Journal of Pain 32 (2025) 105412

Contents lists available at ScienceDirect

The Journal of Pain

journal homepage: www.jpain.org

Original reports

"It's kind of just like a never-ending cycle": Young people's experiences of co-existing chronic musculoskeletal pain and mental health conditions

Nardia-Rose Klem, BSc(Physio)(Hons), MClinPhysio, PhD [a,*,1,2],
Andrew M. Briggs, BSc(Phty)Hons, PhD, FACP [a,3],
Samantha Rowbotham, BSc(Hons), MRes, PhD [a,4],
Robert Schütze, BA, BSc(Psych)Hons, MPsych(Clin), PhD [a,g,5],
Peter B. O'Sullivan, DipPhysio, PGradDipMT, PhD, FACP [a,6],
Anne J. Smith, BAppSc(Physio), PGradDip(Sports Physio), M(Biostatistics), PhD [a,7],
Breanna Tory, BA(Hons), MProfPsych [a,8], Jennifer N. Stinson, RN-EC, PhD [b,c,9],
Susan M. Lord, BMedSc, BMed(Hons), PhD, FANZCA, FFPMANZCA [d,e,f,10],
Helen Slater, BAppSc(Phty), MAppSc(Phty), PhD, FACP [a,11]

[a] *Curtin School of Allied Health, Faculty of Health Sciences, Curtin University, Perth, Australia*
[b] *Research Institute, The Hospital for Sick Children, Toronto, Canada*
[c] *Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Canada*
[d] *Children's Complex Pain Service, John Hunter Children's Hospital, Newcastle, Australia*
[e] *Equity in Health and Wellbeing Research Group, Hunter Medical Research Institute, Newcastle, Australia*
[f] *School of Medicine and Public Health, College of Health, Medicine and Wellbeing, The University of Newcastle, Newcastle, Australia*
[g] *Multidisciplinary Pain Management Centre, Royal Perth Hospital, Perth, Australia*

ARTICLE INFO

Keywords:
Chronic musculoskeletal pain
Mental health
Young people
Qualitative
Grounded theory

ABSTRACT

Chronic musculoskeletal pain (CMP) imposes a significant burden on young people (16–24yrs), impacting their physical, social, and emotional wellbeing and functioning during a critical developmental period as they transition from adolescence to young adulthood. The prevalence of mental health conditions also peaks around this age group, with CMP and mental health conditions being frequently comorbid. Existing epidemiological evidence recognises the relationship as bidirectional; however, there is little in-depth qualitative evidence about how young people experience living with co-existing CMP and mental health conditions. A Constructivist Grounded Theory approach was used. Young people, 16–24 years, living in Australia with self-reported co-existing CMP and mental health conditions were invited to participate in interviews to explore their lived and health care experiences. Twenty-one young people were included (5 men, 1 transgender person, 1 non-binary person, and 14 women). A core category of 'a feedback loop of pain and mental health', characterised the interconnectedness of CMP and mental health in these young people. This feedback loop was influenced both helpfully and unhelpfully

---

* Correspondence to: Curtin University, GPO Box U1987, Perth 6845, Australia.
E-mail address: Nardia-Rose.Klem@curtin.edu.au (N.-R. Klem).

[1] ORCiD: 0000–0002-4414–2719
[2] W: www.curtin.edu.au
[3] ORCiD: 0000–0002-6736–3098
[4] ORCID: 0000–0002-2242–6921
[5] ORCID: 0000–0002-2850–2569
[6] ORCiD: 0000–0002-3982–4088
[7] ORCiD: 0000–0002-4667–7389
[8] ORCID: 0009–0008-9170–4762
[9] ORCID: 0000–0002-9969–8052
[10] ORCiD: 0000–0002-8990–836X
[11] ORCiD: 0000–0002-4868–4988

https://doi.org/10.1016/j.jpain.2025.105412
Received 19 February 2025; Received in revised form 9 April 2025; Accepted 16 April 2025

by intrapersonal factors (emotions, cognitions, behaviours), interpersonal factors (healthcare interactions, relationships, and sense of self) and their personal context (societal discourse about pain, and mental health including stigma and environmental factors). 'A feedback loop of pain and mental health' suggests the need for a whole person, interdisciplinary approach that is titrated to the needs of the young person and addresses both CMP and mental health concurrently. Further research is needed to test the clinical utility of such a model.

Perspective: This study highlights the complex bidirectional feedback loop between chronic musculoskeletal pain and mental health in young people aged 16–24. These findings emphasise the need for interdisciplinary, whole-person approaches to concurrently address both conditions. Future research should explore the clinical utility of such models.

1. Introduction

From epidemiologic data, the relationship between chronic musculoskeletal pain (CMP) and mental health conditions is described as bidirectional.[1,2] This bidirectionality is particularly relevant to younger people, considered here 16–24 years, during a critical biological and social developmental period as they transition from adolescents to young adults – i.e., neither children nor mature adults.[3] Australian data for this age group indicate a chronic pain prevalence (≥3-month duration), including CMP,[4] of approximately 20%.[4–7] Mental health conditions also peak during this developmental period with pain registry data showing 42.0% (n=693) of paediatric and 64.7% (n=3518) of young adult cohorts respectively, with diagnosed mental health conditions.[8]

Despite this burden, significant service gaps persist.[9,10] Existing adult and paediatric services are hard to access, care is often unaffordable, fragmented and not age appropriate.[9–13] Further complicating service provision is limited evidence on effective care for young people experiencing comorbid CMP and mental health conditions. Holley et al. (2016) proposed a multilevel framework examining associations of chronic pain and post-traumatic stress disorder in childhood and adolescence (interpersonal context, trauma / pain-related factors, neurobiological factors).[14] Soltani et al., (2019) described a conceptual mechanistic framework, including parent and child developmental factors and stress contributing to chronic pain persistence and depression in paediatric populations.[15] Collectively, these studies propose various factors contributing to co-existing CMP and mental health conditions. However, the derived frameworks are based on epidemiological and neurobiological data, lacking exploration into the experience of living with these co-existing conditions. Studies are also limited to younger paediatric populations and a single mental health dimension, thereby limiting broader transferability. Lastly, the lived experience of CMP in 16–24-year-olds, has been qualitatively explored as distinct from experiences of co-occurring CMP and mental health conditions.[12,16]

Addressing this evidence gap, the authors recently conducted a systematic review and qualitative evidence synthesis of young people's lived and care experiences with CMP and mental health conditions.[17] Findings highlighted how both intrinsic (physical limitations impacting work/study, feeling different or stigmatised), and extrinsic factors, (social isolation and healthcare experiences), can add cumulative stress load on a young person.[17–20] Despite being the first review to rigorously identify and synthesise these lived experiences, confidence in the findings was generally low (based on GRADE-CERQual judgments[21]) reflecting significant gaps in primary evidence quality and volume. Just one included report directly answered the research question. Remaining data were yielded from subthemes or disaggregated data where the study focus differed from the synthesis objective.

While the bidirectionality of pain and mental health (e.g., prevalence of co-morbidity;[8] biological mechanisms[2,22]) is widely recognised across the literature, evidence regarding the lived experience of young people remains scant. The qualitative evidence synthesis[17] proposed a conceptual framework to understand how multiple inter- and intrapersonal factors can influence lived experiences of these conditions. However, a deeper understanding of how these conditions are experienced based on direct primary data remains fundamental to shaping care models that can address young people's specific needs and preferences. The objective of this primary qualitative study was to address this gap by exploring how young people experience living with co-existing CMP and mental health conditions.

2. Methods

2.1. Study design

This cross-sectional qualitative study was positioned within a broader research programme (myPAinhealTH (myPATH): a digitally enabled adaptive learning system to support quality care of young Australians living with CMP), and adopted a Constructivist Grounded Theory approach, aligned with the work of Charmaz.[23] Constructivist Grounded Theory is considered a set of principles and practices, emphasising flexible guidelines rather than methodological rules, where the purpose is to generate theory.[23,24] Distinct from other qualitative approaches that aim to develop patterns of meaning,[25] grounded theory research is a methodological approach for the systematic generation of theory that is 'grounded' in the data.[26] This approach to qualitative analysis is particularly well suited to areas of research where there are significant knowledge and evidence gaps and where the generation of theory can assist in understanding or explaining complex phenomena.[23,27] While there is a growing body of research on the co-occurrence of chronic pain and mental health conditions, this relates mainly to prevalence reports and proposed biological mechanisms, with less known about the specific experiences of these interactions, particularly in young people; i.e.: *how* do young people experience the co-occurrence of CMP and mental health conditions? The adoption of Constructivist Grounded Theory, in this context, allows for new insights that quantitative studies and existing qualitative literature have not, to the authors' knowledge, explored or captured. Hence, Constructivist Grounded Theory was considered the most appropriate research approach for this inquiry as the method allows for the creation of a framework that can be utilised to inform and guide the development of novel care models specific to this emerging young adult age group. Aligned with Constructivist Grounded Theory principles, this study is situated within an interpretivist paradigm, drawing on a relativist epistemology, and assumes the researchers as part of the research process, valuing their prior knowledge and experience.[27,28] Consistent with the qualitative philosophy, this approach does not imply causal inferences of the grounded theory, rather, the findings offer an inductive data-driven explanation of the phenomena of young people's experience of CMP and mental health conditions.[28] This study was approved by the institutional Human Research Ethics Committee (HREC) (HRE2022–0588) (Supplementary File 1).

