Activity Engagement	−0.81	−0.52	−0.56	−0.95
Pain Willingness	−0.71	−0.40	0.32	0.41
Pre-contemplation	0.67	0.35	−0.47	−0.53
Contemplation	−0.08	0.00	−0.07	−0.13
Action	−0.42	−0.01	0.18	0.42
Maintenance	−0.48	−0.12	−0.03	−0.08
Proportion of Variance	0.34		0.11	Total = 0.45
Redundancy	0.15		0.00	Total = 0.15
Canonical correlation	0.68		0.20	
Canonical correlation squared	0.46		0.04	

Pain Intensity = Pain Intensity Scale; Depression = Center for Epidemiological Studies-Depressed Mood Scale; Catastrophizing = Pain Catastrophizing Scale; Anxiety = Clinical Anxiety Scale; Somatic Symptoms = Patient Questionnaire of the PRIME-MD; Activity Engagement = Chronic Pain Acceptance Questionnaire – Activity Engagement; Pain Willingness = Chronic Pain Acceptance Questionnaire – Pain Willingness; Pre-contemplation = Pain Stages of Change Questionnaire – Pre-contemplation; Contemplation = Pain Stages of Change Questionnaire – Contemplation; Action = Pain Stages of Change Questionnaire – Action; Maintenance = Pain Stages of Change Questionnaire – Maintenance.

correlations were close to zero. The F-test was F (30, 3110.00) = 29.05, $p < 0.001$ for all 5 canonical correlations. After removing the first canonical correlation, the F-test value was F (20, 2581.28) = 4.96, $p < 0.001$. Removing the third canonical correlation and subsequent removals produced F-tests that were not significant ($p > 0.001$). Therefore, significant relationships

TABLE 6 Canonical correlation analysis of the discharge dataset. Variables grouped by negative affect/ poor adjustment (Pain Intensity, Depression, Catastrophizing, Anxiety, Somatic Symptoms) and positive affect/ improved adjustment (Activity Engagement, Pain Willingness, Pre-contemplation, Contemplation, Action, Maintenance).

Discharge	First Canonical Variate		Second Canonical Variate	
	Correlation	Function Coefficient	Correlation	Function Coefficient
Negative Affect/ Poor Adjustment Set Variables				
Pain Intensity	0.45	0.10	−0.41	−0.39
Depression	0.79	0.26	−0.52	−0.95
Catastrophizing	0.97	0.79	0.22	1.14
Anxiety	0.70	−0.07	−0.30	−0.11
Somatic Symptoms	0.62	0.04	−0.36	−0.17
Proportion of Variance	0.53		0.14	Total = 0.67
Redundancy	0.31		0.01	Total = 0.32
Positive Affect/ Improved Adjustment Set Variables				
Activity Engagement	−0.78	−0.42	0.41	0.43
Pain Willingness	−0.69	−0.44	−0.52	−0.54
Pre-contemplation	0.76	0.34	0.12	0.57
Contemplation	−0.30	0.07	0.30	−0.12
Action	−0.57	−0.11	0.48	0.20
Maintenance	−0.58	−0.11	0.61	0.68
Proportion of Variance	0.40		0.19	Total = 0.59
Redundancy	0.23		0.02	Total = 0.25
Canonical correlation	0.76		0.30	
Canonical correlation squared	0.58		0.09	

Pain Intensity = Pain Intensity Scale; Depression = Center for Epidemiological Studies-Depressed Mood Scale; Catastrophizing = Pain Catastrophizing Scale; Anxiety = Clinical Anxiety Scale; Somatic Symptoms = Patient Questionnaire of the PRIME-MD; Activity Engagement = Chronic Pain Acceptance Questionnaire – Activity Engagement; Pain Willingness = Chronic Pain Acceptance Questionnaire – Pain Willingness; Pre-contemplation = Pain Stages of Change Questionnaire – Pre-contemplation; Contemplation = Pain Stages of Change Questionnaire – Contemplation; Action = Pain Stages of Change Questionnaire – Action; Maintenance = Pain Stages of Change Questionnaire – Maintenance.

between the two groupings were captured by the first two pairs of canonical variates.

Table 6 shows standardized canonical variate coefficients, correlations between the variates and canonical variates, proportion of variance, redundancy and canonical correlations for the discharge data. Similar to admission, the first pair of canonical variates were moderately related, and the second pair of canonical variates were weakly related. As compared to admission, both pairs of canonical correlates were more correlated in the discharge set.

All variables in the negative affect/poor adjustment set were correlated with the first canonical variate, with all correlations of these variables above 0.3 (28). The strongest correlations were again catastrophizing (0.97) and depression (0.79). All variables in the positive affect/ improved adjustment set were correlated with the first canonical variable. The strongest correlation was activity engagement (−0.78) and pre-contemplation (0.76). The first canonical variate indicated that increase in catastrophizing, depression, pain intensity, anxiety, and somatic symptoms was associated with decrease in activity engagement, pain willingness, contemplation, action, maintenance and increase in pre-contemplation.

The second canonical variate consisted of pain intensity (−0.41), depression (−0.52), and somatic symptoms (−0.36) in the negative affect/poor adjustment set, and pain willingness (−0.52), activity engagement (0.41) action (0.48), and maintenance (0.61) in the positive affect/improved adjustment set. The second canonical variate showed that decreased pain intensity, depression and somatic symptoms were associated with increase in activity engagement, action and maintenance and decrease in pain willingness.

Overall, negative affect/poor adjustment is negatively correlated with the positive affect/improved adjustment, with pre-contemplation positively correlated with positive affect/ improved adjustment.

Discussion

The aim of this study was to examine the structure of variables in patients attending a chronic pain program, specifically groupings illustrating positive and negative variables. In the biplot, the overall structure of the variables makes up roughly two groupings. One grouping consists of anxiety, depression, catastrophizing, somatic symptoms, pain intensity and pre-contemplation. The second grouping roughly consists of contemplation, action, maintenance, activity engagement and pain willingness. Pain willingness appears to be the least correlated with the other factors in the second group. These two groupings appear to resonate with the bivalent Behavioral Inhibition System-Behavioral Activation System (BIS-BAS) model (45, 46), with one grouping consisting of generally positive variables and the other representing negative variables. The negative variables appear to consist of anxiety, depression and cognitive content; and the positive variables appear to consist of positive emotions and affect (46). The BIS-BAS model, as proposed by Jensen et al. (2016, 2017) was devised to explain the benefits of psychosocial treatments for chronic pain (45, 46). It hypothesizes the existence of two groups of negative and positive cognitions, affect and behavioral intensions or motivations.

When comparing across admission and discharge biplots, the two groupings of variables become more tightly related at discharge. For example, in the positive variables grouping, contemplation moves closer to activity engagement, action, and maintenance cluster at discharge. This type of change has been previously described in the Dynamic Model of Affect (26) according to which, in stressful situations, the separation between positive and negative emotions decreases. The general pattern of clustering changes between admission and discharge as visualized in the biplots seems to reflect similar notions as those described in the Dynamic Model of Affect. That is, under stressful situations, the emotions become less differentiated.

This mixed state is shown in the admission biplot, with a wide spread of variables whereas in the discharge biplot, the separation between the groupings increases to create more distinct groupings, referring to a change to a possible lower stress state overall at discharge. This in fact, corresponds to the fact that all variables consistently improve at discharge from the four-week interdisciplinary pain management program (47).

Factors in the negative group, such as catastrophizing and anxiety, can be broadly considered to be related to poor psychological adjustment to pain (11). The physical functioning factors, namely pain intensity and somatic symptoms are very closely associated with emotional factors. Thus, physical sensation can be seen as an aspect of emotion. This highlights the importance of psychological treatment (48, 49). With the high correlation of pain intensity and somatic symptoms with these psychological factors, the first grouping may be considered as an aggregation of factors associated with poor psychological adjustment and physical functioning. Catastrophizing, emotional distress, and pain intensity have been found to be closely associated with each other (9, 50, 51). The pre-contemplation subscale of the PSOCQ is also positively associated with the close interplay of negative emotions, cognition, and physical pain. Patients in the pre-contemplation stage are focused on their physical pain and on seeking biomedical solutions (52). This grouping reflects earlier similar findings (23, 53).

In the canonical correlation analysis, at both admission and discharge, all five factors (pain intensity, depression, catastrophizing, anxiety, somatic symptoms) contribute to the poor adjustment canonical variate. Depression, and especially, catastrophizing contributes the most to predicting improved adjustment factors (activity engagement, pain willingness, pre-contemplation, contemplation, action, maintenance) as compared to the physically-focused factors, pain intensity and somatic symptoms.

Catastrophizing is the most influential factor in predicting improved adjustment. It is different from anxiety and depression. In the biplot, catastrophizing was more related to pre-contemplation as compared to other affective factors (depression, anxiety). In patients with chronic pain, depression and anxiety are more closely related to each other as compared with catastrophizing (54). Conceptually, catastrophizing is not pain intensity (55) but catastrophizing may be a mediator within the affective and physical factors such as the indirect effect of pain intensity on depressive symptoms via catastrophizing (7), or as a mediator for depressed mood, pain interference, and pain severity (10, 51, 56). Within the context of the pain experience and its effect on patients' lives, from the fear-avoidance model, catastrophizing may be a gatekeeper between recovery and the loop of negative affect (54, 57).

In this study, catastrophizing was measured as a single dimension, which limits its interpretability in terms of its three sub-dimensions of rumination, magnification, and helplessness (58). However, it appears that the most notable sub-dimension of catastrophizing is helplessness (58). Helplessness in catastrophizing is related to pain intensity (59). There may be an interplay between wanting to engage in recovery and return to normal living but helplessness keeps patients with chronic pain from doing so in the short term. Depression and anxiety may be related to long-term helplessness, as catastrophizing and depression are risk factors for physical disability and other poor adjustment outcomes in patients with chronic pain (50, 60). Thus, in this canonical correlation analysis specifically, it may be helplessness that most strongly correlates with factors of improved adjustment and functioning. Further analysis may examine this potential relationship.

In both admission and discharge biplots, there is another group of factors that appears generally negatively correlated with factors in the poor adjustment/functioning as mentioned previously. These factors consist of pain willingness, activity, engagement, contemplation, action, and maintenance. These are subdivisions of the chronic pain acceptance questionnaire and the stages of change questionnaire (13, 52), and psychological factors related to improved adjustment to chronic pain (11). The correlations within these factors are weaker as compared to poor adjustment/functioning. The weaker correlation is most noticeable with pain willingness, as it appears to be almost unrelated to both poor and improved adjustment and functioning. In the biplots comparing principal component 1 (PC1) and principal component 2 (PC2), the two adjustment/functioning groupings point in another direction away from pain willingness. This open space may be representative of factors related to positive psychology, such as life satisfaction or self-efficacy. Pain willingness contributes less to the canonical variate as compared to the other subscale of the CPAQ, activities engagement. Pain willingness has been shown to be different from activities engagement, as activities engagement appears to be more closely related to pain intensity and depression in comparison (12, 61–63). Even though it appears to be different from activities engagement in the biplot, pain willingness contributes to the improved adjustment measures in a similar manner as activities engagement.

Further examination is needed to see how other factors fit into this space captured by the biplot. The action and maintenance subscales of the PSOCQ are closely related, and may measure similar concepts (52, 53). Patients with chronic pain were more willing to engage in self-management at discharge (23). In the biplot, at discharge, contemplation becomes more correlated with action and maintenance as compared to admission (64).

Of the six different factors that make up the improved adjustment/functioning canonical variate (pain willingness, activity engagement, pre-contemplation, contemplation, action, and maintenance), activity engagement has the largest contribution to the canonical variate in relating to lower scores on the poor adjustment/functioning measures. High scores on activity engagement, pain willingness and lower scores on pre-contemplation are predictive of lower scores on poor adjustment/functioning. The negative contribution of pre-contemplation corroborates with the pre-contemplation vector placement on the biplot, grouping together with poor adjustment variables. Pre-contemplation is negatively correlated with the rest of the PSOCQ subscales, and has been shown to be correlated with negative pain control, depression, disability and pain severity (23, 53). The contemplation subscale contributed the least to the canonical variate. It has been shown to be different from the other subscales as well (23). At discharge, the contemplation variable became more closely related to the poor adjustment latent. Even though the PSOCQ was developed for assessing patient readiness to engage in self-management at admission to a program or therapy (52), it may be important to re-examine subscales, especially the pre-contemplation and contemplation subscales at discharge as well as when patients move into long-term self-management.

In terms of relating poor adjustment/functioning and improved adjustment/functioning, the most notable relationship between the two groups is highlighted by catastrophizing and activity engagement. This relationship had been conceptualized with the Coping Strategies Questionnaire (CSQ), as catastrophizing in the CSQ was associated with pain interference in activities and increased pain behavior (65, 66). As well, acceptance may be an important factor of consideration for examining catastrophizing (16). It is unclear if pain level is correlated with pain willingness or activity engagement (9). Thus, it may be possible that change in pain cognition, such as catastrophizing, is a more immediate essential treatment outcome as compared to pain willingness, which may reflect behaviors that follow successful cognitive transition to self-management. Further studies may examine this relationship and possible precedents.

In conclusion, this study mapped the overall structure and pattern of interplay between variables in pain management. The relationships were found to be congruent with theories and models of pain psychology. Further work is needed develop these variable structures and improve understanding of treatment outcomes.

Potential limitations include the sample studied. This study utilizes one group of patients from one pain clinic in Canada. However, the length of time in the collected data and the different patient referral sources provide variation in the sample. Another potential limitation is the two time points in the collected data. Additional time points may provide further insight into changes in psychosocial variables. Future studies may examine changes over longer and multiple time points.

Data availability statement

The data analyzed in this study are subject to the following licenses/restrictions: Hospital owned patient information. Requests to access these datasets should be directed to EH, hapidou@hhsc.ca.

Ethics statement

The studies involving humans were approved by Hamilton Integrated Research Ethics Board. 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

YL and EH contributed to conception and design of the study. EH collected and managed the dataset. YL performed the statistical analysis. YL wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

Publisher's note

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Hidden family rules: perspective on a dysfunctional paternalistic system and the persistence of pain

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This article explores how paternalistic control and power reside within the family system and how this may influence pain and its persistence. Drawing upon clinical case studies and existing literature, this exploration emphasises the role of paternal dysfunction in creating emotional memory images and delves into how this may influence the chronification and treatment resistance of pain (i.e., making pain "sticky"). We argue that a dysfunctional paternalistic family system, often characterised by authoritarian dynamics, emotional neglect, and abuse, results in adverse experiences and emotional memory images that create a fertile ground for the entrenchment and propagation of psychosomatic symptoms, including pain. Further, the paper emphasizes the potential intergenerational effects of such a scenario, where inherited "Family Rules" drive maladaptive coping mechanisms, which contribute to the persistence of psychological and physiological distress across generations. Understanding these complexities offers new perspectives on treating psychological disorders and their physiological ramifications. It also highlights the urgency of addressing dysfunctional familial dynamics in psychotherapeutic interventions for both immediate and long-term psychophysiological health outcomes.

