

Original article

An evaluation of a one-day pain science education event in a high school setting targeting pain related beliefs, knowledge, and behavioural intentions



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A B S T R A C T

Background: Persistent pain is a common condition affecting one in four UK adults. Public understanding of pain is limited. Delivering pain education within schools may improve public understanding in the longer term.

Objective: To evaluate the impact of a one-day Pain Science Education (PSE) event on sixth form/high school students' pain beliefs, knowledge and behavioural intention.

Methods: Exploratory, single-site, mixed-methods, single-arm study involving secondary school students ≥ 16 years old attending a one-day PSE event. Outcome measures included the Pain Beliefs Questionnaire (PBQ), Concepts of Pain Inventory (COPI-ADULT), a vignette to assess pain behaviours; and thematic analysis of semi-structured interviews.

Results: Ninety (mean age 16.5 years, 74% female) of the 114 attendees, agreed to participate in the evaluation. PBQ scores improved on the Organic beliefs subscale [mean difference -5.9 (95% CI $-6.8, -5.0$), $P < 0.01$] and Psychosocial Beliefs subscale [1.6 (1.0, 2.2) $P < 0.01$]. The COPI-Adult revealed an improvement [7.1 (6.0–8.1) points, $P < 0.01$] between baseline and post intervention. Pain behavioural intentions improved post education for work, exercise, and bed rest related activities ($p < 0.05$). Thematic analysis of interviews ($n = 3$) identified increased awareness of chronic pain and its underpinning biology, beliefs that pain education should be widely available, and that pain management should be holistic.

Conclusions: A one-day PSE public health event can improve pain beliefs, knowledge and behavioural intentions in high school students and increase openness to holistic management. Future controlled studies are needed to confirm these results and investigate potential long-term impacts.

1. Introduction

Persistent pain affects one in four people (Zimmer et al., 2022). It is one of the most common reasons for interaction with healthcare professionals and a leading cause of years lived with disability (Fayaz et al., 2016; Vos et al., 2017). Stanford et al. (2008) suggest that many children and adolescents, $\sim 35\%$, are affected by persistent pain worldwide. The prevalence of persistent pain continues to increase, and it disproportionately impacts upon disadvantaged communities and ethnic minorities (Versus Arthritis, 2021).

Public understanding of persistent pain is poor, laden with misconceptions, and inconsistent with contemporary scientific

understanding of pain (Goubert et al., 2004; Ihlebaek and Eriksen, 2003; Munigangaiah et al., 2016; Gross et al., 2006; Darlow et al., 2014; Christe et al., 2021). These misconceptions are rooted in an outdated biomedical understanding of pain and may be creating a significant barrier to good pain management practices. For example, contrary to best practice guidelines, which recommend a move away from biomedically-based interventions towards more active physical and psychological therapies, the use of biomedical approaches such as opioids (Curtis et al., 2019), surgical interventions (Weir et al., 2017) and imaging (Smith et al., 2020) for persistent pain continue to rise. It may be that public misconceptions rooted in the biomedical model play a key role in the continued growth of non-evidence-based care for pain

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(Mankelov et al., 2022). As such persistent pain is increasingly recognised as an important public health issue and new interventions have been called for to address public misconceptions (Goldberg and McGee, 2011; Buchbinder et al., 2018; Gatchel et al., 2018; Johnson et al., 2022).

Pain science education (PSE) is an educational approach which delivers scientific information about pain, packaged in a consumer-friendly way (Moseley and Butler, 2015). PSE addresses the problem of people conceptualising their chronic pain within an outdated biomedical framework wherein chronic pain is directly and exclusively linked with damage to anatomical structures. Such biomedical beliefs are shown to be strongly linked to disability and depression (Baird and Sheffield, 2016). PSE aims to help people to reconceptualise their understanding of their pain away from a biomedical model towards a more contemporary biopsychosocial understanding that pain is a marker of the subconscious brain's perceived need to protect the tissues. Within a clinical setting, when delivered to adults with pain, it can lead to improvements in understanding and reduced pain related fear and anxiety (Watson et al., 2019; Andias et al., 2022; Mittinty et al., 2018). Thus, this form of education may be effective for addressing pain misconceptions within a public health setting (Livadas et al., 2022). Currently, at least two public health campaigns, one in Australia (www.painrevolution.com) and one in the UK (www.flippinpain.co.uk) are delivering PSE in this manner.