2.2. Setting & context

This community-based study was conducted in Australia, involving young people residing across jurisdictions, and living in both metropolitan and regional areas. These diverse geographical settings also enabled capture of a range of socioeconomic groups, and, importantly to an Australian context, varying levels of access to health services. For young people in Australia, in-person pain and mental health services are largely located in metropolitan areas, which are commonly several hours or days drive from regional and remote locations. The Australian healthcare system includes both public and private services, where public health is government-funded and incurs no or 'minimal' out of pocket cost to the patient. However, wait periods for access to public tertiary pain and mental health services are typically extensive, requiring many individuals to delay treatment, or to access private services, thereby resulting in personal financial burden. Paediatric tertiary public health services also typically limit referral to around age 16 for young people in Australia. This leaves a potentially vulnerable transitional period from ages 16–18 years where their status as an adult or paediatric patient is fluid, and access to services can be challenging. Importantly, adult services are not set up to cater for this younger demographic, with this transition period a time where young people can potentially "fall through the cracks" of the health system.[12]

2.3. Sampling

Inclusion criteria were young people (16–24 years of age) living in Australia and experiencing a CMP condition and self-reported impact of pain on their mental health; and ability to speak and read English. Inclusion criteria were pragmatic and designed to reflect the real-world experiences of a young person living with these co-existing conditions, reflecting a diverse experiential spectrum. The age group of 16–24 was selected due to being widely accepted as a time of significant development and social changes where pain and mental health conditions commonly arise, and also reflects pain service design for this age group across Australia.[8] To this point, sampling makes a distinction from previous research on pain and mental health in paediatric populations,[14,15] as the present cohort of young people are developing their sense of identity as emerging adults, creating separation and independence from their parents and family unit. The decision to avoid imposing limitations on diagnoses or condition types was made to better understand the phenomenon of co-existing CMP and mental health conditions, distinguishing it from disease-specific research. This approach offers the potential benefit of enhancing the transferability of findings across the broader landscape of musculoskeletal pain care in Australia.

Young people were asked to self-report their mental health, the case definition was 'chronic pain that is impacting your emotional, psychological or mental health.' This definition of mental health was selected to capture both diagnosed mental health conditions, and/or mental states associated with distress and impairments to functioning, in alignment with WHO definition of mental health.[29] Beyond these inclusion criteria, there were no specified additional clinical thresholds applied for mental health or pain symptoms severity that dictated inclusion or exclusion in this study. This is important for young people where many experience co- and multi-morbidities, some of whom have not received a specific clinical diagnosis for their pain and/or mental health, an approach consistent with sampling from previous research the authors have undertaken in this age group.[12]

A convenience sampling approach was initially used, with all eligible participants being invited to take part in an interview. As data collection progressed, participants were sampled purposively to ensure diversity in experiences and nature of pain conditions, mental health diagnoses, geographic locations, ages, and genders. Aligned with Constructivist Grounded Theory, the final stages of sampling were also theoretical in nature to explicate emergent theory and links between concepts.[23] In grounded theory research, theoretical sampling is a process of 'filling out' properties of the emergent categories, to refine relationships between categories, and to identify variation in the emerging grounded theory.[27] Engagement in theoretical sampling is not an initial sampling technique nor representational, rather, it is used to "buttress researchers' claims to making their studies grounded".[27]

2.4. Recruitment

To facilitate a broad range of perspectives and experiences from across Australian health care settings, young people were recruited via an online screening survey using a Curtin-licenced web-based survey platform, Qualtrics™ [30] software. This screening survey was used to recruit eligible young people with CMP for a larger program of work. Information about the program of work was disseminated via social media, and pain-related national clinical, research and patient advocacy groups, and jurisdictional clinical networks. The survey guided potential participants to initial screening questions for eligibility. Following this, consent was requested via the online survey. To assist the process of sampling, the survey captured demographic data including age, gender, postcode, education level, work status, as well as clinical data including validated measures of pain duration, pain health condition(s), location and severity of pain, and psychological distress (Table 1). These demographic and clinical data were collected for the purpose of characterising the young people in the sample and were not included in the analysis and interpretation of the results. Eligible young people were invited via email and/ or phone to take part in an interview to explore their experiences of pain and mental health challenges. Twenty-two young people were invited to participate in this study, with 21 young people completing interviews (Table 2). One young person withdrew due to university practicum commitments. Two young people opted to

Table 1
Summary of pain-related clinical outcomes collected.

Psychometric tool	Description and Scoring
Brief Pain Inventory (BPI)[31]	The BPI assesses the severity of pain and its impact on functioning: 4 items on pain severity (rated on a scale of 0 to 10, where 0 = 'No pain' and 10 = 'Pain as bad as you can imagine'. Patients are asked to rate their average, worst and least pain over the last week, and their pain right now. Pain severity is calculated as an average of these four items); 7 items on pain interference (rated on a scale of 0 to 10, where 0 = 'Does not interfere' and 10 = 'Completely interferes'. The interference subscale is an average of the seven interference questions). Mean scores for both items are categorised as mild (0–4), moderate (5–6), severe (7–10).
4-item Brief Pain Catastrophizing Scale (Brief PCS-chronic)[32]	Revised PCS short form is a tool to evaluate pain-related catastrophizing: 4 items [5-point Likert scale ranging from 0 (never) to 4 (always)]; the tool is validated across ages and sex/gender. Total scores across items categorised as a mild disorder (0–5), a moderate disorder (6–8), or a severe disorder (9–16).
Pain Self-Efficacy Questionnaire (PSEQ)[33]	The PSEQ is a validated and reliable measure of a person's beliefs and confidence regarding their ability to undertake activities despite pain: 10 items, using a 7-point Likert scale ('Not at all confident '0′ to completely confident '6′), with all items summed for a total score with a possible range from 0 to 60, with a higher score indicating higher self-efficacy.
The Kessler Psychological Distress Scale (K10)[27]	The K10 is a validated psychological screening tool designed to identify significant levels of psychological distress. Scores range from 10 to 50 with higher scores indicating a higher severity of psychological distress. Raw scores of: • 19 and under are likely to be psychologically well, • 20–24 are likely to have mild psychological distress, • 25–29 are likely to have moderate psychological distress, • 30 and over are likely to have severe psychological distress.

Table 2
Participant demographic and clinical characteristics.

Participant ID_gender	Age (years)	SEIFA index of relative socio-economic advantage and disadvantage (decile) in 2021 *	Self-reported CMP diagnosis[+]	Self-reported mental health condition[#]	K10 Score	BPCS Score	PSEQ Score	BPI Pain severity Score	BPI Interference Score
P01_W	20	10	[+]No diagnosis	[#]Unspecified eating disorder	26.0	6.0	38.0	3.3	2.9
P02_M	18	8	Right L5 disc herniation	No diagnosis	20.0	5.0	50.0	4.0	9.0
P03_M	23	-	No diagnosis	Anxiety and depression	26.0	1.0	51.0	8.0	8.0
P04_W	24	-	Fibromyalgia, pudendal neuralgia, vulvodynia, migraines	Complex trauma/ PTSD, anxiety, situational depression	38.0	14.0	13.0	6.0	10.0
P05_W	19	10	Scoliosis, 3 bulging discs, degeneration, sciatica	No diagnosis	30.0	15.0	27.0	4.8	7.0
P06_W	22	10	No diagnosis	Anxiety and depression	32.0	15.0	21.0	7.8	5.4
P07_W	23	6	Spondylitis	Anxiety and panic attacks	24.0	7.0	26.0	3.0	5.0
P08_W	22	3	Psoriatic arthritis, recurring uveitis and colitis	Generalised anxiety disorder	30.0	10.0	27.0	4.0	3.7
P09_W	23	-	Ankylosing spondylitis	Anxiety and depression	31.0	5.0	44.0	5.5	6.0
P10_M	23	10	Hypermobility/ Ehlers Danlos syndrome	No diagnosis	20.0	9.0	42.0	4.3	3.4
P11_W	21	9	Fibromyalgia	Anxiety and depression	19.0	3.0	49.0	3.5	1.4
P12_W	17	9	Ehlers Danlos Syndrome, fibromyalgia, complex regional pain syndrome, osteoarthritis	Complex PTSD, major depressive disorder, generalised anxiety	33.0	10.0	20.0	5.5	6.3
P13_W	21	10	No diagnosis	Anxiety and depression	40.0	15.0	36.0	8.8	8.3
P15_W	16	2	Spina bifida occulta, Ehlers Danlos syndrome, pars defect	Depression, anxiety, PTSD	46.0	15.0	3.0	8.8	9.4
P16_W	16	8	Juvenile idiopathic arthritis	No diagnosis	35.0	10.0	26.0	4.5	1.9
P17_W	17	6	Hypermobility syndrome	No diagnosis	26.0	13.0	44.0	7.3	7.1
P18_W	21	4	Joint hypermobility syndrome, fibromyalgia, subluxing extensor carpi ulnaris tendon injury, chronic neck injury, chronic migraine	PTSD, anxiety	31.0	5.0	48.0	3.3	4.1
P19_NB	24	9	Endometriosis, pudendal neuralgia, abdominal wall pain, chronic pelvic pain	Complex PTSD, borderline personality disorder, anorexia nervosa, gender dysphoria	33.0	8.0	29.0	4.5	3.4
P22_TM	16	9	Hypermobility spectrum disorder	Anxiety and depression	39.0	16.0	11.0	5.5	7.3
P23_M	19	4	Joint pain post juvenile idiopathic arthritis	Generalised anxiety disorder, depressed mood	28.0	7.0	37.0	3.8	4.7
P24_M	23	5	Hip dysplasia, hip arthritis	No diagnosis	22.0	8.0	36.0	3.3	4.0