KEYWORDS

family, family rule, pain, folie à deux, dysfunctional paternalistic system, painogenicity, emotional memory image (EMI), Split-Second Unlearning

Introduction

A nurtured child forms the foundation for health, wellbeing, and human development (1). Family strain and dysfunction have a negative impact on the flourishing of a child (2). Childhood adversity is associated with poorer health and the occurrence, severity, and impact of chronic pain in later life (3–9). Chronic pain negatively impacts family dynamics (10–12), and conversely, family strain negatively impacts pain experience (13–16). Chronic pain in parents is associated with non-specific chronic pain in adolescents and young adults (3, 17–21).

Paternalistic system power remains on the periphery of a pain practitioner's clinical practice. Adversity and trauma resulting from paternalistic system power may influence chronification and treatment resistance of pain later in life (i.e., making pain "sticky"). Pain stickiness is a nickname introduced by Borsook et al. (22) to capture numerous social, psychological, and biological factors that influence pain persistence, pain behavior, and resistance to therapeutic intervention. Borsook et al. argued a need for neurobiologically informed psychotherapy, focused on pain as a motivational drive to avoid harm, to assist people in overcoming pain behavior that prevents exploration of possible alternatives to a life with persistent pain. Our perspective is that "Family Rules" causing adversity and trauma produce emotional memory images (EMIs) that may contribute to pain stickiness.

Reviews of the literature provide evidence that internal family systems contribute to chronic pain and treatment outcomes and should be a target for intervention (23–25). In 2023, a systematic review by Nicolson et al. of 68 studies found strong associations between chronic pain in adulthood and a broad range of adverse childhood events including household dysfunction, bullying, living in fear, emotional trauma, and weak parental attachment (9). Nicolson et al. (9) identified 15 different types of adverse childhood experiences, with emotional abuse being common, although there were no studies that specifically investigated childhood adversity through the lens of paternalistic family system power. In this article, we seek to uncover where paternalistic control and power reside within the family system, and how this may influence pain and its persistence.

Family rules, myths, and secrets

Within an open paternalistic system of a family dynamic model/framework, shared responsibility among parents/caregivers allows the child to freely express their fears, hopes, and dreams (26). A closed paternalistic system demands power and control over those within it, creating censorship, isolation, and fear (27, 28). Satir suggested that family members would develop various behavioural strategies termed "Survival Stances" to describe how individuals acted out their roles to "survive," such as placating, blaming, super-reasonable, and irrelevant (27).

The Family Rule maintains a closed paternalistic system. When a parent (or caregiver) is perceived as uncaring by the child or is caught doing something that they should not be doing, the parent may attempt to suppress the child's knowledge of the event by explaining that the child has misunderstood the situation. By discrediting the child's understanding of a situation in this way, a parent "saves face," hiding the event from others and psychologically suppressing the event for the child and the parent. As the child grows older, the experience may be assigned to a myth or kept a secret, following a Family Rule of maintaining silence out of fear of reprisal. It is as if the secret "hangs" in the relationship as an "ever-present noose," ready to tighten if it should ever be approached (29).

Societal norms that prioritize materialism through a culture of having rather than being contribute to the decline of mental and physical wellbeing, as the focus becomes possessing rather than experiencing (30, 31). When fundamental human needs for autonomy, relationships, security, and purpose are not met, the detrimental effects of materialism become more pronounced (32). Consequently, individuals conditioned to adhere to these norms may favor materialistic remedies such as medication over conversational therapies (33, 34). Thus, we posit a pain patient raised in a closed paternalistic system perpetuating harm and dysfunction via a Family Rule would favor biomedical physicalist or mechanistic explanations for their pain and would seek "physical treatments" for a "physical ailment," even when they are aware that they have been a casualty of psychological trauma. Speaking out or asking for help from the clinician may be psychologically impossible for the patient, as they may be trapped inside a subconscious Family Rule, which enforces the rule of the dominant family member over the health and wellbeing of the individual. The patient may aggressively or passive-aggressively deny any psychological sensitivity. In contrast, a pain patient raised in an open paternalistic system may present to the clinic able to discuss any emotional factors that may be contributing to their pain.

Family system power—a metaphorical folie à deux?

Here, we use the concept of a folie à deux as a metaphor to enlighten the pain practitioner about the nature of patients who may have a non-conscious Family Rule. Folie à deux is considered a delusional belief system held by two or more individuals within the field of mental illness. In 1860, Jules Baillarger coined the term "folie à communiqué" to describe a shared psychotic disorder, and in 1877, Laségue and Falret coined the phrase "folie à deux" ("madness for two") to describe a psychotic disorder shared by two people. American psychiatrist Theodore Lidz and his colleagues carefully observed 14 families of people diagnosed with schizophrenia (35–37) and found that behaviors would be shared between the dominant individual (inducer) who would apply rules to the family (induced) (38, 39) but not to themselves, which to the "induced" would appear as an admonition—"Do as I say, not as I do." The inducer would clearly set themselves up to be seen as a hypocrite, yet the rest of the induced family would suffer punishment if they were to point out that this was the case—"the Emperor has no clothes" (40, 41).

Originally, it was assumed that the primary partner (the inducer) who initiated the delusions had a domineering personality, and the secondary partner (the induced) was generally submissive. This idea has been superseded by the concept of an adaptive mutual delusional system that allows members and partners to identify with each other, channel aggressive drives, and preserve intimacy (42–45). Today, the term folie à deux has been broadened to encompass a delusional belief system concurrently held by two or more individuals, so despite the wording, the disorder is not confined to pairs; it can encompass larger groups, adjusting to "folie à trois," "folie à famille," (44) and "folie en société" (46). This is to represent the number of people engulfed in the shared delusion. In psychiatry, a folie à deux is analogous to the "double bind" first proposed by Bateson in 1956 (47), as a miscommunication within a paternalistic relationship that can lead an individual to schizophrenia.

We caution that our use of folie à deux as a metaphor should not be interpreted to imply that pain is a form of psychosis. Our viewpoint is that the Family Rule is a form of miscommunication within a closed paternalistic system, a metaphorical folie à deux and double bind, that is a potent source of EMIs that, in turn, are realized as changes in neurobiology, including neurophysiological sensitization and bioplasticity that contribute to hyperalgesia, allodynia, and "sticky pain" (48). Furthermore, the relationship between cognitive distortions induced by dysfunctional closed paternalistic systems and pain is complex and far wider in scope than simply a shared delusional disorder (29), e.g., to include family system effects on assuming a "sick role" and illness behaviour (49).

Family rules and emotional memory images

Emotional memory images are central to our theory of Split-Second Unlearning and psychophysiological disease. We proposed that adverse, emotionally overwhelming first-time experiences create EMIs (50) defined as "Trauma induced, non-conscious, contiguously formed multimodal mental imagery, which triggers an amnesic, anachronistic, stress response within a split-second" (51). In brief, traumatic events instigate psychophysiological stress responses and the formation of EMIs within very short "split-second" time frames, and these EMIs can be retriggered in daily living "replaying" stress responses, the recurring nature of which results in chronic "disease." We posit that a Family Rule creates a multimodal EMI resulting from auditory (verbal and non-verbal sounds) and visual cues from the inducer, such as anger, disapproval, and rejection.

The EMI "holds" the unspoken, non-conscious rule, which must be obeyed to prevent severe punishment. The ultimate punishment as an infant may be abandonment by the parent or caregiver (inducer) or the withholding of love and attention (29). Generally, adults can rationalise rejection, whereas cognitive areas of the brain are still developing in children, and therefore, a "primitive" fight–flight–freeze reaction applicable to survival is more likely, i.e., the sense that the situation is "life or death." In infancy and childhood, fighting or fleeing are implausible options, so freeze responses of hyperarousal or hypoarousal are activated to avoid punishment. Bateson et al. (47) suggest that repeated experiences embed adversity, although we assert that EMIs are a contiguously formed response to a single first-time emotionally overwhelming experience.

The EMI is formed when a child is in a state of heightened vulnerability and is learning to grapple with ambiguity and uncertainty stemming from the parent or caregiver's actions. This "learning" becomes encoded within the EMI. Empirical research into adverse childhood experiences underscores the profound psychophysiological repercussions in adults who endured harm during their formative years (52–55). Hence, the EMI traps the child in a psychological double bind, in which they seek assurance from a figure whose behavior is inconsistent. This predicament may precipitate an intolerance of uncertainty, compelling the individual to eschew scenarios that could trigger the EMI [see (56, 57)].

Activation of a Family Rule results in a non-conscious limbic system sympathetically mediated freeze response. In stressful circumstances that enable fight or flight, stress hormones are produced to mediate energy-consuming physical activity. The freeze response, however, puts the person into a heightened state of "pause," and the person is held in a perpetual state of hypoarousal, manifesting as withdrawal and avoidance of sensory stimuli. This may explain, at least in part, the sluggishness observed in psychophysiological states of disease including depression, chronic fatigue syndrome (myalgic encephalomyelitis), and chronic primary pain (58). Chronic primary pain is defined as pain associated with significant emotional distress or functional disability that is not better explained by another chronic pain condition and includes non-specific chronic musculoskeletal pains (e.g., low back pain, neck pain), widespread pain, fibromyalgia, and irritable bowel syndrome (58–60).

The Imbalance of Threat and Soothing Systems model, proposed by Pinto et al. (61), corroborates this theory. In the Family Rule scenario, the freeze response is an optimal survival strategy as the induced do not have the fortitude to flee from or fight the perpetrator. Thus, children or vulnerable adults remain subservient. Releasing a person from a state of hypoarousal may enable a person to act out a fight or flight, assisting escape from the freeze response. We posit that the censorship created by the inducer proliferates the delusion, and the threat of neglect or abuse creates an EMI in the "induced," suppressing their "spirit," resulting in their silence.

We contend that EMIs facilitate psychophysiological disease through dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis, triggering the stress response that augments physiological processes associated with persistent (primary) pain. Genes influence the response of the HPA axis to traumatic events in early life (e.g., FKBP5 and CRHR1 polymorphisms) (62) and how people respond to experiences in early life (63) and in adulthood (64); this may affect risk for chronification of pain (65). Borsook et al. (22) focused their discussion of the stickiness of pain on the contribution of neurobiological processes to a "stuck pain state", including stress-induced epigenetic modifications, central sensitization, synaptic plasticity, HPA axis activity, brain circuitry, and opioidergic and dopaminergic tone, and how these may influence vulnerability or resilience to chronification. We advocate exploring the relationship between paternalistic family dynamics and the stickiness of pain at neurobiological and psychological levels, including health anxiety and reinforcement through caregiving behavior by formerly hostile or critical family members.

Previously, we have described a Split-Second Unlearning theory as a therapeutic framework to diagnose and "clear" EMIs created by trauma and adversity (50). Here, we describe how Split-Second Unlearning techniques can be used for clients presenting with trauma and adversity arising from codes of conduct (behavioral rules) imposed on family members by a dominant family member who does not follow the behavioral rules themselves.

Childhood abuse and trauma

There is strong evidence that adverse childhood experiences are associated with mental health disorders and persistent pain later in life (5, 54, 66, 67). Adverse childhood experiences include emotional and physical neglect and sexual, physical, and emotional abuse. Adverse childhood experiences that are created during a child's formative years when the brain is developing, may leave a lasting imprint within the brain structure or, at the very least, an EMI that perpetuates a cascade of molecular and neurobiological effects, which hinders neuronal development (68, 69). This past adversity subsequently becomes the lens through which the child filters their experience of the world around them. This "experience" can develop into psychiatric symptoms like psychosis, aggression, or anxiety, as well as hostile behaviour as non-conscious physiological processes in the brain "hide" the person's awareness (observer) from the perpetual threat (70).

Globally, it has been estimated that up to 1 billion children have suffered abuse within dysfunctional Family Rule structures (71–74), contributing to adversity and the potential for intractable pain later in life (3–5). Previously, we have explored "Past Adversity Influencing Now" (PAIN) through the lens of temporal language and how this may impact the persistence of pain (75). Considering the relationship between hidden Family Rules and PAIN can assist the practitioner in affecting a positive outcome for the patient presenting with persistent pain.

Detecting PAIN in clinical practice

The literature on childhood and preverbal trauma suggests that adverse experiences associated with Family Rules are difficult to identify. This is likely due to the young age at which adversity has taken place, within the child's development, and the nature of the traumatic event, e.g., varying severity of sexual, physical, or psychological abuse.

In 2023, we introduced a framework called PAIN to encourage exploration of pain through a temporal lens, guiding individuals toward a more positive future (75). Our PAIN framework encompassed temporal phases of pain: past perfect, past imperfect, present, future imperfect, and future perfect. We suggested that EMIs may contribute to a future imperfect and "sticky pain." We described how detecting PAIN requires the practitioner to observe the client's eyes, breathing, voice tonality, and skin tone while completing a case history. The client may not be able to answer obvious questions such as "Were you raped or severely traumatized as a child?" due to the amnesic and anachronistic nature of the EMI formed by the original trauma (51), serving to "keep the family secret safe."

The practitioner can gently coax the client by explaining that EMIs are created via experiences that are emotionally overwhelming at the time. For example, a parent or caregiver yelling at a child playing with a spider, "Don't touch the spider!" produces a fear-induced EMI in the child. Prior to the yell, the child was not afraid of the spider, and the new EMI motivates fear-avoidance reactions to spiders, promoting safety and survival in future encounters. EMIs are created within a dysfunctional paternalistic system, whereby as a child the individual is powerless and complies with the wishes of the "ruler" (inducer), even when illogical, to "survive." This makes sense to those who are within the paternalistic system but may appear to be "fuzzy logic" to an outsider (see **Figure 1**). By providing the client with a simple explanation of this process, practitioners "allow" clients more scope to be open to the prospect of having PAIN.

Structure of compliance

Children are reliant on parents or caregivers as a route to survival. From an evolutionary perspective, children are adapted to promote behaviors that seek alliances with parents or caregivers who provide protection and access to food. Disobeying parents or caregivers may be catastrophic to health and wellbeing, with the possibility of death. Parents or caregivers may impose codes of conduct (behavioral rules) on their children without following the behavioral rules themselves. Neurolinguistic programming (NLP) describes this process from the perspective of the parent or caregiver as a No/My rule structure, i.e., No rules for me/My rules for you. Compliance is the "safest" strategy for a child to "survive" (exist without confrontation) in this rule structure; from the child's perspective (induced), the rule structure is Your/. (period), i.e., your rules for me, full stop—there are no other rules (76). A synopsis of Family Rule structures is provided in **Table 1**, where the EMI is seen as a psychophysiological heuristic.