One component of these public health campaigns is to target younger people within the school setting. PSE has been used effectively with children in a multi-site study in Wisconsin, USA (aged 10–15 years), Belgium (parent/children dyads in which parent outcomes were measured) and Germany (average age 11.5) to improve alignment of pain knowledge and beliefs with contemporary pain science (Louw et al., 2018; Pintó et al., 2021; Kisling et al., 2021). Given that children and adolescents are cognitively and affectively developing, this could be a key point at which to shape beliefs for future adults and lead to longer term shifts in public beliefs (Pate, 2022). Several other successful public health campaigns in areas other than pain, have targeted schools (Gielen and Green, 2015; Herlitz et al., 2020). In previous pain research, children have reported that one location where they learn about pain is at school from peers, as well as learning at home and from media sources (Pate et al., 2019). Further to this, children challenged by chronic pain are absent for 22% of class on average (Norton and Southon, 2020). Therefore, preventative educational interventions targeting pain beliefs may have wider benefits for addressing future pain (Hassett et al., 2013), participation restrictions, and stigma (Wakefield et al., 2021).

This study will be the first school-based UK study examining the impacts of PSE on pain knowledge, beliefs, and behavioral intentions, upon adolescents aged ≥ 16 years. Furthermore, this is the first UK study to explore the impact of a pain focused public health initiative. Finally, the number of school-based studies investigating the impact of PSE on school children is small and more studies are needed to build upon the existing evidence base.

2. Study aims and objectives

The aim of this mixed-methods study was to evaluate the impact of a one-day PSE event delivered within a sixth form (also known as a high school) setting.

The primary objective was to assess any shift in student pain beliefs using the Pain Beliefs Questionnaire (PBQ) and beliefs and knowledge using the COPI-Adult questionnaire, prior to and after a one-day PSE event.

Also measured was participants' behavioural intention in the presence of pain, using a vignette and a widely used multiple choice questionnaire.

A final secondary objective was to qualitatively understand the experience of receiving PSE from the students' perspective and explore their understanding of the material.

3. Methods

3.1. Design

In this, exploratory, single-site, mixed-methods study, sixth form students' pain beliefs, knowledge and behavioural intentions were quantified using three questionnaires pre and post a one-day PSE focussed event delivered as part of the Flippin' Pain public health campaign (www.flippinpain.co.uk). All quantitative data were collected on the day of the event. Additionally, data about the participants' gender, age, and ethnicity were gathered (data categories applied were those used by the UK Government for the 2021 Census). Previous/current experience of pain data were collected by asking participants if they currently, previously, or had never, experienced persistent pain. Then 11 commonly painful body parts could be identified or the 12th option of 'other, please specify' could be selected.

Quantitative outcome measures were completed anonymously. Qualitative data collected during one-to-one online interviews post intervention were thematically analysed. The philosophical approach applied to this mixed-methods study was pragmatism. Ethical approval was provided by ***** University School of Health and Life Sciences Research Ethics Committee. The study protocol was registered with clinicaltrials.gov (NCT05636345).

3.2. Sampling and participants

A convenience sample of students from six sixth form schools (also known as high schools) in the Berkshire, UK region, aged ≥ 16 participated in this study. Participating schools were a mixture of private schools, selective state schools, state schools, and independent schools. There were mixed gender schools and single gender schools.

3.3. Intervention

A one-day PSE event was held at a UK school. The aim of the event was to shift students' understanding of pain in line with contemporary scientific understanding. The PSE event involved a 70-min didactic presentation, delivered by a physiotherapist (CR) with extensive experience of delivering PSE in group settings, with a 20 min Q&A session at the end. This was followed by a series of experiential learning activities, which offered interactive experiences to reflect concepts discussed in the lecture focussing on the role of the brain in perception. Students were able to call at nine different learning stations during a 1-h period, the experience required individuals to make sense of sensory, visual, and audio inputs designed to challenge perceptions and allow them to explore how experiences can be influenced by multiple factors. Virtual Reality experiences were also available for the same learning outcome.