W = woman; M = man; NB = non-binary; TG = transgender
PTSD = Post Traumatic Stress Disorder
K10 = Kessler Psychological Distress Scale; BPCS = Brief Pain Catastrophising Scale; PSEQ = Pain Self Efficacy Questionnaire; BPI Pain = Brief Pain Intensity Pain Subscale; BPI Interference = Brief Pain Interference Subscale (Table 1)
* SEIFA: Socio-Economic Indexes for Areas (SEIFA) is a product developed by the Australian Bureau of Statistics that ranks areas in Australia according to relative socio-economic advantage and disadvantage. The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) summarises information about the economic and social conditions of people and households within an area. This index includes both relative advantage and disadvantage measures. Expressed in deciles (1-10), a low score indicates relatively greater disadvantage and a lack of advantage in general, while a high score indicates a relative lack of disadvantage and greater advantage in general [Australian Bureau of Statistics (2021), Socio-Economic Indexes for Areas (SEIFA), Australia, ABS Website, accessed 11 November 2024]
[+] Where participants indicated ‘no diagnosis’ this was considered a clinically ‘undiagnosed’ CMP condition as inclusion criteria were satisfied for classification as a CMP condition
[#] Where participants indicated ‘no diagnosis’ this was considered an ‘undiagnosed’ mental health condition as inclusion criteria were satisfied for CMP impacting their emotional, psychological or mental health.

have a parent present for the interview.

2.5. Data collection

Interviews were based on a semi-structured interview schedule (Supplementary File 2), developed by the multidisciplinary research team, including a young person with lived experience of CMP. Interviews were conducted by the lead author (NRK), a woman and physiotherapist clinician-researcher with expertise in qualitative methods. At the start of the interviews, NRK explained the purpose of the interview was to better understand how young people experience CMP and mental health. NRK did not have any prior relationship with the participants. Additional interview topics were added to follow lines of enquiry as the research evolved. These included young people’s perception of the necessary skills to cope with their pain and mental health, their social identity when living with CMP and mental health, and the interactions between their health experiences and their mental and pain related well-being. All semi-structured interviews were conducted online via Microsoft Teams™[34], except for one interview conducted over the phone due to Internet connection problems. Data were collected between April and November 2023. Interviews ranged from 50 – 165 min, recorded via the online platform and transcribed verbatim.

2.6. Data analysis

Analysis was aligned with the overarching Constructivist Grounded Theory approach.[23] Over the course of the interviews, NRK wrote memos and diagrammed to assist sense-making of the data. This early analytic process helped to inform subsequent interviews and later theoretical sampling. Initial line-by-line coding was conducted on four diverse transcripts by NRK. A preliminary codebook was generated from this initial coding and a second coder (SR) deductively applied this to the same four transcripts, and divergent and convergent interpretations of the data were discussed with two other authors (AMB and HS). Open line-by-line coding was then conducted on four new transcripts (NRK) and compared with the preliminary codebook with adjustments made to ensure the codebook reflected the raw data. At this stage, NRK began the process of creating focussed codes, which were then applied to the previously coded eight transcripts. A second coder (SR) applied these focussed codes to the originally coded four transcripts, plus one new transcript. Focussed codes were considered as codes with significant salience that represented key emergent findings in the data.[23]

Development of the coding framework (Supplementary File 3) was emergent and iterative in nature throughout the course of analysis. Diagramming and memos were also used at this stage to create early connections between concepts of the data, which were then discussed with the broader team (AMB, HS, SR), and constantly compared with raw data and earlier interpretations. Iterative movement between raw data and interpretations was refined to identify patterns of meaning and the different analytic levels, including sub-categories and categories (Supplemental File 3). This approach aligned with the diagramming of connections within the data. Following this, in alignment with the Constructivist Grounded Theory approach, a core category that captured the meaning and diagrammatic connections between the categories was generated. Team discussions (AMB, HS, NRK, POS, RS, SR) focussed on sense-checking of the interpretations of the data and alignment with existing theoretical and clinical knowledge of this patient population. The model generated from the analysis and diagramming was reviewed by two participants (P06_W22, P10_M23) to ensure resonance with, and usefulness of, the findings.[35] Subsequent transcripts were inductively coded and constantly compared against the emergent focussed coding framework and developing diagrams.[23]

These final stages of analysis were aimed at confirming and disconfirming the emergent relationships between concepts and were iterative in nature moving between early and mid-stages of the interpretive process. The analysis resulted in the development of a theory of pain and mental health conditions in young people. While the case definition for mental health is recognized to exist on a spectrum (poor to good), the young people in this study often used the term mental health to implicitly describe a valence (negative impact) or poor mental health. The results have remained faithful to the young people's use of mental health in this way, while further contextualising a positive or negative impact on their mental health condition in the results and supported this with primary quotes.

2.7. Reflexivity Statement

Reflexivity is considered a key methodological component to Constructivist Grounded Theory research.[23] The influence of the researcher on the research and vice versa was not denied under this methodological approach; however, the authors remained sensitive to how meaning was constructed as a product of their worldviews. The research team was actively reflexive during the analytic process, maintaining an "open mind not an empty head" to the possibilities of the data, considering their existing experience and knowledge of this clinical population.[36] The authorship group, comprised entirely of non-Indigenous people, included a young person with lived experience of CMP (BT), clinical and research physiotherapists who work in the area of CMP (AMB, HS, NRK, POS), a research physiotherapist in the area of CMP (AS), a clinical and research specialist pain medicine physician who works with young people (SML), a clinical psychologist and clinical researcher who works in the area of pain and mental health care (RS), a scientist and nurse practitioner who works in the area of paediatric chronic pain (JS), and a health researcher (SR). The authorship team were all collectively involved in developing the research questions, as well as the interview schedule. The authorship group collectively viewed the importance of building evidence to better characterise the intersection of CMP and mental health for young people and using this evidence to enhance person-centred, integrative and equitable care for young people. Under a qualitative approach, the authors do not deny the influence of their extant Western ways of knowing and doing, nor their clinical, research, professional and any relevant personal perspectives in this field. Rather, they remained aware of their positionality, reflexively considering how their perspectives were informing the development of the findings.[37]

2.8. Rigour

This study was evaluated against Charmaz's quality criteria for Constructivist Grounded Theory studies: credibility, resonance, usefulness, and originality.[35] Demonstrating credibility, the lead author (NRK) conducted in-depth interviews with the participants, including collecting and reviewing key clinical and demographic data prior to interview. As a result, the proposed theoretical model was grounded in rich, diverse data. Further supporting credibility, codes were grounded in participants' experiences, and examples of analysis (Supplementary File 4) were included in this study to evidence the interpretation of findings, with the researchers engaging in a strong reflexive process. Additionally, constant comparison methods, memo writing, and diagramming were used throughout analysis. Consultation with co-authors was also conducted at key stages as a form of 'sense-checking' the emergent findings. This included review by BT, a young person with experience of CMP, and two participants (P06_W22, P10_M23) to ensure resonance and usefulness of the findings. Given the lack of theoretical exploration of pain and mental health in this age group, to the author's knowledge the findings of this study are original. To facilitate explicit and comprehensive reporting, the 32-item Consolidated Criteria for Reporting Qualitative Studies (COREQ) checklist was completed (Supplementary File 4).

3. Results

3.1. Participant characteristics

Young people ranged from 16 to 24 years in age, where 70% identified as women. Young people represented a broad range of self-reported primary and secondary CMP conditions (n=17, 81%) and mental health diagnoses (n=15, 71%) (Table 2). More than half the participants (n=12, 57%) had a K10 score higher than 30, indicating likely severe psychological distress. A third of participants (n=7, 33%) reported high pain interference (BPI), while more than a third (n=8, 38%) reported low pain intensity (BPI) (Table 2).

3.2. Qualitative findings

The following section describes the qualitative results. Findings are structured aligned with Constructivist Grounded Theory conventions whereby there is a 'core category' considered as the chief phenomena around which the theory is built and which accounts for the nuance and variation found in the data.[23] The categories are situated under this core category and demonstrate how the core category describes the phenomena of interest.[23] The qualitative results will firstly describe the categories of CMP (referred to simply as pain) and mental health interconnectedness, intrapersonal factors, interpersonal factors, and context, supported by participant quotes. Participants quotes reflect indexing by participant number, followed by their gender and age, for example: P01_W17. The results then conclude with the description of the core category and grounded theory ‘a feedback loop of pain and mental health’, accompanied by a proposed theoretical model. The hierarchical representation of the findings and comprehensive analysis (core category, categories, sub-categories, focussed codes) can also be found in Supplementary File 3.