Practitioners can incorporate knowledge about Family Rules when using Split-Second Unlearning techniques to "clear" an EMI from a client presenting with bodily pain with no ostensible pathology (e.g., chronic primary pain). PAIN can be revealed via microexpressions that manifest while taking the case history. Making the client aware of their microexpressions (i.e., a biobehavioral marker) indicative of an EMI and engaging the client in a curious exploration of PAIN may be enough to shift their conceptual understanding of their painful condition, opening new opportunities for recovery [further details on these techniques can be found in our previous studies (75, 77)].

Case vignettes

Here, MH uses case vignettes as examples of Split-Second Unlearning to treat PAIN in practice.

Case vignette 1

A 12-year-old girl presented with chronic, widespread, non-specific musculoskeletal pain. The girl had been adopted from an unkempt orphanage in Eastern Europe, where she had been placed by her birth mother. The girl's adoptive mother presented with anxiety regarding her daughter's adoption, and I believed that this anxious tension was translating to her adopted daughter, precipitating musculoskeletal pain. The adoptive mother was diagnosed as having an EMI of her daughter as an infant, resulting in PAIN. As the adoptive mother spoke, both the mother and the daughter sat with their eyes transfixed on the spot within the peripersonal space between them. The mother was encouraged to look through the image of the past and to see

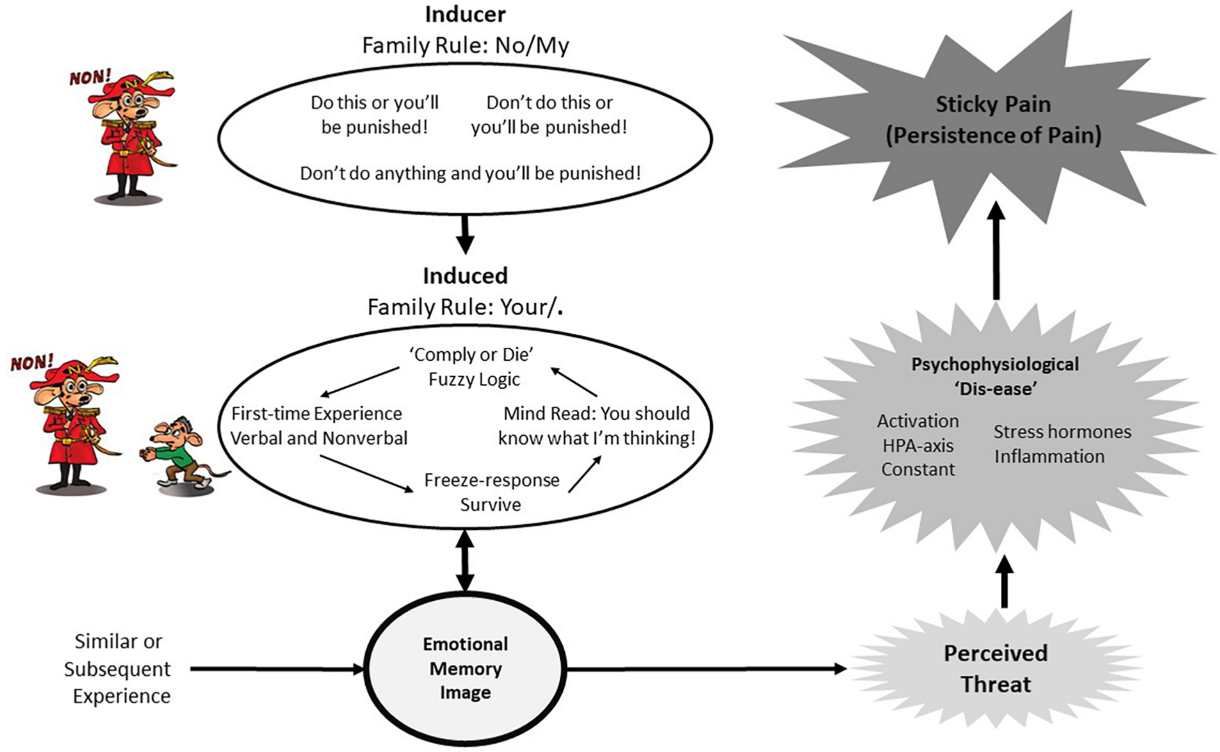


FIGURE 1
Family rule process.

her daughter with today's eyes. This action simultaneously cleared the EMI and the Family Rule of compliance; without the EMI, no rule is necessary. Clearing the adoptive mother's EMI reduced all pain from the girl within 30 minutes of treatment. The client was given an appointment for an online follow-up call 1 month later, at which the child reported no recurrence of symptoms; this was maintained at the 2-month, 6-month, and 12-month follow-ups. It is as though the child's pain was acting as a cry for help on behalf of both the mother and child, who were trapped in PAIN.

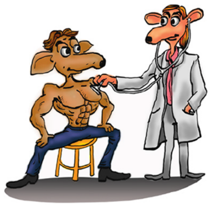
Case vignette 2

A 15-year-old girl with myalgic encephalomyelitis and chronic widespread non-specific musculoskeletal pain presented to the clinic with her mother. The girl had physically matured early, which her mother reported to be of great concern to her father. The mother reported that the father was lavishing extra attention on the girl to ensure his daughter did not start dating, destabilising the family system. It was suggested to the mother that this may be precipitating her daughter's symptoms while the daughter listened indignantly. It was fascinating to note the mother's eyes were averted, while her daughter's eyes were fixated. Both aversion and fixation are signs of fear. The mother was listening, avoiding looking at her daughter, and her daughter was glaring when the Family Rule was brought to their conscious awareness. This is against the rules! The EMI in this situation is held in place by the Family Rule "Though must obey!"; both are induced, and the EMI oppresses them. The action of naming the source frees all from the rule, including the father, and restabilises the family system. The client was given an appointment for an online follow-up call in 1-month. The mother reported that she had discussed our session with her husband, and the couple had begun spending more time on their relationship. Thus, the father had reduced the overwhelming attention given to his daughter. The daughter's pain and fatigue had diminished greatly. At the 6- and 12-month follow-ups, the daughter reported that she was without pain or fatigue.

Case vignette 3

A 48-year-old woman presented with finger joint pain associated with rheumatoid arthritis that had persisted for the past 3 years. When talking about her past experiences, the client's eyes looked to her left; this was interpreted as an experiential timeline from left (her past) to the right (her future). Interestingly, when the client spoke of her arthritis, her eyes fixated upward and to the right. This was interpreted as indicative of an EMI that was generalizing over time. I described my observations and deductions to the client, who appeared astonished and began to recall a conversation with her mother approximately 35 years earlier. The client explained that her mother had early-onset rheumatoid arthritis at age 45 and had been told that if she had a daughter, the daughter would suffer the same fate. This EMI, created from the conversation with her

TABLE 1 Rule structure metaprograms.

Family Rule	Description	Example
1. My/My  These individuals have rules for themselves, and they believe others should have the same.	My rules for me, my rules for you "If you want it to work then follow my instructions."	"I've learned to live with my pain, you must learn to live with your pain too!"
2. My/. (period)  The individual is not concerned about others, seeking only what concerns themselves—period!	My rules for me, full stop (i.e., there are no other rules) "I did it my way." My/. is synonymous with My/No—My rules for me/No rules for you—I'm not bothered about your rules.	"I'm not bothered about statistics I am talking about my pain"
3. My/Your  These individuals have rules for themselves but do not impose them on others.	My rules for me, your rules for you "Each to their own."	"Better lifestyle choices cleared my pain, but you've got to find what's right for you"
4. No/My  These individuals have no rules for themselves and apply rules to others.	No rules for me, my rules for you "Do as I say not as I do." No/My is synonymous with Your/Your—Your rules for me (I must obey you), your rules for you (you can do what you want)	"I have no idea how to clear my pain, but I know what you should do to clear yours"

(*Continued*)

TABLE 1 Continued

Family Rule	Description	Example
5. Your/. (period)  These individuals are oppressed and will comply with whatever their oppressor decides.	Your rules for me, full stop (i.e., there are no other rules) "Anything you say or do is alright with me"	"Whatever you want me to do to clear this pain I'll do it"

Metaprograms act as cognitive shortcuts guiding an individual's decisions, behaviors, actions, and interactions. They represent the internal interpretation of the external reality of experience. These mental frameworks dictate both the focus of an individual's attention and the way they pay attention to things. In the table, rules 1–4 are identified within the NLP literature (see Charvet (78) for more detail on metaprograms). Rule 5 is a new rule created by Hudson (76) that allows for compliance and oppression, leading to "dis-ease" and must be present for an individual to be compliant and survive in a dysfunctional paternalistic system.

mother, remained dormant until the client reached 45 years of age. As the client spoke, she displayed a PAIN; her eyes were wide as she appeared detached from the present and fully associated with her EMI of the past. By bringing the EMI to the client's awareness and explaining how her mother's adversity had transferred to her, the EMI cleared, and the client was fully associated with the present once more. At the 1-month follow-up appointment, pain and swelling had diminished, and flexibility had returned to the client's fingers. At the 6- and 12-month follow-ups, there was no recurrence of any pain.

Summary of case vignettes

The case vignettes demonstrate that bodily pain may be driven by PAIN. Attention to PAIN within a framework of Split-Second Unlearning may rapidly resolve bodily pain by clearing an EMI, allowing the HPA axis to return to a prestress state. The vignettes are examples of psychotherapeutic intervention; however, practitioners must appreciate that these clients did not require "talking therapy." Often, clients are unaware that they are traumatised, either with a capital T or a lowercase t, although they are aware of bodily pain and require help from a practitioner. In vignettes 1 and 2, the parent and child must be present for the Family Rule to be broken or cleared. By gaining new insight into the psychological aspect of pathology, no blame is apportioned to the caregiver, and the EMI is cleared. We concur with Ecker and Vaz (79) that the process of erasure clears any psychophysiological attachment to this emotional learning. In all cases, the Family Rule is the elephant in the room, which will continue to create misery and pain if the practitioner is unable or unwilling to address it.

Closed paternalistic systems and painogenic environments

In a broader context, closed paternalistic systems with the potential for dysfunctional rules, structures, and maladaptive beliefs can operate at various levels in society. This may include idiosyncratic beliefs of an individual, beliefs shared by a few individuals (shared delusions), and beliefs shared by subgroups, subcultures within and between communities, regions, and nations, resulting in, for example, prejudice, discrimination, or dogma. A "collapsing tin can" metaphor describes people living within a "closed-societal system": A social milieu of threat, fear, and anxiety mediated by complex societal structures, settings, and narratives compresses the mental wellbeing of individuals, creating a closed societal system, like high atmospheric pressure compressing the walls of a tin can with a low-pressure interior. Forces producing this constraining milieu may be insidious and invisible to individuals (32, 80, 81). Individuals utilize a variety of strategies for existing and surviving within the pressure of the closed system. Psychophysiological disease may be a consequence and/or a survival strategy of being immersed in insidious macrolevel forces. This promotes the rise in mental illness and non-communicable diseases, including chronic primary pain, chronic fatigue syndrome, depression, generalised anxiety, and so on (82).

Societal settings creating closed systems operating within a No/My authoritarian rule structure (i.e., No rules for me/My rules for you) may fall foul of groupthink. Groupthink is when no one will challenge the thoughts of a group and people just go along blindly obeying in a Your rules for me/full stop fashion (i.e., Your/.).

> "They are playing a game. They are playing at not playing a game. If I show them I see they are, I shall break the rules and they will punish me. I must play their game, of not seeing I see the game" (83, p. 1).

We contend that a dominant biomedical groupthink may be detrimental to alleviating the societal burden of chronic pain, leading to personal suffering. Insights may be gained by exploring dysfunctional paternalistic systems within the socio-ecological framework of painogenicity (84). The concept of painogenicity provides a socio-ecological framework to explore the persistence of pain (84, 85). Painogenicity is the sum of influences that the surroundings, opportunities, or conditions of life have on promoting persistent pain in individuals or populations, encompassing micro-, meso-, and macrolevel factors (85, 86). Macrolevel factors such as built or natural habitats, geopolitics, and economic sectors are often neglected in models of pain, despite their potential to foster a social milieu of threat, fear, and anxiety through illness narratives of pain grounded in tissue damage, pathological causation, and warmongering of biomedical remedy (80, 87).

Increasingly, scholars argue that biomedicalisation of mental health conditions and chronic (primary) pain has perpetuated rather than diminished the burden of disease (32, 88). No doubt, biomedical remedy assists resolution of episodes of pain in many people, some of the time, although the global burden of persistent pain remains high irrespective of a country's social and economic development and despite ever-increasing varieties of treatment (89–91). We advocate exploration of this treatment-prevalence paradox through the lens of a closed paternalistic biomedical system to deepen an understanding of socio-ecological factors influencing the persistence of pain and other intractable non-communicable diseases, including mental illness.

Conclusion

In this article, we describe how dysfunctional family structures may lead to Family Rules resulting in PAIN and EMIs that contribute to the persistence (stickiness) of bodily pain. We describe a Split-Second Unlearning approach to "clear" EMIs and unblock the detrimental effects of PAIN, with the potential for a "healing journey" toward recovery from persistent pain (92). We position this approach within a salutogenic framework of care (93) that may be more successful than biomedical interventions in "unsticking" pain.

We conclude that exploring pain and its persistence within a dysfunctional paternalistic context could deepen an understanding of factors contributing to chronification and treatment resistance and may provide opportunities to assist people on a "healing journey". Emphasizing a holistic, socio-ecological model of pain encourages healthcare practitioners to think beyond traditional diagnoses and treatment strategies. In this regard, consideration of the influence of family dynamics and psychosocial factors on a person's experience of persistent pain may improve intervention strategies and potentially break intergenerational cycles of disease.

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

MH: Conceptualization, Writing – original draft, Writing – review & editing. MJ: Conceptualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

MH is the co-founder and co-creator of the MindReset app, which is supported by individual subscribers. In the previous 5 years, MJ's employer has received income for expert consultancy activities from GSK, TENSCare, and LifeCare Ltd. that lie outside the submitted work. MJ declares book royalties from Oxford University Press. MH was employed by Mind Help Limited.

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Ayurvedic protocols of chronic pain management: spatiotemporality as present moment awareness and embodied time

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Background: Temporality is understood as the subjective perception of the flow of chronological time and is a central component of contemporary and integrative medicine approaches. Although temporal dynamics are recognized as central to the processes associated with chronic pain (CP), the temporal management of CP is inadequately understood in pain research.

Research question: How is temporality conceptualized in Ayurvedic protocols of CP management?.