Seven months prior to the PSE event, DR (a local pain consultant) provided a pain education lecture to individual schools' sixth forms over a three-month period. He provided this education to five out of the six participating schools. He also provided each student with a copy of a popular science book about pain - *the Pain Free Mindset* (Ravindran, 2021). The lecture was a 30-min PSE presentation was largely didactic but also featured some experiential learning activities relating to perception (e.g. visual illusions). In addition, he set a three-month academic groupwork challenge for students to create their own pain education resources that might help other young people to understand pain and how to manage it. The winners of the challenge were announced during the PSE event.

4. Quantitative data collection

4.1. Outcome measures

4.1.1. The Pain Beliefs Questionnaire (PBQ)

The Pain Beliefs Questionnaire (PBQ) includes 12-items (Edwards

et al., 1992, Walsh and Radcliffe, 2002). Each item was scored on a 6-point scale (“always” to “never”). The questionnaire includes two sub-scales. The Organic beliefs subscale, assesses level of agreement with the structural pathology model (biomedical model) of pain. It is an eight item scale, scores range from 8 to 48, lower scores indicate less biomedical beliefs. The other subscale, the Psychological beliefs subscale assesses beliefs about the effect of psychological factors such as anxiety on pain. It has four items and a score range of 4–24. Lower scores indicate less biopsychosocial beliefs. The PBQ has previously been used with individuals with and without pain (Baird and Haslam, 2013; Baird and Sheffield, 2016). The reliability is satisfactory for both subscales, Cronbach >0.75 , (Walsh et al., 2002). Furthermore, Baird and Sheffield (2016) observe that the subscales reflect both direct and mediated effects on key physical and mental health outcome measures. The European Knowledge Alliance advocates the use of the PBQ in assessing pain beliefs (Bellosta-López et al., 2021).

4.1.2. The concept of Pain Inventory for adults (COPI-Adult)

The COPI-Adult was designed for assessing knowledge and beliefs about pain science (Pate et al., 2022) in participants aged ≥ 18 years. It is a 13-item questionnaire with acceptable internal consistency ($\alpha = 0.78$), and good test-retest reliability ($ICC(3,1) = 0.84$ (95%CI 0.71 to 0.91). Questions are scored on a five-point scale (strongly disagree ‘0’ to strongly agree ‘4’), the scale ranges from 0 to 52. Higher results reflect greater alignment with contemporary pain science.

4.1.3. Case vignette

A case study (Supplementary File/Appendix 1) was given to participants to assess actions they would take in a personally related case vignette. It was adapted from previously published vignettes (Bishop et al., 2008; Colleary et al., 2017; Maguire et al., 2019; Mankelov et al., 2020). Participants were asked what actions they would take if they had pain with regards to medication, medical imaging, daily activity, exercise, and work either based on yes/no answers or four/five multiple choice answers. Vignettes have been used previously to assess intended behavioural intentions amongst the general public and are shown to be a valid proxy measure of intended behaviour (Peabody et al., 2000; Bishop et al., 2008).

4.1.4. Statistical analysis for quantitative data

All data were analysed using SPSS. Missing data were excluded from the analysis. If one question in a questionnaire was not answered that overall questionnaire score was not included in the analysis. Categorical data for the portion of appropriate recommendations in the vignette was presented as percentages. Within-group comparisons were made using chi-square analysis comparing the pre-education behaviour responses, with the post-education behaviour responses. The distribution of the questionnaire data was explored visually and all continuous data were found to be normally distributed and presented as mean [standard deviation (SD)]. Within-group differences pre to post education for the PBQ subscales and COPI-Adult were quantified using mean differences and the 95% confidence intervals of the difference, calculated using paired t-tests. Mean effect sizes for each outcome measure were also established using Cohen’s *d* using pre and post data and the SD for the pre-test group (Cohen, 1992). A meaningful change was determined to be 0.5, which would indicate a moderate effect size, with effect sizes of ≥ 0.8 indicating a large effect size (Cohen, 1992). A deviation from the registered study protocol was an exploration of ethnicity on the study aims through secondary analysis. This occurred because an unexpectedly ethnically diverse sample was recruited.