3.2.1. Interconnectedness of pain and mental health

Young people described their experience of pain and mental health as interrelated constructs that interacted to influence one another. Some young people described this interaction as two separate constructs that could converge, while others experienced them as intrinsically linked.

> *For me they started as two separate things, but I suppose they are unavoidably linked now because I am one person – P09_W22*

Young people described different journeys for how this feedback loop evolved for them. Some described firstly experiencing pain, then developing impacts on their mental health. Alternatively, some young people recalled having existing mental health conditions and then developing pain. Irrespective of how the interconnectedness of these co-existing conditions evolved, young people described how the experience of both concurrent conditions endured:

> *I think the pain definitely came first, um, like I’ve always been more of an anxious type of person but it has really kicked in the last sort of 5 years since, like I’ve became an adult, like I’m now in charge of my care and my treatment and like I’ve swapped over from a paediatric specialist to now an adult one um, and I think that has caused a lot more anxiety, that it’s me in control um yeah. So yeah, I think definitely the pain first then the anxiety – P07_W23*

> *My mental health has been ongoing throughout my whole life, to be honest. Like, I, I’ve always had anxiety and depression. Um, you know, from, from childhood. Uh, it, it gets much worse when, when I’m injured, um, when, when the pain increases. It, it’s, directly linked, a hundred percent – P03_M23*

Young people described how pain and mental health could affect each other in either direction. This impact could negatively or positively impact either experience, uniquely varying between young people and across time. For example, some young people described significant mental health drivers of their pain experience, which in turn worsened their experience of mental health. Conversely, the opposite may also be experienced, where pain drives significant mental health impact, further affecting the experience of pain.

> *I think um, the worse my pain would get um probably the worse my mental health would get but then I also think that would make my pain worse because I might not want to go and do things like, I might not want to do my exercises because it feels like – like I feel like it’s not worth it or something like that. And then like I think it’s kind of like a cycle, and it um, they just make each other worse really – P05_W19*

3.2.2. Intrapersonal factors

Intrapersonal factors include a young person’s emotions, cognitions, and behaviours. While pain or mental health may affect these intrapersonal factors, intrapersonal factors may also influence the experience of pain and/or mental health, in either helpful or unhelpful ways.

Emotions such as fear, stress, feeling low, despondent, helpless, and frustration were described as impacting the experience of pain, or manifesting in response to the experience of pain. Young people described these emotions as creating a more intense experience of pain, resulting in a flare, or magnifying a young person’s attention on their pain. Similarly, some young people described how these emotions, linked to their experience of pain, resulted in other psychological sequelae:

> *I think that because it changes my mental state. It then feeds – it’s like a little connector between my mental health. So, it’s like, oh my gosh, I’m in so much pain, this is so frustrating, like I’m struggling so much, I can’t do this anymore. So then that will then link into like, you are not good enough, and like it will, so it will spiral quickly. So I, I don’t think it changes my mental health, but I think it connects into my mental health. So, it changed my state of mind, and then obviously when you’re already in a bad state of mind like my mental health will grab that and just like keep going downhill. – P13_W21*

Young people described how their cognitions such as worry, rumination, negative expectations and vigilance may heighten their experience of pain and/or mental health impact. Conversely, the presence of pain or mental health conditions could also result in the experience of these same cognitions. However, cognitions could also function to dampen the experience of pain or mental health. One participant explained how switching his focus to positives allowed him to better cope with his pain, demonstrating the interface between cognitions, behaviours, and the experience of pain:

> *Like, you know, the meditation or just focusing on the little positives. Yeah, like that. So that whole mindset change has been really good to help, I guess, keep pushing me forward – P02_M18*

Young people also described behavioural responses affecting, or being in response to, their experiences of pain and mental health. These included responses such as avoidance, adaptation, activation, and endurance, which may be helpful or unhelpful to the young person’s experiences of pain and mental health. Some young people described advocacy for their condition with the aim of prompting and receiving support from health professionals, workplaces or, for some, their universities. One participant described how being ‘upfront’ with her lecturers about having the condition of Ankylosing Spondylitis resulted in additional support enabling her to complete her studies, despite having reservations about having to disclose her CMP condition:

> *I have noticed like, if I’m really upfront with lecturers about my experiences then they are pretty good at advocating but it’s also like I shouldn’t have to disclose um, the details of a health condition for the [redacted] school to you know, I am very grateful for the lecturers that help advocate for me but I shouldn’t have to disclose that information to get that support if that makes sense – P09_W23*

Interactions between emotions, cognitions, and behaviours were frequently described by young people, with resultant impacts to their pain and mental health. Some young people described the positive impact of some behaviours, such as regular gentle exercise resulting in reductions in pain and better mood. One participant described how cognitively accepting and ‘becoming friends’ with her pain has improved her coping behaviours:

> *Well, when I was first diagnosed, I kind of always thought of it as the enemy, and I kind of just definitely pushed it away and pretended it wasn’t there, which at the end of the day, made it a lot worse because I’d still do the things that would trigger it and I’d just pretend that everything’s fine and I could do everything a normal 20 year old could do, but I think now just learning to understand basically like a friend what it likes, what it doesn’t like and just knowing that it’s always going to be there, but I’m just going to have to live with it. – P08_W22*

However, many young people described how pain would often result in the behaviour of withdrawal that negatively impacted their emotions and cognitions. Participant 6 described how being in bed all day worsens her pain and results in worry about how she will manage her pain:

> *If I’ve been in bed all day, doing nothing and not really speaking to anyone, and then – I feel like it’s those times that my pain is worse, and I end up like really upset about my pain as well. Um, like, even like last week I just was like crying every day because the pain was just like really*

> *bad and I didn't know how to handle it, I didn't know how to make it better, or who to see or where to go from then – P06_W22*

3.2.3. Interpersonal factors

The interpersonal factors, considered as young people's experiences with their external world, included healthcare experiences, relationships, and their sense of self. These interpersonal factors could influence, and be influenced by, a young person's experience of pain and mental health.

Young people described their various healthcare experiences affecting their mental health and experience of pain. This included young people's desire to find the right fit for their pain and mental health care, which often resulted in trialling numerous and varied treatment and management approaches, with some young people not deriving the benefit they expected. Young people also described significant challenges navigating health services and the health system, unsure of how to find the care they needed to support their pain and mental health. Some young people described presenting to hospital Emergency Departments in an attempt to access the support they needed:

> *Yeah, ended up in emergency departments, probably out of frustration more than anything else and hoping they would speed it up. Emergency departments don't do that. They actually slow it down. And they have the fast track in [location] anyway. They have fast track, which I like to call fast tracked purgatory because it's where they, it's where they see you, where you're actually not a priority at all. But they do at some point want to get you out without admitting you – P10_M23*

Positive care experiences could have a helpful impact on young people's pain and mental health. Where healthcare practitioners spent time building relationships with the young people and providing them with practical solutions, this was considered a positive and validating experience. Illustrating the interaction between interpersonal and intrapersonal factors, these positive healthcare interactions could also extend to facilitating helpful behaviours to support young people managing their pain:

> *Doing my own research and just talking to physios and OTs about what it is [my condition] has helped so much. Even just learning different techniques. about the spoon theory and how many spoons I have in a day and how much an activity takes for all my energy levels. It just helps so much because I don't overdo myself a day before and then the next day I'm just in so much pain. So yeah, it's definitely learning about the condition has helped so much and I understand my body a lot more and I know the triggers. – P08_W22*

However, care could also be unhelpful and impact young people's experience of pain and mental health. One participant explained numerous therapeutic encounters where doctors advised that there was no 'cure' as ultimately unhelpful, and resulting in impacts to his mood and sense of self:

> *The shuttling between medical doctors and spending a lot of money on it, when there was nothing they could do to cure it, um, was not helpful really. Like it actually, I think, exacerbated how I felt about myself and it exacerbated sort of a creation of an image in my own brain of me as, you know, it being defective in some way. And in many ways, I look at those years as sort of lost… Because I typically spent a lot of my time sitting in doctor's surgeries and spending a lot of money on that too, when actually I probably could have put that money into actual practical things that helped. – P10_M23*

Pain and mental health experiences were described as impacting young people's relationships, including their friendships, intimate relationships, and family. Commonly, young people described how they felt worried about experiencing pain and having a bad time, or "ruining the fun" (P02_M18) for others. For some young people, the fact they were experiencing pain and changes to their mood left them feeling guilty about potentially burdening their friends. This included how the physical functioning limitations of their pain restricted their ability to participate in some activities. The anticipation of a negative relational experience meant young people often opted to decline social events rather than go out with friends, which could lead to further emotional and mental health impacts. Contrasting the negative impact others described, one participant explained how taking a graded approach to returning to sports facilitated re-engagement in a community and building friendships with likeminded people. She also described how this re-engagement resulted in improvements in her anxiety and depression:

> *Getting back into sport definitely helped. And it was like a new set of friends and like it was kind of like a complete fresh reset. They didn't really know what had been going on. So, it was quite nice to have that, um, in your life… And like since then, I've, my mental health has been really good, I still see a psychologist once every two to three months, um, just as sort of like a checkup, um, more preventative than anything, just to kind of keep on track – P11_W21*