Method: Ayurvedic physicians ($N = 10$) from India were recruited through purposive and snowball sampling. A semi-structured interview protocol was employed to gather qualitative data focusing on the Ayurvedic protocol employed to treat CP patients. The interviews were audio-recorded, professionally transcribed, and thematically analyzed. Member validation, participant voice, and researcher self-awareness were employed to strengthen reliability and validity.

Findings: An ontologically grounded thematic exploration of Ayurvedic protocols illustrates that temporality is conceptualized in CP as spatiotemporal present moment awareness (PMA) and embodied time (ET). Spatiotemporality as PMA references an awareness of the relationality of cognitive temporal movement, *dosha* operations, and their pathophysiological expression in the body. Spatiotemporality as ET is conceptualized as awareness of the expression of time in embodied emotional and psychosocial processes as in the movement of the breath through the body, the movement of body sensations over time, and in their intersection with consciousness.

Discussion: The study findings present an experiential and relational framework situating spatiotemporality ontologically as an organizing principle in CP management. While temporality focuses on the representation of experiences and relations over time, spatiotemporality foregrounds a constructionist approach by centering the embodied spatial cognitive expression of time, consciousness, and subjective experience.

KEYWORDS

mind–body approaches, complementary and integrative medicine, environment, chronic pain management, Ayurveda, ecological, spatiotemporality, embodied time

Introduction

Chronic pain (CP) is the leading indication for the use of complementary and integrative medicine (CIM) approaches (1). Approximately 33% of adults and 12% of children in the United States use CIM for a range of conditions such as the management of back, neck, and joint pain (2–5). CIM therapies support enhanced ownership of care and shared decision-making (6–8) and employ diverse ontological frameworks to emphasize an experiential and relational praxis (9–14). Studies focusing on body ownership in CP management (15) emphasize the individualized nature of pain to underscore the benefits provided by multisensory integration and self-awareness from CIM therapies employing mindfulness, deep breathing, gratitude, and relaxation techniques (9, 16–19). CIM therapies employ temporality (in movement, mindfulness, and seasonality) in targeting subjective wellbeing and health-related quality of life (20) through centering the organization of experiences and relations over time. Temporality emphasizes the subjective perception of the flow of chronological time through the past, present, and future, as experienced through historicity in events and movement, or understood phenomenologically as simultaneity, subjective duration, successiveness, and the subjective present. CIM therapies involving meditation and mindfulness focus on awareness of the passage of time and self-consciousness, distinguishing between self-time perspective (internal time), world duration (external time), and the embodied self as associated with the subjective experience of internal time (21). The consciousness of subjective time is experienced in relationship with the temporality of pain experience through being conscious of the present as a moment in time (22). Temporality in CP can be experienced as a form of depersonalization separating the field of presence from the past and the future through embodied functions such as implicit bodily memory and bodily anticipation (23). Although such findings address temporality, the embodied self, and subjective time in CP, there is an inadequate understanding of how temporality is conceptualized by CIM providers and how CIM providers employ temporality in managing CP. Similarly, the patient's subjective experience of pain temporality in CP management also remains underexamined (24). The pain experience disrupts lived temporality, suggesting a need to examine how time is experienced in the CP phenomenon (25).

The multicomponent nature of temporality is underscored in examinations of how time (e.g., through time perception) contributes to the construction of health and flourishing. Phenomenologists have attended to the construction of temporality through the temporally contracted disease progression model to a focus on the present discrete snapshot of disease in the diagnosis and prognosis process (26). In humans, time perception encompasses the integrating and evaluating temporal facet of memories, emotions, and experiences. It has been examined through constructs such as present fatalism, morning–evening orientation (27), present-hedonism orientation, and subjective and objective passage of time to understand the interconnections between circadian typology, individual time perception, and passage of time (28). Interest in time perception has spanned identification of its neurobiological basis through a focus on brain structure variations (28) to understand its relationship with the flow of time (29), image of time (30), and neural bases for perception of time (31) to understanding its role in behavioral health through explicating its associations with self-regulation (32), anxiety, and depression (33), among other outcomes.

More recently, consciousness and self-reflexivity have been recognized as components of temporality in the pain experience. Investigations of neural correlates of mental phenomena such as the self, consciousness, and perception have examined spatiotemporality as a mechanism for understanding how the brain's activity in constructing inner time and space is manifested in cognition and mental features (34). The neurophysiological estimation of time and the perception of self are considered as sharing a common neural substrate, suggesting that alongside bodily arousal and attentional capture, self-reflexivity may also be a component of dilated subjective time during the experience of pain (35). Imaging studies suggest a spatiotemporal reorganization of brain activity and CP cognition whereby conscious experiencing of unpleasant sensory or emotional sensations through cognitive processing is perceived as pain (36). One way of considering temporality, thus, is as embedded in the neurophysiological expression of CP. The inter-individual difference in the neurophysiological encoding of painful stimuli and memory emphasizes how the anxiety influences the handling of the noxious vs. the innocuous stimuli (36).

A focus on anxiety and sensory intensification in the pain experience emphasizes pain development as constituting its own time within time, as through slower life routines, greater uncertainty, and a limited future time perspective. Temporality has been assessed in chronic (or persistent) pain measures through pain temporal pattern, pain duration, and future time perspective. Future time perspective is understood as the subjective perception of time as limited or expansive in an assessment of future opportunities and the amount of time one has left to live (37). In contrast, flow experiences are temporally grounded in their perception of life in its entirety within a unified flow process and with a unified sense of purpose (38). Some studies have examined how pain limits individuals' qualitative perceptions of the future by challenging their ability to construct flow experiences that envision a future or by negatively affecting their future outlook (39). Moreover, a limited future time perspective is associated with greater pain-related activity interference whereas longer pain duration as in CP has been associated with a more expansive future time perspective (40).

Along with future time perspective and flow experiences, the conceptualization of temporality in CP has focused on balanced time perspective or an adaptive engagement with past, present, and future time perspectives in alignment with contextual elements (41). The balanced time perspective is associated with myriad positive psychosocial outcomes including higher life satisfaction (42), emotional intelligence (43), psychological need satisfaction and gratitude (44), happiness (45), attributional complexity, wisdom, and mental health (46), and mindfulness (47, 48). Temporally, mindfulness has been understood as a non-judging and open way of relating toward the present moment (49) associated with constructs such as knowledge of one's true self (50), self-awareness, and meaning in life (51). Balanced time perspective is also associated with outcomes such as emotional regulation and affect (52); flow, mindfulness, and mental health (53); and adaptive identity styles and flourishing (46). Because cognitive and emotional processes involved in the construct meaning-in-life draw upon distinct temporal frames, the meaning-making and time perspective relationship can be modified in illness domains such as CP. Similar to mindfulness, the construct meaning in life is also temporally grounded, referencing an orientation to the world that embraces the past, present, and future (54, 55). For instance, meaning-making through the past orientation has been associated with autobiographical reflections (56), in the present by staying in the moment or present-focused with mindfulness (33), and in its future orientation with wellbeing processes (57). The association of time perception (e.g., as future and balanced time perspective) with subjective wellbeing, meaning-making, and mental health (including positive associations with love, joy, life satisfaction, wisdom, growth narratives, gratitude, life satisfaction, and flow experiences) suggests how understanding temporality is central to managing anxiety, depression, and negative affect associated with CP (58, 59).

Although temporal dynamics are central to the pathophysiological, psychosocial, and behavioral processes (including mindfulness, meaning in life, and flourishing) associated with CP and its clinical management, their association with the temporal facets of the pain experience (e.g., frequency, duration, and intensity of pain episodes) has not received adequate attention in pain research (60). Methodological approaches such as ecological momentary assessments have examined the modulation of pain experiences and their dynamic nature over time with patients' natural daily environments, variability in context and activity dependence, and diurnal cyclicity. However, the temporality of these associations has not been sufficiently examined in CP management [e.g., circadian variability of CP in rheumatoid arthritis (61–64)]. CIM approaches such as the Ayurvedic system of medicine focus on temporality (e.g., in the characterization of *dosha* dominance in the lifespan, diurnally, seasonally, and ecosystemically; where *dosha*s reference the manifestation of the three forms of energy, *vata*, *pitta*, and *kapha*, that govern the operations of the body) and provide an ontologically distinct medical model for understanding temporality in CP management. For instance, Ayurvedic medical protocols of CP categorize musculoskeletal pain conditions as dominated by *vata* and *kapha doshas* and as affected by diurnal (morning stiffness and increased pain intensity in rheumatoid arthritis are seen as an instance of clinical presentation in musculoskeletal pain) and seasonal changes (65). Ayurvedic treatments (*Amavata* for diagnosis and *virechanakarma,* including *swedana* in the morning) prioritize the observation of temporality in the diagnosis, prognosis, and therapeutic processes [e.g., by avoiding daytime sleep, *divaswapna* (66)]. Thus, an examination of Ayurvedic conceptualization of temporality can further conceptual understandings of temporality and provide innovative insights into CP management from distinctive ontological medical models. This study examines how temporality is conceptualized in Ayurvedic protocols of CP management through an in-depth thematic analysis of semi-structured interviews with Ayurvedic physicians.

Materials and methods

Participants and procedures

The study analytic procedures have been described elsewhere in detail (12). The goal of this concise, exploratory qualitative study is to provide deeper insights into the phenomenon of interest (CP management in Ayurvedic protocols). To achieve this goal, a methodological approach centered on expert sampling of Ayurvedic physicians in India ($N = 10$) with a Bachelors of Ayurvedic Medical Science (BAMS) degree was employed to gather information-rich data with limited resources (see Table 1 for participant description) (67). The study participants were recruited from a city in the southwest and one from the northwest region of India from a professional training center and based on public practitioner searches. Participant recruitment was conducted following the criterion of maximum variation, availability, willingness to participate, and ability of participants to communicate experiences and opinions in English in an articulate manner (68). The study's participant recruitment was concluded once a representative depth and breadth of perspectives was obtained from a small yet tightly focused pool based on saturation within a specific content domain and where participant responses showed low variability and high homogeneity (69). A semi-structured in-depth interviewing protocol (Appendix 1) was employed with a combination of open-ended domain-level questions and probes for the exploration of participant beliefs, thoughts, and practices. The case study method was consulted to elucidate the conceptual dimensions of an underexamined, niche conceptual domain and to identify similarities and differences in the phenomenon of interest (68, 70). To gain an understanding of CP management approaches in-context, the researcher incorporated observations of Ayurvedic provider–patient interactions, artifacts, offices, and hospitals *in situ* in national and regional urban centers and through official tours of national and international Ayurvedic medical institutions in India (Table 2 provides a summary of the research methodology flow). Participant interviews were conducted in practice sites, residences, and hospitals and were audio-recorded, professionally transcribed verbatim, and analyzed using thematic analysis (71). The interviews were conducted in English; thus, the participants' occasional recitation of native language verses (e.g., Sanskrit) from original ancient texts such as the *Charaka Samhita* in their interviews was not transcribed. The researcher has native or bilingual proficiency in English and Hindi and elementary proficiency in Sanskrit.

TABLE 1 Participant demographics.

Pseudonym	Age (years)	Education	Specialty	Profession*	Employment (years)***	City†
A	32	MD Ayurveda (BAMS)	*Dravyaguna*	Ayurvedic Physician & Practitioner	9	Pune
B	45	MA, Ayurveda MA, Sanskrit		Ayurvedic physician	20	Pune
C	44	BAMS & MD, Ayurveda	*Kayachikitsa*	Ayurvedic physician	18	Pune
D	51	BAMS Ayurveda MS in Ayurvedic Dietetics	Medicine & Surgery	Ayurveda physician/practitioner	27	Pune/ Mumbai
E	33	BAMS Ayurveda	Medicine & Surgery	Ayurveda physician/practitioner	10	Mumbai
F	26	BAMS Ayurveda	Medicine & Surgery	Ayurveda physician/practitioner	2	Delhi
G	34	MD, Ayurveda	Charak Samhita	Ayurveda physician and academician	17	Pune
H	46	BAMS Ayurveda	Medicine & Surgery	Ayurveda Acharya** (Physician)	20	Pune
I	46	BAMS Ayurveda, MA, Yoga	Medicine & Surgery, Yoga	Ayurveda Consultant, Physician, Yoga teacher	22	Pune
J	69	MD, PhD, Ayurveda	Medicine & Surgery	Professor & Government of India	35	Delhi

*Profession as self-described by participant.
**Ayurved Acharya is the Hindi translation for Ayurved Physician.
***Aggregate reported in cases where participants have had multiple concurrent or additional professional roles (e.g., Ayurvedic physician and yoga teacher or academician).
†Location of current practice reported or where participant was based for a major duration.

TABLE 2 Research design and structure considerations (69).

Philosophical Worldview	Selected Qualitative Strategies of Inquiry	Research Methods	Research Design
Social constructive	Participation	Purposively recruited participants using snowball sampling	Qualitative
Phenomenological	Observation (e.g., Ayurvedic physician–patient meetings; preparation of food in traditional Ayurvedic methods; consumption; lifestyle at Ayurvedic physician homes)	Semi-structured interviews Videos and photographs	Small sample size
Multiple meanings	Field visits (e.g., Ayurvedic centers, national government bodies, and major regional hospitals)	Data analysis: inductive theme analysis	Non-generalizable
Socially and historically contingent construction and interpretation	Immersion *in situ* (e.g., meditation retreat and training; physician home visits)	Interpretative, descriptive analysis and presentation Self-reflexive write-up Internal validation	Rich, complex data context and analysis

Validity and reliability

The study's trustworthiness was emphasized by strengthening its validity and reliability through the use of triangulation and data synthesis by supplementing the observation of Ayurvedic physician interactions with their patients ($n = 5$ physician–patient session visits). To bolster the subjective and interpretive nature of the data analytic process, internal validity was supported through face validity and multiple forms of empirical observation. These included visits to Ayurvedic physician offices and homes ($n = 6$), observation of the Ayurvedic belief system in its lived socio-cultural context, and data triangulation through researcher employment of multiple experiential modes (72) including completing a 10-day silent Vipassana meditation retreat and an advanced certification in Ayurvedic diet and nutrition principles. Rigor in the analytic process was incorporated through researcher sensitivity to the culturally specific meanings in bolstering the accuracy of interpretation, identification of similar and contradictory themes, and presentation of multiple participant voices (72, 73).

Ethical considerations

The International Review Board (IRB) approval (Human Subjects Review Committee, FWA00020237) for the study protocol (Protocol # 52) was received on 29 April 2019, for the larger study goal of examining Ayurvedic mind–body therapies in CP management. Informed consent was obtained through oral administration of the informed consent (audio-recorded) prior to participation in the study and receipt of an electronic or hard copy of the informed consent.