4.1.5. Qualitative data analysis

All participants from the schools were invited to attend a semi-structured interview three months after the completion of the project to discuss their experience of the project and how it influenced their understanding of pain. A semi-structured interview schedule can be

found in supplementary material. Interviews were recorded and undertaken by SS via Microsoft TEAMS with transcription. Member checking of transcripts was undertaken. Paper transcripts and Excel were used for inductive experiential thematic analysis (Braun and Clarke, 2006). Transcripts were read multiple times and provisionally coded by SS. Coded statements were then grouped together into themes. All views were treated equally. A second researcher (JM) also read all the transcripts to ensure the themes were logical and rooted in the data. The themes were then discussed amongst the group. Data saturation was not sought within this study.

4.1.6. Reflexivity

Researcher background may influence data collection, analysis, and interpretation. To contextualise the findings that follow, five of the researchers (JM, DR, AG, JP and CR) have regular experience of delivering PSE to patients, clinicians and students. Two of the researchers do not have experience of PSE delivery, DM and SS. JM and CR are directly involved in the *Flippin’ Pain* campaign. JP teaches pain science education to healthcare students at university level and has created PSE resources for children (those resources were not used in this study).

5. Results

A total of 114 students attended the event and 90 participants consented to take part in the quantitative aspect of this study. The characteristics of the participants are shown in Table 1. Most participants were female with only 19% being male. Dominant ethnicities were Asian and White and 14% of the sample population currently had pain. The breakdown of pain experience for White, Black, and Asian participants are presented in Fig. 1, there was no statistical difference in pain experience between ethnicities ($p = 0.70$). The amount of people included in each analysis is indicated throughout. Missing data appeared from visual inspection to be missing at random. To explore if there was a difference between those for whom data was missing and those for whom data was available a comparison was made between individuals included in the analysis of the change in COPI score ($n = 81$) and those who were excluded due to missing data ($n = 9$). There was no statistical difference in the baseline characteristics of age, sex, ethnicity, or pain experience.

5.1. Quantitative results

All pain belief outcome measures improved following the event with an increase in psychological beliefs and a reduction in biomedical beliefs (Table 2). Effect sizes for improvements in biomedical beliefs and the COPI-Adult scale were large and psychological beliefs saw a moderate effect size improvement. A secondary analysis, using ANCOVA, adjusted

Table 1
Participant characteristics.

Characteristic	
Age (years)	16.5 (0.5)
Sex (n)	
Male	14
Female	74
Prefer not to say	2
Ethnicity	
Asian	48%
Black	9%
White	42%
Mixed	1%
Pain	
No pain	49%
Previous pain	37%
Current pain	14%

Legend: Missing data for age ($n = 5$), missing data for Pain ($n = 1$).

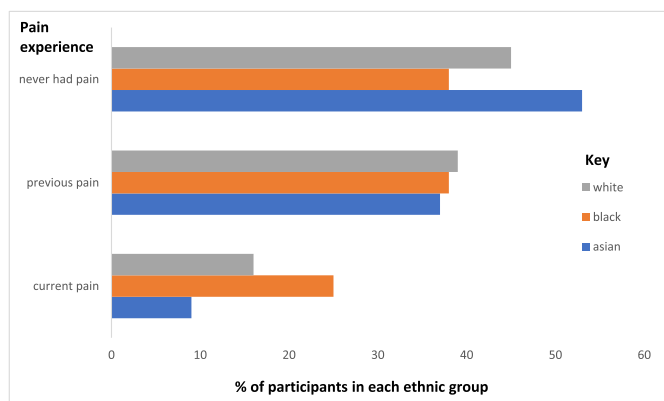


Fig. 1. Pain experiences of participants by ethnic group. Legend: Missing data for n = 2.

for baseline values, found no difference in change from pre to post event beliefs for the different ethnicities of Asian, Black, and White individuals (p = 0.30).

Immediately post-education, participants made more appropriate recommendations (p=<0.05) when imagining themselves with pain with respect to opioids, work, exercise, and bed rest compared to pre-education. The recommendations for managing activities of daily living (ADLs) did not alter markedly but were already well aligned with guidelines before the event (Table 3).

N = number of responses to questions (missing data - not all questions were completed by all participants).

5.2. Qualitative results

Three participants (one male and two female) agreed to take part in the qualitative interviews. The three participants were not experiencing pain at the time of interview. Each interview lasted approximately half an hour. Three themes were identified.

5.3. Theme 1: enhanced understanding of persistent pain

Participants considered their initial understanding prior to the event (including the preparatory work with DR) as poor and now considerably improved. They now felt they understood that ‘hurt did not always equal harm’ (a key event message) and were able to relate this to themselves.