Elements of the young people's evolving sense of self were frequently challenged by the experience of co-existing pain and mental health. These elements included identity-defining activities such as music and sport, and their ability to work and study in fields that reflected their emerging or desired professional and vocational identities. These impacts to their sense of self were described as affecting the young people's mental health and experience of pain. This impact was particularly profound for young people who worked in physically demanding fields, where pain limited their functioning at work. One participant explained how his profession as a musician was significantly impaired when he experienced pain, resulting in impacts to his mental health, as well as to his social world:

> *As a musician, it's, um, our ability to play our instrument is really tied to our sense of self-worth, um, as, as it is for lots of people. But I think for musicians, our, our work life is in some ways uniquely tied to our social life as well. So, you know, I'll finish a day of work and then instead of, you know, going to the bar with, with people, I'll, um, hang out with other musicians and play a gig or something. So, yeah, definitely, a high impact – P03_M23*

Demonstrating the interface between interpersonal and intrapersonal factors, other young people described how ongoing investigations to find a cause or explanation for their pain could create a state of perpetual uncertainty and worry about their pain condition. Young people frequently described the significant impact of the interaction with health professionals (where young people did not feel heard, understood, or validated in their experiences), resulting in significant emotional and cognitive impacts (e.g., frustration, confusion, anger) affecting their mental health:

> *I felt really like I felt really invalidated and I felt really like what? Like there's like there's something wrong with me that like I was like, well, I don't get it. I also felt crazy because this man is looking at me going, 'No. Like, there's nothing wrong with you. I don't know why you're feeling pain' and then would end the sentence there. And nothing would fill that space. And I'm just like, well, what the fudge like? What am I meant to do with that? Because I do feel pain, I can't sleep because of this. So yeah, I felt really let down. I felt super confused and I was just like, well, what am I meant to do now like? – P01_W20*

3.2.4. Context

Context, considered as the overarching factors affecting young people's experiences, included the broader societal discourse about pain and mental health, as well as environmental factors. The way in which pain and mental health were perceived by society for a young person, were described as impacting their experience of pain and mental health. This extended to misunderstandings about the lived experience of CMP for a young person (i.e., the belief of being 'young and healthy'), the invisibility of both pain and mental health, and stigma associated with both conditions. These experiences of the wider societal discourse about pain and mental health could result in intrapersonal and interpersonal impacts, often manifesting as negative emotions and impacts to their relationships.

Commonly, young people described how their "healthy" peers did not understand their experience of CMP. Some young people also described feeling stigmatised because of their pain and mental health conditions. One participant described their experiences of invisibility and stigma associated with both their pain and mental health conditions. While they described both conditions being misunderstood, they described more experiences of stigma with their mental health condition as it was perceived as less 'concrete' than pain:

> *…Mental health wise, definitely, yeah. Because in, like, the mental health system and also publicly, it's not really, it's kind of viewed in a certain way…. And because, yeah, it's often invisible [mental health], it's kind of like, you can't, like, I can't really bother, like, I have to kind of function and ensure I could, like, you know, I don't know. Um, but I think I probably more feel it [stigma] in relation to my, um, mental health, I guess, um, because pain feels a bit, a little bit more concrete, I guess. – P20_NB24*

The pervasive societal notion that pain reflects a danger or a threat to the body was often impressed upon young people. These danger-based beliefs about pain were described as increasing their worry and feelings of fear about their pain, which could lead to avoidant behaviours. One participant described his experiences of advice from his social circle reinforcing a belief of pain being dangerous, causing increased worry about his pain and a need to be protective:

> *Kinda like stressed me out. I was like, like what the hell's going on? And then especially cuz like, family and friends have had similar things like, oh yeah, like be really, be really, really careful. You don't wanna end up having like a permanently numb foot or having like permanent pain or whatever. So, there's a lot of that as well. Like, just be super, super careful. It's really bad if you do this and that and the other – P02_M18*

Environmental impacts, including access to health services, health system structures, economic factors, and the appropriateness of the physical environment, were also described as impacting young people. For young people who transitioned from paediatric to adult services, health services and related health systems meant they were at potential risk of "falling through the gaps" (P12_W17). Access to government funded services, particularly mental health services, was also challenging for many young people, who were forced to access private services, incurring 'out of pocket' expenses:

> *I think they could have helped me, because I had been there in the past and I had the best psychologist ever when I was in like year 10 and it was just someone that I wanted to talk to, wanted to rant to, it was fine. But when I went back for an assessment in first year of uni, um, they were like nah, you're crazy. And I was like ok, which it was a bummer because like, I dunno, I feel like mental health support should be accessible and because yeah I dunno. I dunno. I was just bummed that I had to pay so much money to see someone because the free place that I could have gone to said that I was crazy or whatever. – P06_W22*

The appropriateness of physical infrastructure at workplaces and educational institutions could also either facilitate or hinder the young person's ability to continue working or studying productively. Some young people described negotiating accommodations with their workplace to support their functioning, such as sit-stand desks, pacing of work, and the ability to work from home. However, other young people choose to seek work that better fitted within the physical limitations of their condition:

> *I wouldn't be able to do a very physical job. And I think, um, just, just cause, uh, pain's kind of triggered by a lot of physical activity. Um, so I've tried to pick a career that's a bit more, um, flexible like that, like try and be a teacher next year at, at uni. Um, and I think the amount of time I'd want to spend volunteering also, I probably couldn't do as much at the moment cause, my body wouldn't be able to take it. I think if I did more exercise, it might, but it's a bit, yeah, it would take some time. – P23_M19*

3.2.5. *The grounded theory: 'a feedback loop of pain and mental health'*

Young people's experiences of co-existing CMP and mental health conditions are characterised within the core category of 'a feedback loop of pain and mental health' (Figure 1). This theory posits the dynamic, reciprocal nature of the interconnectedness of these two co-existing conditions. Specifically, pain can influence the experience of mental health, which can further affect the experience of pain; and, mental health can influence a young person's experience of pain, further affecting their mental health experience.

Categories of intrapersonal and interpersonal factors can both helpfully or unhelpfully influence, and be influenced by, a young person's experience of pain and mental health driving this feedback loop. Intrapersonal factors relate to i) emotions (feelings, e.g., stress, feeling low, frustration, sadness, hope, relief, happiness); ii) cognitions (thoughts, e.g., pain-related worry, rumination, negative expectations, acceptance, looking at positives); and iii) behaviours (observable conduct, e.g., avoidance, withdrawal, endurance, resilience, activation, adaptation). While intrapersonal factors collectively contribute to the broader pain and mental health feedback loop, interactions can also occur between each of these three factors. For example, emotions or cognitions can drive behaviours, and behaviours can also result in different cognitions and impact on emotions.

Interpersonal factors capture young people's interactions with their external world, including i) experiences of healthcare (e.g., interactions with healthcare professionals, process of diagnostics); ii) relationships (e.g., experiences with friends, family, and intimate relationships); and iii) sense of self (e.g., ability to do identity-defining activities, professions or vocations). Interactions between healthcare, relationships, and sense of self may also occur and have an influence on the feedback loop.

Additionally, intrapersonal and interpersonal factors may interact. In this case, external experiences or relationships may affect a young person's emotions, cognitions and/or behaviours, with the converse also being true. For example, the inability to travel due to pain can result in emotions of feeling low, or withdrawal behaviours that can result in impacts on relationships, while experiencing control over pain can lift mood. These interactions may then also contribute to the broader feedback loop, influencing a young person's overall experience of pain and mental health.

Overarching intrapersonal and interpersonal factors is the young person's context. This encompasses societal discourse about pain and mental health (e.g., how CMP and mental health are (mis)understood and discussed by the general public, social stereotypes about CMP and mental health in young people), and the role of environmental factors (e.g., access to health services, geographic location, health system structures including funding models). These factors can influence a young people's experience of pain, mental health, and related intrapersonal and interpersonal factors. For example, environmental impacts can influence a young person's experience of care through a lack of access to appropriate services, or unhelpful societal discourse about pain can impact a young person emotionally leaving them feeling stigmatised, feeling alone or isolated and challenging their social inclusion.