Research design and researcher role

The bottom-up research design employing a small sample size allowed for the exploration and thick (i.e., rich and detailed) description of an underexamined conceptual domain. The research design facilitated flexibility of exploration of the philosophy and practice of an ontologically distinct whole medicine system (Table 2). One limitation of a purposeful sampling strategy is the lack of knowledge of the range of variation at the onset of the study; thus, a combination of conceptual understanding of the research domain coupled with iterative data analysis alongside the data gathering process supported the determination of emergent data saturation (74). A second limitation is the bias stemming from a study designed and conducted by a single researcher with a philosophical background in Ayurvedic lifestyle on the interpretation of the concepts in relationship with biopsychosocial and integrative medicine clinical approaches.

Case study inductive data analytic procedures

This study reports findings derived from a subset of the data. Inductive qualitative content analysis was employed (75) to derive the categories and themes from the data. Critical conceptual insights were integrated into the interpretive analytic processes comprising the phenomenon of study by including participant voices and reducing data into categories and themes through iterative funneling (76). The data analysis process was initiated alongside data gathering. At the end of each interview, the audio recording was reviewed by the researcher to identify themes and ideas deemed as interesting, iterative, or recurring. These were further explored in successive interviews to ensure their dimensions were fully examined. The present study was analyzed solely by the author; thus, these steps helped mitigate researcher bias and strengthen data analysis. To further help mitigate researcher bias in the data analytic process, the researcher sought to cultivate openness to emerging concepts and themes (77) and undertook multiple passes of the data. The first pass of the transcripts examined the environmental–ecological context with subsequent passes narrowing down to the temporal experientiality of CP, to spatiotemporality and its key thematic dimensions (76). The data analytic procedures sought to go beyond observation, description, and categorization to identification of points of distinction and relatedness with existing conventional knowledge bases through a process of abstraction and constant comparison. In the second pass, the researcher conducted a line-by-line process of open coding with a subsequent pass-through salient data to identify axial codes that comprised the descriptive themes by attending to the "patterns, insights, and concepts" (72) (p. 167) that emerged in the descriptive level (e.g., association of cognitive temporal movement with *doshas*). Relationships among the categories were finalized by keeping interpretation close to participant descriptions to help strengthen reliability through reader corroboration of the themes. Participant confidentiality was maintained in the presentation of their quotes in the findings. Minor corrections for syntax or missing words were made for readability and are presented in parentheses. The participants are referenced by alphabetical letters in parentheses, e.g., [A] or [C].

The reporting of the findings emphasizes participant voices in the spirit of the interpretive nature of an explorative research inquiry, highlighting the researcher's native knowledge alongside participant interviews (please refer to Appendix 2 for author's note regarding limitations in the interpretation of the study premise and findings for Ayurvedic and integrative medicine clinical practice). As a small qualitative study, the findings enhance understandings of temporality and propose an innovative conceptual framework to further its integration in CP management. Owing to the qualitative case study design with a small sample size, the study findings are exploratory and descriptive in nature and non-generalizable. The findings can be further validated and extended through experimental methodologies to enhance understandings of an inadequately understood conceptual domain in CP management.

Results

Thematic analyses reveal Ayurvedic protocols for pain management and conceptualize temporality in CP as spatiotemporal present moment awareness (PMA) and embodied time (ET).

Spatiotemporality as present moment awareness

Ayurvedic physicians employ temporality in present moment awareness in CP management by seeking to construct a balance between the spatial–temporal organization of cognitive temporal movement and the *doshas*, among the three *doshas*, and between

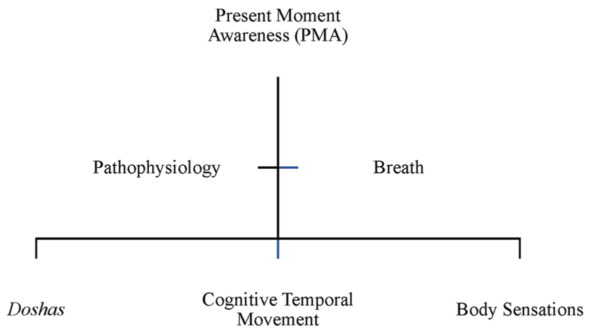

FIGURE 1
Spatiotemporality as present moment awareness.

the cognitive temporal movement, the *doshas*, and *dosha* expression in body sensations (Figure 1). Spatiotemporality is conceptualized in PMA as an awareness of the relationality of cognitive movement, *dosha* operations, and their pathophysiological expression through their movement as thought and intentionality in the body (Figure 2). PMA is conceptualized as the state of awareness in the present regarding cognitive temporal movement with the three body constitution types (*doshas*) and their pathophysiological expressions. Ayurvedic practitioners employ methodological approaches including *mantra* chanting, respiration-breath modulation through yoga and *pranayama* and diet and lifestyle modification to cultivate PMA.

Pain is understood in Ayurvedic medicine as a perception of sensations in the physical, mental, and emotional body. The perception of sensations is an essential component of the *doshas* in the body. In PMA, the Ayurvedic physician addresses the imbalance of the three *doshas* with cognitive temporal movements categorized as an unpleasant sensation, or pain. According to H, "whenever you will find pain, there is a role of *vata*," with there being "three different types of pains." The form and description of pain is characterized as any form of sensation in the body, whether that be pleasurable or like "needles… shifting… throbbing… sharp." The spatiotemporal perception of pain indicates the type of *dosha* predominance causing the imbalance. For instance, it can be burning (characteristic of *pitta* imbalance), or dull (characteristic of a *kapha* imbalance) [H]. Accordingly, a spatiotemporal equilibrium or harmony among the *doshas*, the sense organs, the cognitive system, spiritual system, and the elimination of toxicity, is associated with pleasant sensations characterized by good health and wellbeing. As [H] explained, good health is "when there is harmony among the body, mind, soul, *indriya* (the senses) *dosha*, and *mala* (toxins). If all the body along with its mind and conscious (ness) are working together in harmony then only we can say that the person is in good health." As [G] explains, "many of the aspects of the body are controlled by the mind through the breath or the *pranayama*", such as "the relation between vata and the *raja guna* of the mind. *Raja dosha* of the mind… when we control our respiration, we control our mind." The Ayurvedic physician emphasizes the spatiotemporality of the interrelationships between respiration and the brain and breath and mind. Thought is understood as a cognitive temporal movement, regulated by *vata dosha*: "and when there is a movement, there is a *vata* exercises that control the mind" [G]. The emphasis on movement (e.g., of thought in this instance, and all functions governed by *vata* more generally) underscores the spatiotemporal nature of cognitive processes.

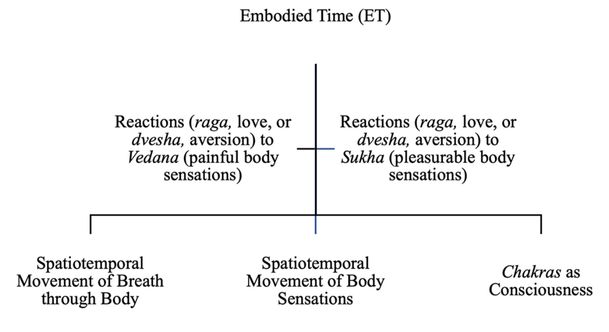

FIGURE 2
Spatiotemporality as embodied time.

The theme of PMA emphasizes how the Ayurvedic physician looks for a spatiotemporally balanced operation of the *doshas* to create harmony without the dominance of any one *dosha* or accumulation of toxicity (that may be perceived as an unpleasant sensation, pain, or disease). In other words, to understand pain, the Ayurvedic physician starts with the principle that "*mana* (mind) and emotions are very closely related… we need to take care of body and mind while treating the chronic pain management." One way Ayurveda cultivates PMA is as a cognitive approach to realigning the individual's relationship with pain. One approach in Ayurveda, [H] noted, is "*mantra* chanting or having positive thoughts in your mind… [which] reduces the pain threshold." Thought and cognitive activity is understood as a form of temporal movement arising from the interaction of the body and mind, referencing the spatiotemporal organizing of the nature of the relations between mind and emotions. *Mantra* chanting focuses positive thoughts centering the body, centering the mind, spirit, and nature relationship in PMA. For the Ayurvedic physician, both the origin and manifestation of diseases are associated with historical time and its relationship with cognitive temporal movement: "whatever disorders take place in mind, they surely affect the body… whatever diseases take place in the body, they certainly affect the mind, so there is a strong interrelation in between mind and body" [B]. Understanding the nature of pain encompasses understanding the "psychological disturbances… profession, stress levels, diet habits" of the patient [H]. Obtaining an understanding of the psychosocial experiences alongside the anatomical, biochemical, and sensory experiences of pain as a sensation allows the Ayurvedic physician to comprehend pain processing spatially through its cognitive temporal movement arising from an imbalance.

To understand CP, [G] examines how pain and sadness in the mind and body mutually influence each other in the patient. The nature of sound is spatiotemporally connected with thoughts (e.g., silent thoughts in the mind or thoughts in an utterance). Thus, sound as employed through *mantras* expresses the cognitive temporal movement of intention. Yoga (combining breath through *pranayama*, body through *asanas*, and mind through meditation and *mantras*), alongside lifestyle and diet modifications, has the function of energizing the mind by strengthening the direction of thoughts that express the movement of negative qualities to positive [G]. The *doshas* are further modified by their spatiotemporal qualities (or *gunas*). The *gunas* are also targeted in Ayurveda to bring their energy characteristics expressed through sensations in balance for reconceptualizing how the pain sensation is experienced. [G] brings the movement of the body and thoughts in harmony over time through "diet and nutrition, lifestyle management…

exercise, yoga *pranayama*, relaxation and breathing techniques, some medicinal herbs, *panchakarma*, and then rejuvenation." Spatiotemporal analysis of these components at an individual level illustrates the interaction of their energy composition as defined in Ayurveda with the individual's *dosha* balance and working to bring their movement in harmony.

Spatiotemporality as embodied time

Ayurvedic physicians cultivate embodied time in CP management as an awareness of the expression of time as embodied in the emotional and psychosocial processes of the body. CP management employs ET by cultivating an awareness of spatiotemporality as reflected in the movement of the breath through the body, the movement of body sensations over time, and their intersection with consciousness (Figure 2). To connect body sensations (ranging from painful, *vedana* to pleasant, *sukha*) with consciousness, Ayurvedic practitioners employ approaches such as *pranayama* yoga, diet, herbs, *marma*, *panchakarma*, and *dinacharya* and *ritucharya* (Table 3).

Pain is conceptually understood by the Ayurvedic physician as sensations of both pleasure (*sukha*) and sadness (*vedana*). However, for its treatment as pathology, [A] mentioned that CP is "not directly related with the *atma* (consciousness), means in case of chronic pain … if you go with the Sanskrit shloka, meaning of *vedana* means pain … is essential for your mind, is *sukha*, means pleasantness … The pain who is give very much difficulty to your mind, it's a *dukha*, means sorrowness. So, every condition is related with that definition." Hence, pain is spatiotemporally embodied sensations expressed over time through the body. The notion of time, or *kaal,* is considered essential in understanding the cause of its expression: "because the pain, how many days pain is occurring? … How many days the things is happening, because … One of the reasons of any disease is *kaal* [time]" [A]. Spatiotemporality embodies the expression of time through the body as sensations of pain and pleasure.

ET is expressed in the spatiotemporal movement of the breath through the body. According to [H], "*pranayama* yoga or relaxation techniques … increase the *prana* or energy force in your body. Also, they remove the obstructions in the body and does the help to reduce the pain threshold." The obstructions (or blocks) can be psychosocial or pathophysiological. Through its spatiotemporal movement, breath modulates and aligns thought and the internal functions of the body. In fact, "emotionally *mana* [mind] is in the heart and the brain is the functional part of *mana* [as consciousness]… herbs like *brahmi*, *ashwagandha*, then *vata*, *yashtimadhu* … reduce the mental pressure and ultimately the pain" by targeting the mental functions. Thus, the spatiotemporal movement of the breath through the body balances the mind and brain and modulates pain by aligning the perception of challenging (*dukha*) or pleasurable (*sukha*) sensations in the body.

TABLE 3 PMA and ET: balancing and reconceptualizing modalities.

PMA	ET
Balancing and Reconceptualizing Modalities	
Mantras	*Pranayama yoga*
Yoga *asanas*	Diet
Pranayama	Medicinal herbs
Diet	*Marma*
Medicinal herbs	*Panchakarma*
Meditation	*Dinacharya* and *ritucharya*
Panchakarma	
Exercise and lifestyle	

ET is expressed in the spatiotemporal movement of body sensations over time. For [B], "many things come under [our reactions to feelings, such as] *raga*, like hatred is there, anger is there, passion is there, fear is there, fear of something. All these are the diseases according to this text and they're saying that these are the real diseases." In other words, the arising of reactions (e.g., love, *raga*, or hatred/aversion, *dvesha*) to specific feelings of pleasure (*sukha*) and pain (*dukha*) as perceived in the body in response to CP are also associated with time and associated with CP pathophysiology. As [B] noted, the very first *Vaidya*, "hasn't enlisted any physical disease [diagnostic conditions], actually. They haven't enlisted fever there, they haven't enlisted diarrhea, they haven't enlisted skin diseases … We can see that all the physical diseases basically arise most of the times from the mind, psychological effects." [B] emphasizes the cause of CP as the arising of the reaction (through aversion, *dvesha*, or love, *raga*) to the emotional or thought sensation in the body (*vedana* or *sukha*) that in turn gives rise to an imbalance in the body that manifests as physical conditions or disease. As [B] notes, "if we see in *Charaka Samhita*, that is another classical text of Ayurveda, the various diseases like fever, [d]iarrhea, [skin] diseases … they are telling [us] that the very first appearance of these diseases in the … ancient times [was] due to some psychological things related to mind." Thus, the arising of reactions (*raga*, *dvesha*) in the mind to the spatiotemporal movement of embodied sensations (of *dukh*a and *sukha*) over time is associated with the pathophysiology of CP.

ET is expressed through the consciousness of the individual expressed through the *chakras*. The *marma* massage practice connects the consciousness components of the body (*chakras*) with spatiotemporal movement of breath and body sensations in ways that function to balance and rejuvenate. Pain treatment through practices such as *marma* and *panchakarma* in the Ayurvedic physician's description is based on the evaluation and alignment of breath in everyday practices and norms that are manifested through the actions of the body:

> "I will advise them a proper diet, then proper nutrition. Then I will advise them to have a regular exercise, proper implementation of dinacharya, after *that ritucharya, ritucharya* is nothing but the fine-tuning of *dinacharya* with the nature. So, you have to make certain changes according to the outside climate. So that will help the patient for healthy living. Then I will suggest them to have some type of herbal teas on regular basis. Then I will suggest them the regular exercise, yoga, *pranayama* along with some massage,

> even massages mentioned in *dinacharya*, to reduce the dryness of the body … Also, I will suggest my patient to have the *rasayana* treatment, which is a good treatment for rejuvenation. Then also I will suggest them to have the *marma* therapy treatment or *marma* massage, which can be done at home level." [H]

The *marma* massage may include practices such as *abhyanga* and *svedana* (oil therapy, *taila* massage). As [I] notes, "in *panchakarma*, we use an oil. Suppose we can, for daily application also, if there is pain like in, if there is ligament tear, or if there is muscle tear, and there is persistent pain." The treatment is tailored to the unique *dosha* composition of each individual. According to [H], "*marma* is the junction between the physiology and consciousness … each major *marma* point corresponds to several *chakras* or energy centers of the body. And when we stimulate these *marma* points, the energy which is clogged is released and it increases the circulation and helps to reduce the pain." Thus, *marma* practices are employed with the goal to remove the consciousness blocks and help modulate the embodied reaction to pain sensations (*raga* and *dvesha*) over time.