“Because every single time something hurt, I kind of just assumed that something was damaged.” (P2)

5.4. Theme 2: Holistic approach to persistent pain

Participants revealed that they had a more biopsychosocial/holistic approach to persistent pain now, which helped them to see that there was hope for recovery in people who experienced pain.

“[the event] made me understand the kind of holistic nature to pain treatment, which I didn’t really have any idea about before.” (P1)

Table 2 Change in pain related beliefs pre to post event.

Measure [Scale range]	Pre Mean (SD)	Post Mean (SD)	Mean difference (MD)	95% CI	P-value	Effect Size (Cohen d)
Pain Beliefs Questionnaire (Organic sub-scale) [8–48]	27.5 (3.5)	21.6 (2.9)	-5.9	-6.8 to -5.0	<0.01	1.7
Pain Beliefs Questionnaire (Psychological sub-scale) [4–24]	16.3 (2.6)	17.9 (3.0)	1.6	1.0 to 2.2	<0.01	0.6
COPI-Adult [0–52 point scale]	35.4 (4.7)	42.5 (4.9)	7.1	6.0 to 8.1	<0.01	1.5

Legend: Pain Beliefs Questionnaire organic subscale n = 85, Pain Beliefs Questionnaire psychological subscale n = 86, COPI-Adult n = 81.

5.5. Theme 3: Importance of pain education

Participants considered there to be a need for more pain education and were keen for it to be made more widely available. They felt that increasing public understanding of pain may help those without pain, by creating a more supportive environment for them (P2).

“So if we knew more about what they were going through even on a surface level, then we would be able to show them more empathy and you know empathy is always good.” (P2)

6. Discussion

The aim of this study was to evaluate the impact of a one-day PSE event delivered within a school setting. This is the first UK study examining the impacts of pain knowledge and beliefs following PSE combined with experiential learning, upon adolescents, as part of a public health campaign, and the first study to investigate the effects of PSE upon the age group ≥16 years.

The main finding was that biomedically-focussed beliefs about pain reduced significantly whilst there was an increase in participants’ biopsychosocial understanding of pain. Additionally, there were significant improvements in behavioural intentions in line with clinical guidelines. Qualitatively, participants revealed that they had not given much consideration to pain being a long-term condition, nor the mechanisms of it. Now that they perceived themselves to have a more enhanced understanding of persistent pain, they could see the rationale for more biopsychosocial based care, and they felt that improving public understanding would foster a more supportive environment for those with persistent pain.

The magnitude of the improvement in beliefs was encouraging. The changes in the Organic Scale (MD -5.9 points) indicated a less biomedical understanding of pain. The COPI-Adult indicated an improvement in pain beliefs and knowledge (MD 7.1). Louw et al. (2018) found a moderate effect size of mean improvement in beliefs (11%) between pre and post education scores, after a 30 min PSE intervention with middle school children (mean age 12.7 years). Changes in belief in Louw et al.’s study were measured using five belief related questions and responses were not totalled but rather subject to individual question analysis. Belief changes indicated by the PBQ in our study with older children found 15% improvement in the Organic Scale with a large effect size, and a moderate effect size (8% improvement) in the Psychological Scale.

COPI scores on a 14-item scale (rather than our COPI-Adult 13-item scale) after PSE were comparable to findings in Pate et al. (2023) study examining the normative pain beliefs of Australian children with no

Table 3 Appropriate recommendation before and after a one-day pain science event.

	N	Appropriate recommendations % (n)		χ ²	p-value
		Pre	Post		
Scan	63	15.9 (10)	36.5 (23)	2.830	0.093
Opioids	63	82.5 (52)	92.1 (58)	6.820	0.009
Work	83	75.9 (63)	84.3 (70)	11.815	0.001
Exercise	82	75.6 (62)	93.9 (77)	8.929	0.003
ADLs	82	87.8 (72)	91.5 (75)	1.917	0.116
Bed Rest	80	13.8 (11)	47.5 (38)	9.637	0.002