4. Discussion

The present findings focus on the experiences of 16–24 year olds who undergo significant biological and social developmental changes as they

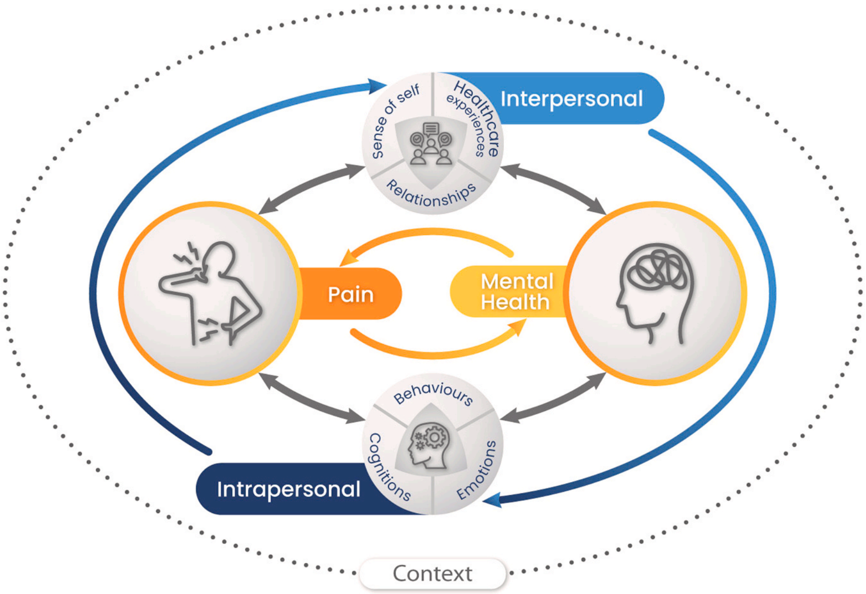

Fig. 1. A theoretical model demonstrating a feedback loop characterising the interconnectedness of co-existing chronic musculoskeletal pain (CMP) and mental health in young people (centre; depicted in shades of orange). As indicated by blue connecting arrows, this feedback loop may be influenced both helpfully and unhelpfully by intrapersonal factors, (emotions, cognitions, behaviours; as indicated by the bottom circle), interpersonal factors (healthcare interactions, relationships with others, as indicated by the top circle) and context (societal discourse about pain and mental health including stigma, environmental factors) (outer dotted line). The relationship between each of the factors is non-linear, potentially interactional and complex, with the nature of the feedback loop and interacting factors being unique to each young person.

transition to young adulthood in the face of co-existing CMP and mental health conditions. The 'feedback loop of pain and mental health' model derived from this research showed young people's experiences were influenced in a valenced manner, by intrapersonal factors (emotions, cognitions, behaviours), interpersonal factors (healthcare experiences, relationships, sense of self) and a broader context (societal discourse about pain and mental health, environmental factors). This theoretical model supports and builds on extant qualitative epidemiological research describing pain and mental health as sharing a bidirectional relationship,[2,12,38] while further facilitating a deeper understanding of the nature of their lived intrapersonal and interpersonal interactions. This model extends the authorship's previous systematic review and qualitative evidence synthesis of lived and care experiences of CMP in this age group, which described how intrinsic and extrinsic factors can compound or buffer allostatic load in young people with an already stressed, developmentally-sensitive system.[17] The findings from this study extend the current evidence, providing more direct evidence on the nature of the complex experiential interactions that young people with co-existing CMP and mental health encounter, and evidence that experiences are relevant to a population with heterogeneity in CMP classifications.

4.1. Strengths and limitations

To the authors' knowledge, this study offers the first qualitative explanatory model of the experience of CMP and mental health conditions in young people aged 16–24 years. Previous literature has offered theoretical models on the intersection between pain and mental health, however these have been derived from younger paediatric populations (i.e., parental interactions are more developmentally relevant), explored a single dimension of mental health (e.g., depression), or focused on epidemiological data.[14,15] Thus, the role of paediatric developmental factors and parental influences relevant to these previous models are not directly transferable to the emerging young adult age group. The inquiry applied a Constructivist Grounded Theory methodology, involving a comprehensive, systematic analysis and generation of theory, grounded in rich data. Constructivist Grounded Theory is particularly useful where there is a current lack of explanation or theoretical understanding of phenomena, which is relevant to understanding the experience of co-existing CMP and mental health conditions in young people. The findings provide evidence that can inform service models for this young population, models that consider the integration of truly synergistic CMP and mental health co-care. The study sample was diverse and rich in the range of demographic characteristics, CMP conditions and mental health diagnoses (where the participants had an existing diagnosis) and/or level of psychological distress and lived experiences.[35] Data were collected to the point of theoretical sufficiency.[35] Analysis was robust, including iterative movement between analytic stages and consultation with the broader cross-discipline and lived experience authorship team.[35]

Several limitations are acknowledged. While this research may be transferable to similar high-income country healthcare settings, such as Canada and New Zealand, the transferability of this work to different cultural settings will require further research. The sample lacked representation from diverse populations, including Aboriginal and Torres Strait Islanders People and peoples of diverse cultures who speak English as a second language. The study was cross-sectional in nature and CMP and mental health conditions were self-reported. Research is needed to test the theoretical model's clinical utility and applicability, including in chronic pain populations more broadly.

4.2. Implications for a young person's care: disrupting the feedback loop

Previous research exploring the interaction between CMP and mental health conditions in young people has described the relationship in terms of contributing factors rather than a description of how and why the these co-existing factors occur from those who have lived experience.[1,14,15] However, the feedback loop model presented in this current paper aligns with the notion of allostasis, which reflects the body's normal physiological process of effectively buffering, or down-modulating, stress load via the hypothalamic-pituitary axis, functioning as a negative feedback loop. Under prolonged stress, the effective regulation cannot be sustained via the negative feedback loop, resulting in allostatic load and various physiological consequences.[39–41]

For young people in this study, the persistent interaction and feedback loop of CMP and mental health conditions can result in prolonged sensitisation of the other, meaning the stress response is never 'switched off' in a developmentally sensitive system.[42] This creates an environment of sustained stress resulting in allostatic load, and potential mood and inflammatory vulnerabilities.[22,43]

The findings suggest that care models designed to disrupt and target key potentially preventable and modifiable 'drivers' of the feedback loop, in the form of intrapersonal or interpersonal factors, and context (for example, health system funding structures, pain-informed societal discourse) may beneficially affect outcomes in young people experiencing CMP and mental health impact. The notion of 'disrupting' the feedback loop in young people during their developmentally critical transition from adolescence to young adulthood, when pain and mental health often emerge, supports time-critical care models. Such care models would ideally address a young person's CMP and mental health concurrently,[44,45] responding to a call to action from the pain and mental health clinical space.[14]

While an interdisciplinary model of care is widely accepted as best practice and would be appropriate to facilitate co-care and disruption to the pain and mental health feedback loop,[33,46] the findings clearly highlighted how care experiences were often fragmented and non-integrative. Echoing the findings of previous research,[12,13,16] such experiences were described as unhelpful and distressing for young people experiencing co-existing CMP and mental health conditions. Presently, guidelines for interdisciplinary care typically highlight 'what to do' but infrequently provide guidance on 'how to' achieve such care, especially in primary care settings.[47] For example, the notion of a 'feedback loop' provides support for a transdiagnostic approach to interdisciplinary care. Here, the 'how to' of transdiagnostic care considers that diverse clinical presentations have common underlying neurobiological, psychological and social mechanisms, and may therefore benefit from similar treatment elements.[44,45,48] This approach moves away from solely diagnosis-driven management, which often fails to consider the multifactorial, individual and complex nature of co-morbid pain-related disorders.[49] Based on this study's proposed feedback loop theory, a transdiagnostic approach for a young person experiencing co-existing CMP and mental health needs, proposes that timely targeting of key modifiable driver(s) of the feedback loop may result in positive impacts to their experience of pain and mental health.

Supporting the adoption of a transdiagnostic integrative care approach, is clinical staging. Staging facilitates the delivery of hierarchically-arranged care to accordingly stratified individuals.[45,48,50,51] Care varies in terms of the intensity, duration, and mix of intervention options.[48] Staging has been described extensively in mental health care,[45,50] incorporating a risk-stratified approach to mental health service delivery. While clinical staging is in its infancy in CMP, recent research identified three pain phenotypes in 16–24 year olds experiencing CMP, characterised by an increasing symptom-severity gradient in multidimensional pain-related variables: 'low', 'moderate', and 'high', where the latter two had a higher prevalence of comorbid mental health conditions.[8] The authors suggested that phenotype-informed care could facilitate timely implementation of targeted interventions, titrated to the symptom-severity gradient, and tailored by an interdisciplinary team to meet young people's individual needs.[8] In this context, the findings suggest that young people may be profiled using validated screening tools and comprehensive clinical interviews to assess the severity, impact and dominance and interplay of pain and mental health, thereby identifying potentially modifiable targets (intra- and interpersonal) for interdisciplinary care to disrupt the feedback loop.

The findings suggest a possible way forward for improving the delivery of high-value, timely, age-appropriate, and holistic care for young people with co-existing CMP and mental health conditions therefore requires reconsideration of 'how' we deliver care, not just the 'what'. Yet, interdisciplinary care that is underpinned by a transdiagnostic and staged approach is seldom implemented in health systems.[52] A key issue that is well recognized in previous implementation research is the barriers to building sufficient health workforce capacity and capability to deliver such interdisciplinary service models.[53] This may be in part due to a lack of a common clinical reasoning framework and a shared interdisciplinary understanding and clinical care language for managing co-morbid pain and mental health.[54] Additionally, a lack of workforce confidence and competence in managing co-existing CMP and mental health conditions may contribute to why young people in this research frequently described invalidating, unhelpful, and distressing interactions with their healthcare professionals. Here, the use of validated screening tools to identify psychosocial risk have long been known and yet are not routinely adopted in clinical practice. Physiotherapists, for example, express low confidence in managing psychosocial factors.[31,55–57] Similarly, psychologists have reported poor confidence and competence to address physical pain.[32] The findings suggest co-care models may require targeted clinician upskilling to support a deeper shared understanding and joint actioning to address young people's CMP and mental health care needs, including supportive self-management. Appropriate funding models remain critical to supporting more effective complex care, and implementing intelligent health services (e.g., digitally-enabled) that can be rapidly scaled to achieve wider reach.