In *panchakarma*, one of the central treatment pathways in Ayurveda, according to [G], "the mind is very much involved … we rejuvenate that mind, or we calm that mind [using] a medicinal purgation for the vitiated [*dosha*]." Similarly, as [G] noted, practices such as yoga also cultivate the consciousness: "while doing *yogasana* [such as the] sun salutation is a kind of concentration or is a kind of thinking of ourselves. *Pranayama* is also thinking of ourselves. Any kind of yoga is also thinking of ourselves … When we are doing sun salutation, their other typical *asanas* with the control on our respiration. While doing such kind of *asana*, we control our mind." The energy facets of physical movement as defined in yoga align the energy flow with the thought and connect with the energy flow of nature, the environment, and the cosmos. For instance, as [G] noted, there is a connection between these yoga and *marma* practices with food, as described in the case of treatment for knee pain, "so, when we are treating the knee joint, with the help of any kind of medicines or *panchakarma* process, I must, or a physician must look after the … mental status of that person … or any kind of disorder or digestive problem." Food ultimately gets converted into matter, thought, and energy. The spatiotemporal movement of these shapes the individual experience of CP. Spatiotemporality is conceptualized in ET as an awareness of the relationality of inner time and space with the emotional, cognitive, and consciousness processes through their movement in the body as breath, as body sensations, and as shifts in consciousness (Figure 2).

Discussion

The Ayurvedic protocols of pain management conceptualize temporality in CP as present moment awareness and as embodied time. PMA comprises a spatiotemporal awareness of cognitive temporal movement, *dosha* operations, and their pathophysiological expression as constructing the body. PMA is cultivated through mind–body practices that support spatiotemporal awareness of thought and sound (e.g., in chants, such as *mantras*), constituting the individual's cognitive, pathophysiologically experienced environment (Figure 1 and Table 3). ET comprises a spatiotemporal awareness of the relationality of breath, body sensations, and consciousness as constructing the individual's experiential environment. ET is cultivated through practices that produce a spatiotemporal awareness of breath, body, and consciousness (e.g., in *pranayama* yoga, *marma*, and *panchakarma*), constituting the individual's ecosystemic, seasonal, and circadian environment (Figure 2 and Table 3).

PMA is described as cultivating a spatiotemporal awareness of cognitive temporal movement (e.g., thoughts), *dosha* operations (e.g., movement of the three different forms of energy, *vata*, *pitta*, and *kapha*), and their pathophysiological expressions (e.g., pain duration and intensity). PMA is centered in the spatiotemporal equilibrium among these interrelated components (e.g., among the three *doshas* and their expression in body sensations). For instance, as the *doshas* manage the functioning of the body, a state of dynamic equilibrium will support the elimination of toxicity, alignment with cognitive temporal movement (governed by specific *dosha* functions), and regulation of body sensations. The spatiotemporality of cognitive movement expressed as thought is regulated through practices that center the body and mind (e.g., through particular forms of sound, as in *mantras*). Thus, the Ayurvedic physician will examine the relationality of the *dosha* processes governing the operations of the body and the mind. The spatiotemporal practices in PMA will focus on individualized centering and balancing functions such as those emphasizing positive and resilient qualities using *mantras,* yoga *asanas,* and *pranayama* (Figure 1 and Table 3).

ET is described as cultivating a spatiotemporal awareness of movement of breath (e.g., as *prana*), of the body's emotional and psychosocial sensations (e.g., of pleasure and pain), of the reactions to body sensations (e.g., of positive and negative affect to feelings of pain or pleasure), and in their intersection with consciousness (e.g., as *chakras*). ET is centered in the spatiotemporal expression of energy, body sensations, psychosocial reactions, and consciousness in an experiential ecosystemic environment. For instance, embodiment references the integrated experience of movement of breath through the body, the movement of body sensations, and of nature and the ecosystemic environment in consciousness. The spatiotemporality of breath, of body sensations and their reactions, and consciousness is expressed through practices that center the integration of the body, its perceptual mechanisms, and the consciousness (e.g., as in *marma* massage). Thus, the Ayurvedic physician will examine the spatiotemporal nature of the emotional, cognitive, and consciousness processes. The spatiotemporal practices in ET will emphasize rejuvenation and self-reflexivity using *marma, panchakarma, pranayama* yoga, and medicinal herbs (Figure 2 and Table 3).

The study findings present an experiential and relational framework conceptualizing temporality through its spatial dimensions as an organizing principle in CP management. While temporality focuses on the representation of experiences and relations over time, spatiotemporality emphasizes a constructionist approach by centering balance and equilibrium in the passage of time, consciousness, and subjective experience of the body in relationship with its environment. Spatiotemporality highlights pain as a materially grounded experience that evokes cognition, emotion, perception, and consciousness body-in-context. Research shows that CP disrupts the experience of lived temporality (25) CP cognition, and conscious experiencing of sensations through cognitive processing (36). The body dissociation associated with CP is centered through spatiotemporality as PMA and ET in embodied, relational, and body-aware ways. Biopsychosocial approaches to CP management emphasize mindfulness meditation and cognitive therapy as modes for altering pain catastrophizing (e.g., by altering cognitive content, processing, and negative affectivity) or restructuring pain-related cognitive content, making adaptive changes necessary to counter pain perception (78). The spatiotemporal frame balances the emphasis on cognition in Mindfulness-based cognitive therapy (MBCT)-based approaches through the integration of the PMA and ET dimensions. The spatiotemporality of PMA and ET cultivates an experiential and emergent quality that has the potential to extend tailored multimodal treatment plans that comprise pain neuroscience education, cognition-targeted exercise therapy, sleep and stress management, and/or dietary interventions to support CP management. Integrating the ontological–epistemological framework of Ayurvedic whole medicine attends to the spatiotemporal environment in nuanced ways to cultivate a dialectical relationship with the reflexive self in PMA [e.g., self-awareness (35)] and the embodied internal–external temporal environment referenced by biographical–historical, geographical–universal environments in ET.

Understanding time perception as a component of an individual's psychological phenomena (79), PMA in CP management emphasizes the alignment of recollections and anticipation with the spatiotemporal awareness of the body and change (of sensations) in the present, past, and future. Integrating cognitive temporal movement and *dosha* awareness extends current research examining temporality in multisensory integration and self-awareness (9, 16, 17) as they contribute to body ownership and acceptance in CP management (15) by expanding the conceptualization of temporality from the subjective representation of experiences and relations over time, time perceptions, and flow experiences (53). PMA introduces spatiotemporality as a state of dynamic equilibrium cultivating an awareness of internal time, external duration, and the self with subjective experience (21) through centering the spatiotemporal frame in the pathophysiologically experienced environment. Extending temporal constructs such as the conceptualization of the passage of time (21, 22) through the lens of spatiotemporality centers the internal and external environment of the body in its lived space and attends to the disruption in lived temporality experienced by CP patients. Time is assessed as a component of spatiotemporality in clinical CP diagnosis, treatment, and evaluation when the Ayurvedic physician examines the patients' daily and seasonal lifestyle, mind, and emotions as an interconnected whole in PMA and ET. Assessing the experience of longitudinal time through PMA and ET helps the Ayurvedic physician focus integratively and in environmentally centered and embodied ways on the subjectively experienced past, present, and future by focusing on sensemaking related with past choices (43), prioritizing what is meaningful in the moment (80), or imagining a purposeful future (81).

The cultivation of PMA can support the disruption of lived temporality and the experience of time (25) in CP through the practices employed by the Ayurvedic physician. The Ayurvedic physician attends to the relationship of internal time with spatiotemporality through sound and the body's energy balance as expressed through daily practices and the lived environment. Mindfulness practices can be enhanced through PMA by conceptualizing being present in the moment with awareness of thoughts, the pathologies of the body, and the doshas in relationship with the spaces of one's lived environment and the natural world. Similarly, the awareness of spatiotemporality in daily practices through sound (*mantras*) extends the understandings of mental health in relationship with cognitive activity as a form of temporal and referencing the spatiotemporal nature of the relations between the mind and emotions. Self-reflexivity supports the provider–patient relationship (5) in PMA as cultivating an awareness of the relationality of cognitive movement, *dosha* operations, and their pathophysiological expression in the body. PMA processes align cognition and pain processing to highlight how enjoining awareness of the relationality of space with temporality advance techniques incorporating dialectic integration of change with acceptance of the present.

Grounding temporality with spatial awareness in ET connects intentionality with action upon pain duration, future time perspective, and subjective perception of time (37). ET deepens the conceptualization of space to include internal bodily spaces, the lived environment, and the natural environment that shapes the body's functions to cultivate an awareness of spatiotemporality as integrated with the embodied sensory and psychosocial processes of the body. The Ayurvedic assessments of *dosha* analysis, tongue analysis, and its relationship with the *doshas* to assess temporal change are key to conceptualizing the embodied mind–body relationship. Integrating spatial awareness in ET attends to the intentional recollection and spatiotemporal (re)situatedness of sensory memories, emotions, and experiences (41). Spatiotemporality of embodied processes such as those of flow of breath (through *pranayama*) and the body's energy centers (through *chakra* meditation or *marma* massage) enhances awareness of how pain perceptions are constructed through continual interaction with bodily, lived, and environmental spaces. Spatiotemporality of ET processes deepens conceptualization of unified flow experiences (29, 38, 41) in adaptive mutual engagement with pain experiences and cultivate ways of conceptualizing spaces as temporally constructed in CP management.

The conceptual explication of spatiotemporality as ET extends the understandings of how the pathophysiological, behavioral, and emotional processes of CP relate with temporal dynamics (60) and expansion in the perception of subjective time and space (82). Conceptualizing spatiotemporality as ET expands how CIM provider co-engagement in CP management (83) is constituted as perceptual subjective process over time through cultivating awareness of intentionality in movement of breath, thoughts, and emotions that inform the bi-directional relationship between cognition and pain and the disruption of cognitive processing in CP (34, 36). Emerging perspectives such as the ecological momentary assessment approach assessing the modulation of pain experiences over time (61) in relationship with their natural daily environments can be extended through an embodied understanding of their relationship with the patient's daily activities and circadian variability (84). Examining the qualities of bodily vitality (as *ojas*), strength (as *bala*), and type (as *prakriti*) through relations of space and time in alignment with circadian and seasonal temporal cycles offers an expansive and integrated frame for conceptualizing spatiotemporal relationships of the mind and body.

The study is limited by its very small, expert-focused sample size in a complex knowledge domain spanning temporality, Ayurvedic medicine, and biopsychosocial CP management. The generalizability of the study is further limited by the fact that it was designed and conducted by a single researcher. Future studies can explicate the clinical contribution of constructs such as temporality and belief (85) that are significant components of Ayurvedic medical ontologies and respond to the call to enhance specialized clinical practice in Ayurveda (86) (see also Appendix 2). The process of observing change over a spatiotemporal frame, such as through the moment-by-moment movement of the breath in PMA and ET supports both the expression and perception of CP. The Ayurvedic physician employs their knowledge of individual operation of *doshas,* bodily vitality (as *ojas*), bodily strength (as *bala*), integral individual bodily nature (as *prakriti*), and ET (as *kaal*) to recommend multimodal approaches comprising nutrition, physiological postures through yoga and massage, movement through practices involving physiological purification (e.g., *nasya)*, and a whole-person approach through the central Ayurvedic program of *panchakarma* and related modalities and therapies. In centering patient empowerment, the Ayurvedic physician incorporates an assessment of the patient's mental and spiritual strength (*bala*) in the treatment of pain in alignment with the daily and seasonal temporal cycles.

The findings address a gap in the conceptualization of temporality in CP management and offer an ontologically diverse conceptualization of spatiotemporality in envisioning how space and temporal relations can be conceptualized in integrative CP models (87–89). Incorporating PMA and ET in adaptive relationship with the lived environment, cognitive and emotional processes, and circadian and seasonal changes enhances how clinical approaches to CP management can consider pain subtype, structural pathology, and patient biopsychosocial profile by attending to the relations of space and temporality in nuanced and complex ways.

Author's note

An earlier version of this paper was presented virtually at the International Communication Association Annual Convention, and an additional version has been previously presented virtually at the National Communication Association Annual Convention. Previous versions have also been presented as an abstract at the Global Approaches of Integrative Oncology session of the National Cancer Institute and the Trans NCI-NIH Conference on International Perspectives on Integrative Medicine for Cancer Prevention and Cancer Patient Management (virtual poster presentation). This study presents part of the larger data set. Additional publications from this data set can be found under References, Agarwal, 2020.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the Human Subjects Review Committee, Salisbury University, MD, United States, FWA00020237, Study Protocol #52. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because the study poses minimal risk to the participants. Informed consent was administered orally and audio-recorded; the participants were provided an electronic copy of the informed consent form.

Author contributions

VA: Conceptualization, Data curation, Formal Analysis, Methodology, Writing – original draft, Writing – review & editing.

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Conflict of interest

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Appendix 1

Selected salient conceptual domains and constructs explored in the semi-structured interview

Protocol

- Participant information: Name/Age/Qualifications (specialization)/Degree credentials/Profession/How many years in current profession and position/Location
- Domain: Chronic pain management, Ayurvedic principles and practices, connection of *ahar/dravya/shastra*/with *chikitsa* focus on connection of *manas/atman/shareer* in Ayurvedic practices and their effectiveness (how described, perceived, conceptualized)
- Understanding tailoring principles in practice for pain management mind–body integrative approach (*dosha/panchmahabhoota/rasa/guna*)
- Understanding physician communication of abstract concepts and implementation in practice by patient
- Evolution to incorporate role of *desha* and environment from *Charaka Samhita* to present-day.