bespoke PSE (37 points (67%). Our study's mean baseline score for adolescents was 35.4 points (68%) and post intervention was 42.5 points (82%). The COPI-Adult in this study showed a 35% improvement in pain knowledge and beliefs which is on a par with the knowledge changes found in Louw et al.'s study (31.3%) but the change in beliefs from the PBQ is greater in this study than in Louw et al.'s. Louw et al. found small change in beliefs effect sizes generally but a medium effect size change with one belief question, and large effect size with a second. This study found large effect sizes consistently in the PBQ organic beliefs scale and the psychological beliefs scale. [Pintó et al. \(2021\)](#) also found children (aged 8–12)/parent dyads responded well to a 45-min PSE session with improved parental knowledge by 15% and reduced fear and avoidance behaviour related to pain as reported by parents by 6%. The smaller changes in [Pintó et al.'s](#) study in comparison with the current study may have been due to adults having a better baseline understanding of pain than children used in this study or that of Louw's (different scales have been used thus values are not directly comparable).

Behavioural intentions, as measured by percentage of appropriate recommendations for people with pain, improved statistically with respect to opioids, work, exercise and bed rest after education. The idea that persisted was that scans maybe needed in the presence of persisting pain, though the improvement in responses improved from 16% correct answers to 37%. The change in appropriate recommendations for activities of daily living (ADLs) was small, 4% however the baseline appropriate recommendations were high at 88%.

The changes in pain beliefs and knowledge noted in this study from the one-day PSE event may have been more marked had students not had the 30 min pre-event lecture with DR. The learning with DR was not assessed but may have resulted in some provisional learning prior to the baseline measurement which may have impacted on the magnitude of change which occurred between the pre and post event day measurements. It is likely that if it had had an impact, it would have inflated baseline levels thus resulting in a smaller magnitude of change between the pre and post measures. Thus, the magnitude of change reported in this study may be lower than it would have been without the preparation day.

The potential impact of these findings is important to consider. If these changes were maintained they may influence the participants' current and future experiences of pain, and its associated disability and depression. They may also influence how these individuals respond to persistent pain amongst friends and family creating a more supportive environment with less stigma ([Perugino et al., 2022](#)). Of particular note was the characteristics of the sample, which mostly consisted of ethnic minority groups, groups that have not been captured within previous studies exploring pain beliefs and interventions in schools ([Louw et al., 2018](#); [Pintó et al., 2021](#); [Kisling et al., 2021](#)). Such marked positive shifts within such a diverse group of ethnicities is encouraging and identifies school based pain education interventions as one potentially valuable way of targeting a wide range of ethnic groups and addressing any health inequalities between ethnicities that may stem from beliefs about persistent pain.

Amongst the three main ethnicities participating in this study, Asian participants had a higher percentage of students who reported never having experienced persistent pain (53%) and the lowest percentages of previous and current pain. There is a growing body of evidence to suggest that ethnicity impacts upon persistent pain. A recent report by Versus arthritis in the UK identified higher prevalence, and greater impact, of pain amongst ethnic minorities (Versus [Arthritis, 2021](#)). It is unclear why this trend occurs. Secondary analysis in the current study found that there was no difference in change in beliefs between Asian, Black, and White ethnic groups. This is an encouraging finding. Addressing misconceptions about pain may be an important approach to tackling the persistent pain epidemic. This data suggests that interventions to address misconceptions appear to be equally effective for different ethnicities, suggesting that such an approach would not widen health inequalities. Furthermore, doing this within a school setting may

be particularly attractive to maximise that chance that access to, and engagement with, the materials are similar amongst ethnicities. This provides a compelling case for delivering PSE within the high school curriculum and a means of improving public understanding of pain.