5. Conclusion

Key to the clinical utility of the theoretical model presented is testing whether the feedback loop can be disrupted by targeting modifiable contributing intrapersonal and interpersonal factors in a truly integrated co-care approach. Presently, evidence for what care works for this young people population, including what 'dose' and what components of co-care, for whom, when, and in which settings remain limited, highlighting an area of future research need. Future research may be concerned with longitudinal and mixed-methods research to assess changes in the dimension of the feedback loop over time. While the results of this study suggest that staged, transdiagnostic and integrated care would benefit young people with co-existing CMP and mental health conditions, barriers exist in successful implementation, including skilled health workforce capacity and capability.

Disclosures

This research is funded by the Australian Government Medical Research Future Fund (MRFF) (APP2016567) with co-funding from the Government of Western Australia, Department of Health (WA Health). The MRFF provides funding to support health and medical research and innovation, with the objective of improving the health and wellbeing of Australians. Further information on the MRFF is available at www.health.gov.au/mrff.

The contents of this published material are solely the responsibility of the individual authors and do not reflect the views of the Government of Australia or the Government of Western Australia. N.R.K., A.M.B., S.R., and H.S., were supported, in part, by MRFF funding. B.T. was supported, in part, by funding from the Government of Western Australia, Department of Health (WA Health).

AMB further declares research grant income, unrelated to the current submission, paid to his institution in the 36 months prior to submission of the current paper, from the following agencies: AO Alliance, Asia Pacific League of Associations for Rheumatology, Australian Rheumatology Association, Pan American League of Associations for Rheumatology, World Federation of Chiropractic, Western Australian Government Department of Health Grant, Bone and Joint Decade Foundation, Institute for Bone and Joint Research, Canadian Memorial Chiropractic College, and Arthritis and Osteoporosis Western Australia. AMB also declares consulting fees paid by the World Health Organization, an honorarium paid by the American College of Rheumatology, and travel support to attend technical and scientific meetings from World Health Organization, the University of Otago, and World Federation of Chiropractic. AMB is an unpaid and voluntary member of the International Coordinating Council of the Global Alliance for Musculoskeletal Health.

HS further declares research grant income, unrelated to the current submission, paid to her institution in the 36 months prior to submission of the current paper, from the following agencies: Commonwealth of Australia (Health Professional Pain Education; Health Professional Arthritis Education; Endometriosis), AO Alliance, Asia Pacific League of Associations for Rheumatology, Australian Rheumatology Association, Pan American League of Associations for Rheumatology, World Federation of Chiropractic, Western Australian Government Department of Health Grant, Bone and Joint Decade Foundation, Institute for Bone and Joint Research, Canadian Memorial Chiropractic College, and Arthritis and Osteoporosis Western Australia. HS also declares travel and accommodation support from the International Association for the Study of Pain, Australian Pain Society, and Australian and New Zealand College of Anaesthetists (Faculty of Pain Medicine) for invited presentations at scientific meetings and technical meetings.

POS declares speaker fees for workshops on the biopsychosocial management of pain, from special interest physiotherapy groups and multi-disciplinary audiences of clinicians and researchers.

RS declares support from the Insurance Commission of Western Australia, support from the Government of Western Australia, Future Health Research and Innovation Fund, and support the Raine Medical Research Foundation. RS additionally receives honoraria for lecturing about the biopsychosocial management of pain.

Helen Slater (H.Slater@curtin.edu.au) and Andrew Briggs (A.Briggs@curtin.edu.au) take responsibility for the integrity of the work as a whole, from inception to finished article.

Study pre-registration

Not applicable.

CRediT authorship contribution statement.

Conceptualisation: all authors. Data curation: NRK. Formal analysis: NRK, HS, AMB, SR. Funding acquisition: HS, AMB, NRK, AS, POS, SML, JNS. Investigation: NRK, HS, AMB, SR. Methodology: NRK, HS, AMB, SR. Project administration: NRK, SR. Resources: N/A. Software: N/A. Validation: NRK, HS, AMB, SR. Visualisation: NRK, HS, AMB, SR. Writing – original draft: NRK, HS, AB, SR. Writing – review and editing: all authors.

Acknowledgements

The authors gratefully acknowledge young people who generously participated and contributed their experiences to this study. Dr Jason Chua is acknowledged for his assistance in building the Qualtrics survey tool.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jpain.2025.105412.

Data availability

To align with institutional ethics requirements, all raw data (audio and transcription) is not available for this manuscript.

References

1. Vinall J, Pavlova M, Asmundson GJ, et al. Mental health comorbidities in pediatric chronic pain: a narrative review of epidemiology, models, neurobiological mechanisms and treatment. *Children*. 2016;3:40. https://doi.org/10.3390/children3040040.
2. Hooten WM. Chronic pain and mental health disorders: shared neural mechanisms, epidemiology, and treatment. *Mayo Clin Proc*. 2016;91:955–970. https://doi.org/10.1016/j.mayocp.2016.04.029.
3. Stinson J, Connelly M, Kamper SJ, et al. Models of care for addressing chronic musculoskeletal pain and health in children and adolescents. *Best Pract Res Clin Rheumatol*. 2016;30:468–482. https://doi.org/10.1016/j.berh.2016.08.005.
4. Treede RD, Rief W, Barke A, et al. Chronic pain as a symptom or a disease: the IASP classification of chronic pain for the international classification of diseases (ICD-11). *PAIN*. 2019;160:19–27. https://doi.org/10.1097/j.pain.0000000000001384.
5. Chambers CT, Dol J, Tutelman PR, et al. The prevalence of chronic pain in children and adolescents: a systematic review update and meta-analysis. *PAIN*. 2024;165. https://doi.org/10.1097/j.pain.0000000000003267.
6. MBF Foundation. *The High Price of Pain: the Economic Impact of Persistent Pain in Australia*. Published 2007. Accessed January 9; 2025. Published 2007. Accessed January 9 ⟨https://www.painaustralia.org.au/static/uploads/files/mbf-economic-impact-wffhrlzqsaht.pdf⟩.
7. Arthritis and Osteoporosis Victoria. Published 2013. Accessed January 9 *Arthritis and Osteoporosis Victoria: A problem worth solving*; 2025. Published 2013. Accessed January 9 ⟨https://muscha.org/wp-content/uploads/2018/07/APWS-PLS.pdf⟩.
8. Slater H, Waller R, Briggs AM, et al. Characterizing phenotypes and clinical and health utilization associations of young people with chronic pain: latent class analysis using the electronic Persistent Pain Outcomes Collaboration database. *PAIN*. 2024;166:67–86. https://doi.org/10.1097/j.pain.0000000000003326.
9. Hogg MN, Gibson S, Helou A, et al. Waiting in pain: a systematic investigation into the provision of persistent pain services in Australia. *Med J Aust*. 2012;196:386–390. https://doi.org/10.5694/mja12.10140.
10. Hogg MN, Kavanagh A, Farrell MJ, et al. Waiting in Pain II: an updated review of the provision of persistent pain services in Australia. *Pain Med*. 2021;22:1367–1375. https://doi.org/10.1093/pm/pnaa374.
11. Berkovic D, Ayton D, Briggs AM, et al. Personal healthcare costs borne by younger people living with arthritis in Australia: an exploratory observational study. *Health Soc Care Community*. 2022;30:e2540–e2548. https://doi.org/10.1111/hsc.13697.
12. Slater H, Jordan JE, Chua J, et al. Young people's experiences of persistent musculoskeletal pain, needs, gaps and perceptions about the role of digital technologies to support their co-care: a qualitative study. *BMJ Open*. 2016;6, e014007. https://doi.org/10.1136/bmjopen-2016-014007.
13. Slater H, Stinson JN, Jordan JE, et al. Evaluation of digital technologies tailored to support young people's self-management of musculoskeletal pain: mixed methods study. *J Med Internet Res*. 2020;22, e18315. https://doi.org/10.2196/18315.
14. Holley AL, Wilson AC, Noel M, et al. Post-traumatic stress symptoms in children and adolescents with chronic pain: a topical review of the literature and a proposed framework for future research. *Eur J Pain*. 2016;20:1371–1383. https://doi.org/10.1002/ejp.879.
15. Soltani S, Kopala-Sibley DC, Noel M. The co-occurrence of pediatric chronic pain and depression: a narrative review and conceptualization of mutual maintenance. *Clin J Pain*. 2019;35:633–643. https://doi.org/10.1097/AJP.0000000000000723.
16. Slater H, Jordan JE, O'Sullivan PB, et al. Listen to me, learn from me": a priority setting partnership for shaping interdisciplinary pain training to strengthen chronic pain care. *Pain*. 2022;163:e1145–e1163. https://doi.org/10.1097/j.pain.0000000000002647.
17. Klem NR, Slater H, Rowbotham S, et al. Lived and care experiences of young people with chronic musculoskeletal pain and mental health conditions: a systematic review with qualitative evidence synthesis. *Pain*. 2025;166(4):732–754. https://doi.org/10.1097/j.pain.0000000000003407.
18. Cicchetti D, Rogosch FA. A developmental psychopathology perspective on adolescence. *J Consult Clin Psychol*. 2002;70:6–20. https://doi.org/10.1037//0022-006x.70.1.6.
19. Copeland WE, Adair CE, Smetanin P, et al. Diagnostic transitions from childhood to adolescence to early adulthood. *J Child Psychol Psychiat*. 2013;54:791–799. https://doi.org/10.1111/jcpp.12062.
20. Copeland WE, Wolke D, Shanahan L, et al. Adult functional outcomes of common childhood psychiatric problems: a prospective, longitudinal study. *JAMA psychiatry*. 2015;72:892–899. https://doi.org/10.1001/jamapsychiatry.2015.0730.
21. Lewin S, Booth A, Glenton C, et al. Applying GRADE-CERQual to qualitative evidence synthesis findings: introduction to the series. *Implement Sci*. 2018;13:2. https://doi.org/10.1186/s13012-017-0688-3.
22. Agorastos A, Pervanidou P, Chrousos GP, et al. Developmental trajectories of early life stress and trauma: a narrative review on neurobiological aspects beyond stress system dysregulation. *Front Psychiatry*. 2019;10. https://doi.org/10.3389/fpsyt.2019.00118.
23. Charmaz K. *Constructing Grounded Theory: A Practical Guide through Qualitative analysis*. London: SAGE Publications,; 2006.
24. Klem NR, Shields N, Smith A, et al. Demystifying qualitative research for musculoskeletal practitioners part 3: Phenomeno-what? Understanding what the qualitative researchers have done. *J Orthop Sports Phys Ther*. 2022;52:3–7. https://doi.org/10.2519/jospt.2022.10485.
25. Braun V, Clarke V. Reflecting on reflexive thematic analysis. *Qual Res Sport Exerc Health*. 2019;11:589–597. https://doi.org/10.1080/2159676X.2019.1628806.
26. Noble H, Mitchell G. What is grounded theory? *Evid Based Nurs*. 2016;19:34. https://doi.org/10.1136/eb-2016-102306.