Semi-structured interview protocol domains

I. Mind–body practice protocol: Mind and body in relationship with each other
II. Communication of mind–body–spirit practices for CP
III. CIM practice protocol
IV. Focusing attention (*man*) and regulating emotions in mind–body practices:
V. CIM practices associated with pain management
VI. How does the Ayurvedic physician help the patient address the following pain aspects in their lives? (Fatigue/Stress/Fear/Quality of life/Cognitive impairment/Body distress)
VII. Understanding how Ayurveda communicates the relationship between healing, functionality, quality of life, and wellbeing in CP management

Appendix 2

Ayurvedic terminology in clinical practice and interpretive premise of study

The interpretive premise of the study implies that the thematic findings reference the author's interpretive lens to the Ayurvedic ontological and philosophical thought as reflected in the themes in the Results section of the study. Accordingly, the interpretive frames identified in this exploratory study are not clinical findings intended to reflect the medical training informing Ayurvedic physicians' clinical practice protocols as applied in Ayurvedic and integrative medicine in India. Rather, they reflect the author's identification of spatiotemporality as a philosophical and interpretive construct that may be further evaluated, examined, and explicated in future studies to enrich its dimensionality in practice through a diverse knowledge translation provided by the findings in this study. To this end, the study provides one instance of an effort to provide one instance of a complex translation of the knowledge base and study field of the examination of Ayurvedic philosophy from a diverse lens.

For related research findings specifically from a clinical practice perspective, for instance, Ayurvedic physicians will assess temporality in a highly complex and nuanced manner to examine when pain arises or peaks (i.e., pain variation), its relationship with diurnal and seasonal temporality, age, geography, diet, and lifestyle, among a range of variables. Ayurvedic physicians will also examine the specific dominance of the dosha function with each of these variables (e.g., the gradual decline of *kapha dosha* as the person ages and its relationship with pain variation). Similarly, a range of principles and precepts is employed to inform such assessments of health and disease (e.g., the principle of hot, *ushna*, and cold, *sheeta*) and their related pathogenesis features (90). Greater clarity in such constructs can help tailor Ayurvedic treatments to patient priorities for choosing Ayurveda treatment [e.g., potential to eradicate disease, belief, direct and indirect evidence of efficacy and safety in managing the clinical condition of interest (91)].

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Perspectives on community-based system change for people living with persistent pain: insights from developing the "Rethinking Pain service"

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In this perspective article we advocate community-based system change for people living with persistent pain. Our view is that greater use of the voluntary and community sector, in partnership with the clinical sector, creates the conditions for a "whole person" approach to pain management, leading to greater personalised care for adults living with long-term pain whilst having the potential to ease some of the pressures on General Practitioners and other clinical services. We advocate pain care that is socially connected, meaningful within socio-cultural contexts and aligned with the principles of salutogenesis. We provide an example of a UK National Health Service (NHS) commissioned pain service called "Rethinking Pain" that operationalises this perspective. Led by the voluntary and community sector, Rethinking Pain works in partnership with the clinical sector to provide a central holistic pathway of care for people experiencing persistent pain. This is the first time that this model of care has been commissioned for persistent pain in this area of England. The Rethinking Pain service is underpinned by core values to work with people to manage their pain holistically. The Rethinking Pain team proactively engage with people in the community, actively approaching and engaging those who experience the biggest health inequalities. In this article we provide an overview of the context of pain services in the UK, the rationale and supporting evidence for community-based system change, and the context, pathway, values, goals, and aspirations of the Rethinking Pain service.

KEYWORDS

chronic pain, voluntary and community sector, system change, clinical sector, salutogenesis, whole health, community

Introduction

Recently, the UK has introduced integrated care systems that focus on a person-centred approach as part of reforming its health and care landscape (1). Guided by the National Health Service (NHS) Long Term Plan, health and care services need to continually evolve to meet the changing health needs of society (2). A key area of work within the NHS long term plan is "personalised care" which focusses on shared decision making, giving people more choice and control over their mental and physical health. In 2023, the International Association for the Study of Pain (IASP) Global Year advocacy campaign focussed on integrative pain care (3), defined as "… the carefully planned integration of multiple evidence-based treatments—offered to an individual suffering from pain—that strives to be individualized (person-centred), mechanism-guided, and temporally coordinated". This definition situates individualised person-centred care within a mechanistically guided treatment paradigm. Gaudet et al. contend that people need to be equipped to take control of their mental, emotional, spiritual, and physical health in order to live their most meaningful lives, and that this cannot be achieved solely by improvements in existing health systems (4). Instead, Gaudet et al. argue there is a need for "true cultural transformation" in health care services for whole health to be realised (4).

We advocate policies and practices that promote health at the community level (5, 6), utilising the principles of salutogenesis as a vehicle to alleviate painogenic environments and the burden of persistent (chronic) pain (7). Salutogenesis is about creating an environment and lifestyle that supports the way people understand their interaction in the world (comprehensibility), view their life (meaningfulness) and respond to stressful situations (manageability), i.e., developing a strong sense of coherence (8, 9). Salutogenic interventions take a whole-person approach grounded in a person's unique life story and current situation, encompassing physical, mental, social, and spiritual aspects that are meaningful to the individual. Through active participation, individuals learn to identify and utilise resources to successfully change comprehensibility, meaningfulness, and manageability, to reconfigure their conception of health as a lifelong process, with stressors and tension becoming a normal part of life and potentially health-promoting. In 2022, Langeland et al. reviewed 41 studies and concluded that salutogenic programs and interventions help people learn how to construct self-identity and a sense of coherence in various challenging life situations including mental health problems and pain (10). In other words, salutogenic approaches help people actively adapt to stressful environments through discovery of resources that shift them away from "dis-ease".

In this article, we provide perspective for personalised care for people living with persistent pain through greater use of voluntary and community care sector activity. We describe a new community-based chronic pain support service called Rethinking Pain that is led and delivered by the voluntary and community sector. Rethinking Pain aligns with the key features of salutogenesis and whole-person health. Although a salutogenic framework was not used in the design of the service and a sense of coherence not measured as a health outcome, we contend that community-based support pain services, such as Rethinking Pain, are likely to improve sense of coherence not only in individuals, but also in communities. Rethinking Pain is commissioned by Bradford District and Craven Health and Care Partnership (a statutory NHS organisation responsible for the provision of health services in England), including funding from Primary Care Networks. We provide examples of the referral pathway along with the context, goals, values and aspirations of the Rethinking Pain service, from the perspective of the Rethinking Pain team, captured during one, two-hour focus group discussion, conducted six months after the service had "gone live". The focus group discussion was conducted as part of a broader, on-going, service evaluation underpinned by Theory of Change research methodology (11) which we will publish in a subsequent research article. However, the Rethinking Pain team members provided informed consent that anonymised quotes could be used in this "Perspectives Article" as examples of their views.

Provision of pain care in the UK

The current landscape of pain services in the UK

In the UK, people living with persistent pain are typically supported by their General Practitioner (GP, physician), other health professionals (e.g., physiotherapists or pharmacists), or by multi-disciplinary pain clinics or pain management programmes (12). The service provision for people living with persistent pain is determined at a local level by the respective funding organisations and may be in community, primary or secondary care settings. Typically, people present to a GP or first contact physiotherapist who has authority to refer patients to secondary care for more specialist support, although there is an absence of secondary pain clinic provision in some areas. Core standards for pain management services in the UK published by the Faculty of Pain Medicine provide a comprehensive overview of commissioning, pathways, personnel, interventions, and governance (13).

Biopsychosocial approaches to pain management are considered optimal (14), although fragmentation of bio-psycho-social elements of service delivery are recognised limitations (15, 16), especially when they are not part of the same referral "pathway" with oversight and organisation from one provider. There is variability in chronic pain service provision in different areas of the UK and this may be associated with health inequalities and inequities resulting in poor outcomes for patients (17, 19). Integrating care requires resources, commitment across organisations, functioning information technology, coordination of finances and care pathways, aligned objectives, and buy-in from teams (20).

Rationale for system change

Between one-third and one-half of the UK population (28 million adults) are affected by persistent pain (21), creating significant pressures on NHS clinical services. Waiting times for NHS pain services are often many months. There is a need to ease pressures on clinical services yet also provide high quality care. The NHS long term plan is to give people more control of their own health with a drive for more personalised care. Personalised care aims to fundamentally shift how professionals work alongside patients and to focus on "what matters" to individuals (1). Working collaboratively across the voluntary, community and clinical sector is one way to achieve this.

A Cochrane review provided evidence that personalised care resulted in health improvements for long term conditions, including pain (22). Personalised care improved musculoskeletal health related quality of life, understanding of the condition and confidence in self-management for people living with fibromyalgia (23). A key feature of personalised care is to work in partnership with patients, as a whole person within the context of their whole life, to deliver care and support that matters most to individuals (24). Importantly, patients should have access to various support options including peer support and community-based resources to build knowledge, skills and confidence to manage their health and wellbeing (24). Social prescribing is a key component of personalised care. Social prescribing connects people to activities, groups, and services in their community to meet the practical, social and emotional needs that affect their health and wellbeing (25). The focus is to support individuals to have more control and choice over their health.

Evidence to support system change

In the UK, the National Institute for Health and Care Excellence (NICE) make various recommendations to assess and support people living with chronic (primary and secondary) pain, including options accessible via community-based organisations (26). Previously, integrating community support (i.e., the voluntary and community sector) into NHS pathways has been challenging. However, the long-term plan of the NHS is to build the infrastructure for increased community engagement. The NICE were unable to evaluate the clinical and cost effectiveness of social interventions for persistent pain because there were no clinical studies comparing social interventions with standard care (27). However, a systematised review of social prescribing in the UK as part of non-clinical community interventions identified 86 schemes, of which 40 schemes were evaluated using either quantitative, qualitative or mixed methods approaches (28). Findings suggested benefits for self-esteem, confidence, mood, anxiety, depression, and mental well-being. Furthermore, a qualitative study by Moffatt et al. (29) found that a link worker social prescribing programme to connect people with long-term conditions, including pain, to the community, reduces social isolation and improves self-confidence, resilience, effective problem-solving strategies and health-related behaviours. There are increasing calls for healthcare to connect people to activities, groups, and services in their community because "The Biomedical Model [for treating pain] Needs Urgent Help" (30) p. 263. There are examples of voluntary and community sector support services working in partnership with the NHS specifically for people living with pain [e.g., Dover Town Primary Care Network (31)], but, to our knowledge, there are no NHS commissioned pain services that are voluntary and community sector-led. Sim and Barker contend that community pain services can be delivered at lower costs while enabling long-lasting integration of self-management into the lives of individuals (32).

The concept of the Rethinking Pain service

Rethinking Pain is a new community-based pain service that aligns to the key features of personalised care. The Rethinking Pain service aims to support people's physical, mental, social, and environmental needs in the community, whilst providing a seamless pathway of care into therapy-led provision for people who need additional support. The purpose is to provide a central, holistic, connected, and accessible pain pathway for adults who have been experiencing pain that has been adversely affecting their quality of life, despite treatment, for greater than three months.

The Rethinking Pain service has been commissioned by Bradford District and Craven Health and Care Partnership, including funding from Primary Care Networks. Commissioning the voluntary and community sector to lead and deliver pain care, in partnership with the clinical sector, is a significant system change for this geographical area of England, i.e., this is a voluntary and community sector-led (rather than therapy- or medically- led) pain service.

The Rethinking Pain team comprises health coaches, social prescribers and community partners who are trained to support the health and wellbeing of people with persistent pain. Their role is "patient facing" i.e., they work in the community (in non-clinical settings) in partnership with people who are experiencing persistent pain. The Rethinking Pain team also comprises GPs and clinical therapists who have specialist experience and/or training in supporting people with persistent pain. Their roles are to support the health coaches, social prescribers, and community partners; to develop resources and educational materials; to provide clinical governance; to discuss more complex patients in regular multidisciplinary team meetings; and to deliver Cognitive Behavioural Therapy (CBT) with patients who require additional support.

Health coaches and social prescribers are recruited from local recruitment and community sector platforms to meet professional standards and competencies set out in the NHS Workforce development framework for health and wellbeing coaches. Health coaches complete a comprehensive in-house pain focussed training programme as part of their role at Rethinking Pain. This includes training on supported self-management for people living with persistent pain designed and delivered by clinical members of Rethinking Pain, supplemented by external courses and resources for practitioners (e.g., 10 Footsteps to Live Well With Pain, a training course for practitioners wanting to develop key skills and tools to support pain self-management; https://livewellwithpain.co.uk/ten-footsteps-programme/).

The design, delivery and development of the Rethinking Pain programme was informed through proactive engagement with caregivers, families, and the wider community via a variety of community consultation exercises. Service users are encouraged to involve family members, caregivers, or friends by attending educational modules, or being present during consultations, so that those living with people experiencing pain also receive relevant information about persistent pain. Choice and consent are important, and an interpreter service is available for individuals who do not speak English as a first language. In terms of the wider community, the Rethinking Pain team have partners from the voluntary and community sector who run engagement events in community settings and faith centres, including the delivery of educational modules.

Referral process

There is a central referral pathway for Primary Care Networks (PCNs) which enables GPs or musculoskeletal practitioners to refer people into the Rethinking Pain service. Once in the service, there are three tiers of support. An overview of the referral pathway is provided in Figure 1. In Tier 1, pain trained health coaches provide 1–1 support. They work with individuals to understand what is important to them in the context of their whole life. Individuals are signposted to a 2 h education module and are connected into the community. People who require additional support move through to Tier 2 where there is more active signposting from health coaches and/or social prescribers plus a range of education modules. Tier 2 education modules are continually being developed as the Rethinking Pain team consult different communities within Bradford District and Craven. Currently, the Tier 2 modules are:

1. More on Managing Pain
2. Keeping Active & Safe Movement
3. Sleep Therapy
4. Emotional Wellbeing Support
5. Developing Helpful Habits, Setting Goals & Making Plans
6. Diet Therapy
7. Creative Therapies
8. Your Stories (a chance to talk and be heard)
9. Acceptance & Taking Control of Your Pain
10. Beliefs, Spirituality, Faith, and Pain.

In Tier 1 and Tier 2 the GPs and clinical therapists work “in the background” to support the health coaches, social prescribers, and community providers, and provide clinical governance. There are regular multi-disciplinary team (MDT) meetings where any patients that are requiring additional support are identified so that they can be discussed and where appropriate move seamlessly through to Tier 3 (Figure 1). The additional support offered in Tier 3 is therapy-led CBT.