Qualitative findings revealed that students generally did not previously view pain as a persistent condition, thinking of it only as a short-term (acute) problem. Consequently, participants concluded that a holistic approach to pain management was beneficial and within this there was hope for recovery and that pain was not just a 'dead end'. They also expressed the need for patients to ask their doctors for alternatives to medicines if that was what they were offered. These preliminary interviews support the logic that shifting understanding of pain more in line with contemporary scientific understanding will enhance pain related health literacy and potentially empower people to make more informed, evidence-based pain management choices. [Mankelov et al. \(2022\)](#) highlighted the difficulties experienced by healthcare professionals when trying to manage their patients in a guideline-consistent, evidence-based way. Patients were not generally receptive to guideline-consistent management and "demanded" biomedical solutions to pain management. It may be that education at school level could change this. There could be an argument for adding PSE to the secondary school national curriculum through subjects such as "core life skills". This is also known as personal, social, health and economic education (PSHE) which is part of the national curriculum and mandated by the [Department of Education \(2020\)](#) (<https://www.gov.uk/government/publications/personal-social-health-and-economic-education-pshe/personal-social-health-and-economic-pshe-education>). Understanding pain could potentially encourage young people to engage in active physical and psychological therapies in keeping with clinical guidelines should they develop persistent pain at some point, it may also encourage them to facilitate such behaviours amongst members of their friends and families who have persistent pain. However, the effectiveness of much of life skills teaching is unknown ([Nasheeda et al., 2019](#)) and thus further work is needed to explore the potential impact of bringing PSE into the curriculum is needed.

The clinical implications of these findings are that PSE is accessible to adolescents with and without pain, and improves the alignment of pain beliefs, knowledge, and behavioural intention with the evidence base, irrespective of ethnic background. Furthermore, adolescents have the capacity to appreciate the biopsychosocial nature of pain. Only 12 participants currently had pain thus further sub analysis to explore any differences between those with and without pain was considered to be of limited value.

7. Limitations

This was an exploratory study, the design of which does not allow any attributions of causality. Future controlled studies are needed to investigate the effectiveness of this intervention. Furthermore, only the immediate impact of the intervention was explored, there was no medium to long-term follow up. Thus, it is unknown if pain beliefs, knowledge, and behavioural intentions remained positive in the longer term, or indeed, into adulthood. Even if beliefs did remain improved it is unknown if this would have led to more actual appropriate evidence-based actions on behalf of the participants. Furthermore, as paper surveys were circulated it is suspected that two of the behavioural intention questions were not answered by most participants as they were on the reverse page of the questionnaire. Future studies might conduct questionnaires online and use systems that encourage all questions are answered. One of the six schools did not receive the preliminary 30-min lecture prior to the event. As data was collected anonymously, subgroup analysis to explore the implications of this was not possible. One aspect of the vignette asked about return to work for people with persistent pain, it could be argued that the vignette may have been more meaningful to participants if the focus was on school rather than work. Only three individuals volunteered to take part in the interviews thus limiting

the extent of thematic saturation that will have occurred however based on Malterud et al. (2015) the sample group, aim of the study, quality of the dialogue and analysis strategy were well aligned to give a rich reflection of opinions. Interviews for qualitative data collection took place three months after the intervention and this time delay could have affected enthusiasm for interviews by participants. However, it also provides tentative insight that the participants' new understanding of pain was still present after three months, at least for these three participants. Future studies could consider conducting interviews on the same day as the intervention whilst engaged study participants are physically present. The ethnicity data were collected using broad categories and these would benefit from greater detail in the data collection process to allow further analysis of the findings (e.g. mixed ethnicity).

8. Conclusion

A one-day PSE event delivered as part of a public health campaign was associated with improved sixth form/high school student pain beliefs, knowledge, and behavioural intentions in the short-term. Qualitatively, students reported limited prior awareness of persistent pain. Post education, students felt they understood persistent pain better and the need for a holistic approach to treatment. This preliminary data highlights the school setting as a potentially important target for pain based public health interventions to improve public pain beliefs in a manner conducive to reducing pain related health inequalities. Addressing adolescent pain beliefs may lead to more positive attitudes in adulthood and thus help to improve public adults' pain beliefs, knowledge, and behaviour in the longer term and their experiences of pain in the future. However, controlled trials with longer term follow up are needed to investigate the effectiveness of this intervention before any firm recommendations can be made.

Declaration of competing interest

JM is a community pain champion for the Flippin Pain™ campaign which is run by Connect Health Ltd. JM has received no personal income for this role.

CGR 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™ campaign which is run by Connect Health Ltd. The consultancy fees for this role go directly to Teesside University, CGR 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, Medtronic 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.

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JWP has received speaker fees for presentations on pain and rehabilitation. He receives royalties for books on pain education.

DR has received speaker fees for presentations on pain and Long Covid by professional bodies, commercial partners and pharmaceutical companies. He receives royalties for his book on pain management. He has received research funding from the Health Innovation Partnership, University of Reading.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.msksp.2023.102818>.

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