27. Charmaz K, Bryant A. Grounded Theory. In: Peterson P, Baker E, McGaw B(s), eds. *International Encyclopedia of Education (Third Edition)*. Oxford: Elsevier; 2010: 406–412.
28. Klem NR, Bunzli S, Smith A, et al. Demystifying qualitative research for musculoskeletal practitioners Part 2: understanding the foundations of qualitative research. *J Orthop Sports Phys Ther*. 2021;51:559–561. https://doi.org/10.2519/jospt.2021.0113.
29. World Health Organisation: Mental disorders. Accessed 10 January 2025, ⟨https://www.who.int/news-room/fact-sheets/detail/mental-disorders⟩; 2022.
30. Qualtrics. Qualtrics Experience Management Platform [Internet]. Provo, UT: Qualtrics; 2025 [cited 2025 May 6]. Available from: https://www.qualtrics.com.
31. França AA, Santos Vd, Filho RL, et al. It's very complicated': perspectives and beliefs of newly graduated physiotherapists about the biopsychosocial model for treating people experiencing non-specific low back pain in Brazil. *Musculoskelet Sci Pract*. 2019;42:84–89. https://doi.org/10.1016/j.msksp.2019.04.011.
32. Darnall BD, Scheman J, Davin S, et al. Pain psychology: a global needs assessment and national call to action. *Pain Med*. 2016;17:250–263. https://doi.org/10.1093/pm/pnv095.
33. Gatchel RJ, McGeary DD, McGeary CA, et al. Interdisciplinary chronic pain management: past, present, and future. *The American Psychologist*. 2014;69:119–130. https://doi.org/10.1037/a0035514.
34. Microsoft Corporation. Microsoft Teams [computer program]. Redmond, WA: Microsoft Corporation; 2024. Available from: https://www.microsoft.com/en-au/microsoft-teams/group-chat-software.
35. Charmaz K, Thornberg R. The pursuit of quality in grounded theory. *Qual Res Psychol*. 2021;18:305–327. https://doi.org/10.1080/14780887.2020.1780357.
36. Dey I. *Grounding grounded theory*. guidelines for qualitative inquiry. San Diego: Academic Press,; 1999.
37. Walsh R. The methods of reflexivity. *J Humanist Psychol*. 2003;31:51–66. https://doi.org/10.1080/08873267.2003.9986934.
38. Corser J, Caes L, Bateman S, et al. A whirlwind of everything': the lived experience of adolescents with co-occurring chronic pain and mental health symptoms. *Eur J Pain*. 2023;27:981–994. https://doi.org/10.1002/ejp.2140.
39. Vaegter HB, Palsson TS, Graven-Nielsen T. Facilitated pronociceptive pain mechanisms in radiating back pain compared with localized back pain. *J Pain*. 2017; 18(8):973–983. https://doi.org/10.1016/j.jpain.2017.03.002.
40. Paananen M, O'Sullivan P, Straker L, et al. A low cortisol response to stress is associated with musculoskeletal pain combined with increased pain sensitivity in young adults: a longitudinal cohort study. *Arthritis Research Therapy*. 2015;17:355. https://doi.org/10.1186/s13075-015-0875-z.
41. Blackburn-Munro G. Hypothalamo-pituitary-adrenal axis dysfunction as a contributory factor to chronic pain and depression. *Current Pain and Headache Reports*. 2004;8:116–124. https://doi.org/10.1007/s11916-004-0025-9.
42. Gunnar MR, Wewerka S, Frenn K, Long JD, Griggs C. Developmental changes in hypothalamus-pituitary-adrenal activity over the transition to adolescence: normative changes and associations with puberty (published correction appears in) *Dev Psychopathol*. 2009;21(1):69–85. https://doi.org/10.1017/S0954579409000054.
43. Carbone JT. Allostatic load and mental health: a latent class analysis of physiological dysregulation. *Stress*. 2021;24:394–403. https://doi.org/10.1080/10253890.2020.1813711.
44. Linton SJ. A transdiagnostic approach to pain and emotion. *J Appl Biobehav Res*. 2013;18:82–103. https://doi.org/10.1111/jabr.12007.
45. McGorry P, Nelson B. Why we need a transdiagnostic staging approach to emerging psychopathology, early diagnosis, and treatment. *JAMA psychiatry*. 2016;73: 191–192. https://doi.org/10.1001/jamapsychiatry.2015.2868.
46. Miller ET, Abu-Alhaija DM. Importance of interdisciplinary pain management. *Pain Manag Nurs*. 2019;20:91–92. https://doi.org/10.1016/j.pmn.2019.02.001.
47. Slater H, Briggs AM. Strengthening the pain care ecosystem to support equitable, person-centered, high-value musculoskeletal pain care. *Pain*. 2024;165. https://doi.org/10.1097/j.pain.0000000000003373.
48. Scott J, Henry C. Clinical staging models: from general medicine to mental disorders. *BJPsych Advances*. 2017;23:292–299. https://doi.org/10.1192/apt.bp.116.016436.
49. Caneiro JP, Roos EM, Barton CJ, et al. It is time to move beyond 'body region silos' to manage musculoskeletal pain: five actions to change clinical practice. *Br J Sports Med*. 2020;54:438–439. https://doi.org/10.1136/bjsports-2018-100488.
50. McGorry PD, Hickie IB, Yung AR, et al. Clinical staging of psychiatric disorders: a heuristic framework for choosing earlier, safer and more effective interventions. *Aust N Z J Psychiatry*. 2006;40:616–622. https://doi.org/10.1080/j.1440-1614.2006.01860.x.
51. Sawrikar V, Stewart E, LaMonica HM, et al. Using staged care to provide "right care first time" to people with common affective disorders. *Psychiatr Serv*. 2021;72: 691–703. https://doi.org/10.1176/appi.ps.202000145.
52. Ng W, Slater H, Starcevich C, et al. Barriers and enablers influencing healthcare professionals' adoption of a biopsychosocial approach to musculoskeletal pain: a systematic review and qualitative evidence synthesis. *Pain*. 2021;162:2154–2185. https://doi.org/10.1097/j.pain.0000000000002217.
53. George S. Lost in implementation: risk stratified care for musculoskeletal pain. *Pain*. 2023;163:2137–2138. https://doi.org/10.1097/j.pain.0000000000002939.
54. Linton SJ, O'Sullivan PB, Zetterberg HE, et al. The "future" pain clinician: competencies needed to provide psychologically informed care. *Scand J Pain*. 2024; 24. https://doi.org/10.1515/sjpain-2024-0017.
55. Henning M, Smith M. The ability of physiotherapists to identify psychosocial factors in patients with musculoskeletal pain: a scoping review. *Musculoskeletal Care*. 2023; 21:502–515. https://doi.org/10.1002/msc.1725.
56. Klem N-R, Ruscoe J, Ng L, et al. Australian physiotherapists attitudes, perceptions, and behaviours towards psychosocial screening tools: a qualitative interpretive description study. *Disabil Rehabil*. 2024;46:6367–6375. https://doi.org/10.1080/09638288.2024.2328315.
57. Singh G, McNamee G, Sharpe L, et al. Psychological, social and lifestyle screening of people with low back pain treated by physiotherapists in a National Health Service musculoskeletal service: an audit. *Eur J Physio*. 2023;25:20–26. https://doi.org/10.1080/21679169.2021.1950208.