The uniqueness of the Rethinking Pain service

The salient driving force in the Rethinking Pain service is the voluntary and community sector. This is a step-change of traditional models of care which is highly contingent on statutory providers. Of course working with clinical practitioners remains a fundamental component, but this partnership is on a more equal footing and guided by advocating for wider system change. The health coach is a critical role, given that they can build trust and rapport and give time and resource to working in collaboration with the patient in non-medical settings:

> “*Those health coach contacts are the person who’s with them on this longer and sustained journey, without a focus on discharge*” (Rethinking Pain team)

The health coach can be responsive to need and to negotiate goals and targets to support pain management, underpinned by principles of personalised care:

> “*It really is a negotiation with the individual…their plan will be constantly setting goals, resetting the goals and it really is that relationship which is the core of it all.*” (Rethinking Pain team)

The Rethinking Pain service places great value on being socially connected and reconfiguring notions of biomedical cure by focussing on social, community and environmental needs. Rethinking Pain opts for a discourse on new possibilities and empowering individuals:

> “*Supporting and empowering individuals so that they can better manage their pain in their daily lives…. from an individual’s perspective it’s equipping them with tools and giving them the confidence to try something new around managing their pain.*” (Rethinking Pain team)

> “*Pain is inevitable to some extent, but it is the suffering element that I think we’re trying to help people who are in pain manage better…..also helping them [the patient] live better with pain.*” (Rethinking Pain team)

A unique feature of the Rethinking Pain service is the seamless partnership and care pathway across the voluntary, community and clinical sector. This is a significant system change for Bradford District and Craven and if successful has potential to be scaled-up nationally. Reconfiguration of mindset and funding is necessary to realise system-change and “true cultural transformation” for persistent pain across the health sector globally (4). In the UK, health campaigns targeting policy makers and the public are changing the way people think about, talk about, and treat persistent pain. Perhaps the most critical systemic barrier to implementing Rethinking Pain on a larger scale is funding, particularly for services that are additional to existing provision, and/or innovative, and/or are awaiting the outcome of formal service evaluation. Prior to Rethinking Pain a community-barrier was people having the confidence to access voluntary and community activities without support. Rethinking Pain overcomes this using health coaches, social prescribers and link workers who gain the trust of the service user and act as a bridge between clinic and community. Moreover, there needs to be an uplift in the status of the voluntary and community sector by placing them as key partners so that they are engaged on an

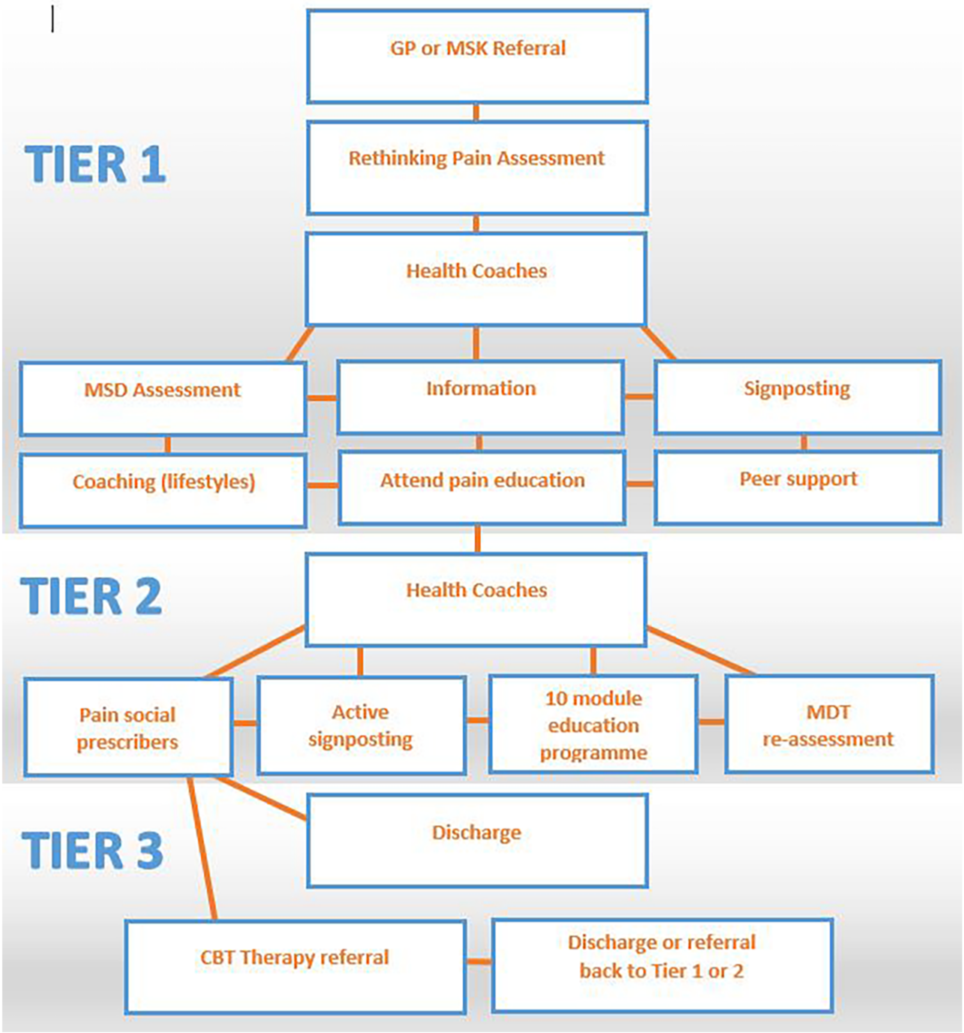

FIGURE 1
Rethinking pain referral pathway.

equal footing to the clinical team, with investment in training so that the expertise of health coaches, social prescribers and link workers is valued equally to that of clinical colleagues.

Reconfiguration from medical- or therapy-led to voluntary and community sector-led pain service provision was driven in part by a desire to de-medicalise through community engagement, pain education, health coaching, social prescribing, *and* tiered support in a single pathway of care. The intention of the Rethinking Pain service is to optimise the delivery of “whole-health”:

> “*Working with clinical teams, that’s unique and that’s about a focus to bring this service to people in their place, in their communities where they’re comfortable and where we can deliver in ways that meet their needs. I think it’s innovative… there is a lot of interest in this piece of work because of the system change potential and the learning around connecting services, and what happens for those services and for people in the service.*” (Rethinking Pain team)

Service aspirations

Prior to Rethinking Pain, Bradford District and Craven services had the following challenges:

1. GPs had limited options for people with persistent pain
2. The number of people with persistent pain was increasing
3. Social determinants of persistent pain were not being addressed
4. Health inequalities and persistent pain

Bradford District and Craven Health and Care Partnership are addressing these needs by commissioning the voluntary and community sector to deliver a central, holistic, connected, accessible care pathway. The principal tenet of the Rethinking Pain team’s core set of values is that the biomedical model has significant limitations and that health services alone are unable to counteract persistent pain in communities:

> "*The medications we (health professionals) use are pretty useless (for chronic pain) and some of the interventions that we've thought of being quite successful in the past, again not great, and so therefore we as a district had to think about what else is there available to our chronic pain patients. And the honest answer was there was nothing.*" (Rethinking Pain team)

> "*The answer isn't solely medical. If it was, we wouldn't need this service.*" (Rethinking pain team)

The Rethinking Pain service harvests the power of the voluntary and community sector, whilst simultaneously collaborating across the clinical sector, so that a person's physical, emotional, social, and environmental needs are considered.

> "*Pain is multifactorial, multifaceted and managing everything else around the pain, including mental health, physical health….if you're able to manage those conditions and those factors, then you're more likely to have a better quality of life….*" (Rethinking Pain team)

> "*You know, the people sat around told us that they've tried all the medicines. They've done acupuncture, they've done all of that. We explore how can we [Rethinking Pain] help you manage that [alternatives to medication] moving forward?*" (Rethinking Pain team)

A core ambition for the Rethinking Pain team is to meet diverse needs by proactively engaging with local communities representing such diversity. The team recognise the impact of health inequalities and the importance of addressing these for people living with persistent pain.

> *For the (RP) service, to try and evaluate whether we're having an impact on our disadvantaged communities and (to consider) how we could change and adapt to cater for different needs. The population in Bradford is very diverse. It would be really good to try to see where we are really with those communities, so we can improve the offer to them.* (Rethinking Pain team*)*

Genuine co-production of the Rethinking Pain service is seen as central to succeeding in understanding and addressing health inequalities:

> "*Moving forward, it (co-production) would be a real opportunity, to really grasp that with both hands and really involve the people that are accessing and using the service in developing it*" (Rethinking Pain team)

The importance of cultural-adaptation

Rethinking Pain is based on community and voluntary participation within a multi-cultural region of the UK Rethinking Pain serves an ethnically diverse city with a significant Black, Asian and minority ethnic population, and a predominance of people with Pakistani heritage and Muslim faith. Bradford is ranked the third highest for health inequality nationally and characterised as a population group amongst the most income and employment deprived. Social and cultural conditions influence the prevalence, presentation, illness behaviour, and community responses to persistent pain in diverse communities. It is common for people with persistent pain in Bradford to experience life with high levels of social deprivation, poor housing and limited formal education, and the Rethinking Pain Team recognise that participants with persistent pain conceptualise and experience pain in a much wider sense than a Westernised biopsychosocial model. Service users frequently referred to "faith and belief" constructs to understand and live with pain, effectively using their faith and beliefs to live a positive life with pain. Thus, the nature and cultural utility of the educational modules delivered by Rethinking Pain have evolved over time to acknowledge and explore beliefs related to pain, e.g., the development of an educational workshop on Beliefs, Spirituality, Faith and Pain. Health coaches record and flag people they work with where conversations indicate their faith would be a barrier to them from engagement with aspects of the support. Health coaches attend bi-weekly meetings with a multidisciplinary team (MDT) that includes voluntary and community sector leads, a clinical team (GPs and CBT therapists), and social prescribers to discuss their caseloads and clients presenting with complex circumstances. The MDT meetings are an opportunity for the full Rethinking Pain team to support health coaches in their decisions and to consider and discuss the diverse offer of the programme.

Other aspects considered critical to the successful delivery of the Rethinking Pain service include; recruiting staff who are multilingual and of similar faith and representative of Bradford's diverse communities, a key partnership with a voluntary and community sector organisation Happy Healthy You (Bradford and Beyond), promoting voluntary and community sector engagement events to connect and work with the various communities represented in the region, and co-production of materials, sessions and workstreams with members of the community, to assure cultural appropriateness and sensitivities. Rethinking Pain uses an organisation with expertise to make information accessible to communities with low level literacy skills or where English is not the primary language.

Service evaluation

The Rethinking Pain service will be evaluated by an independent research team, underpinned by principles of theory of change (11) that will reveal the principles, values, components, structures, processes, and goals of Rethinking Pain. This might overcome some of the potential barriers to scalability by showing the value of working with the voluntary and community sector and which aspects of the service may be transferable to different contexts and geographical areas. Funding is more likely to follow if Rethinking Pain demonstrates success at easing pressure on GP and hospital services. In addition, the Rethinking Pain team have instigated ten community consultations to be thematically analysed as part of the development and evaluation of the first year.

Findings from the development, implementation and evaluation of the service will be shared with commissioners, clinical, voluntary and community partners, patients, and the wider society. Evaluation activities will include theory of change workshops, interviews with key stakeholders/staff and partners, quantitative and qualitative analysis of monitoring data, and consultation with different communities.

Implications for future policy and practice

A review by Kozlowska et al. (20) recognised resistance to change and constrained resources as a barrier to better integrated care in the UK Barriers included lack of commitment to integration by the organisations involved, conflicting organisational interests, insufficient resources to develop the integrated service, and inadequate mechanisms of payments between the organisations. We advocate Gaudet et al.'s call for "true cultural transformation" of services to a whole health system, if "whole-person health" with or without pain is to be realised (4). In that regard, the Rethinking Pain service will be tested across twelve primary care networks. If successful, the Rethinking Pain service will provide evidence for a new conceptual model for a health and well-being pathway that complements and reduces the need for medical intervention, and this can be adopted across the NHS, and potentially other long term health conditions.

Rethinking Pain provides opportunities for greater shared understanding of how the voluntary and community sector can work collaboratively with medical professionals and clinical settings to support patients with persistent pain. It is expected that a set of principles for targeting equitable interventions towards those with the greatest need and who face health inequalities, will be produced, and shared with the potential to be transferable and scalable. Successful development and implementation of integration of the Rethinking Pain service across the NHS will require shared goals and values across organisations and well-resourced teams to foster commitment and enthusiasm for joint working (20).

Conclusion

Our perspective is that greater use of the voluntary and community sector, in partnership with the clinical sector, creates the conditions for a "whole-person" approach to pain management, leading to greater personalised care, whilst having the potential to ease some of the pressures on General Practitioners and other clinical services. The Rethinking Pain service are piloting this perspective, by providing innovative voluntary and community sector-led system change for people living with persistent pain in Bradford District and Craven. The Rethinking Pain team are adept at using de-medicalised pain "language" in de-medicalised settings and embracing the whole context of a person's living experience within their community. The intention is that people reconceptualise pain beyond a biomedically-dominated narrative and are empowered to embark on a "healing journey" meaningful within their socio-cultural context and grounded in the principles of salutogenesis. Evaluation of the Rethinking Pain system change will be published in subsequent articles by our team.

Data availability statement

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

Ethics Statement

Ethical approval was gained from Leeds Beckett University Research Ethics Committee to undertake the focus group discussion. Participants provided informed consent that anonymised quotes could be used in this "Perspectives Article" as examples of their views (Application Reference 112905).

Author contributions

MJ: Writing – original draft. KP: Writing – review & editing. JW: Writing – review & editing. KT: Writing – review & editing.

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Conflict of interest

In the previous 5 years, MJ employer has received income for expert consultancy activities from GlaxoSmithKline, TENSCare, and LifeCare Ltd. that lie outside of the submitted work. MJ declares book royalties from Oxford University Press.

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

Publisher's note

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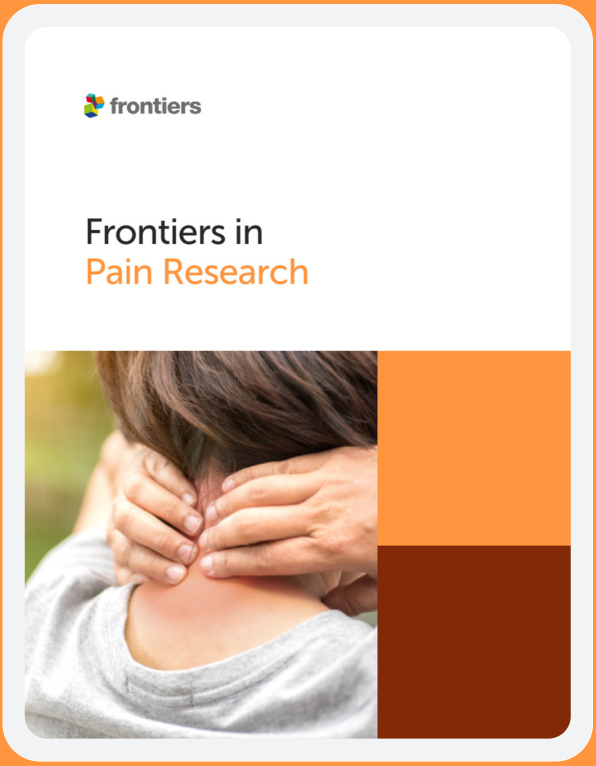

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