

Enhancing Pediatric Pain Management in Turkey: A Modified Delphi Study on Culturally Adapted Pain Neuroscience Education for Chronic Pain in Children

ABSTRACT

Background: Pain Neuroscience Education (PNE) is a commonly used technique applied by physical therapists in the rehabilitation of chronic pain.

Objective: The aim of this study was to culturally adapt an existing PNE for children with chronic pain (PNE4Kids) to Turkish children with chronic pain (PNE4Kids-Turkish).

Methods: A three-round modified Delphi-study was conducted between September 2023 and February 2024. Experts completed questionnaire with 5 items to elicit demographic data and 16 closed and 7 open-ended questions to assess relevance of information, feasibility of stories, visual information, and clarity of message in the 4 main areas of ‘normal pain biology’, ‘pain modulation’, ‘chronic pain, adaptations, central sensitization’, and ‘the application and implications of PNE4Kids. MAXQDA software was used for qualitative analysis of open-ended questions. A total of 38 experts (mean age: 36.6±9.05 years, 6 male, 32 female) were recruited for this study.

Results: The results of the first round indicated that 84-100% of Delphi experts strongly agreed or agreed on the relevance of information, feasibility of stories, visual information, and clarity of message in respect of the 4 main areas. During second and third round, an acceptable degree of agreement with clinical usefulness of PNE4Kids-Turkish materials was obtained.

Conclusions: PNE4Kids was culturally adapted for Turkish children suffering from chronic pain. The findings of this study mainly highlight the viewpoints of the experts.

Implication to practice: This is the first study to have developed and culturally adapted the PNE4Kids for Turkish children with chronic pain. The PNE4Kids-Turkish is crucial, valuable, helpful, and understandable for Turkish children with chronic pain. In addition, the PNE4Kids-Turkish has the potential to close the gap in research and clinical areas for Turkish children with chronic pain.

Keywords: chronic pain, child, Delphi technique, neuroscience, culture

INTRODUCTION

Chronic pain is a biopsychosocial phenomenon that is influenced by a multitude of factors, encompassing cognitive, emotional, cultural, and social dimensions alongside biological factors (Moseley & Butler, 2015; Treede et al., 2019). The global prevalence of pediatric chronic pain is estimated to range from 20 to 35% (Dahlhamer et al., 2018; Palermo et al., 2018). Among the most prevalent types of pediatric chronic pain are headaches, abdominal pain, and musculoskeletal pain, with reported prevalence rates typically falling within the median range of 11% to 38% (Fisher et al., 2018; Huguet & Miro, 2008; King et al., 2011). The current child population rate of 26.5% in Turkey is higher than that of EU member countries.

Although, there is a lack of available information regarding the prevalence of chronic pain among children in Turkey. Bugdayci et al. (2005) stated that the prevalence of recurrent headache is 49.2% in Turkish children aged 8-16 years. In a recent study conducted by Karaaslan et al. (2023), it was shown that 56.4% of children and adolescents, aged between 6 and 18 years, reported experiencing headaches at some point. Pediatric chronic pain seriously affects the psychological, physical, and social well-being of children and their families, leading to a decline in overall quality of life (Palermo et al., 2018). It can adversely affect children's school attendance and participation in leisure activities, resulting in academic difficulties and social isolation (Vervoort et al., 2014). Moreover, there is an increased likelihood of persistent pain extending into adulthood (Treede et al., 2019). The burden of pediatric chronic pain also places substantial strain on healthcare systems worldwide (Groenewald et al., 2014). Given these challenges, it is imperative to promptly provide treatment to children enduring chronic pain (Pas et al., 2018). A recent systematic review underscored the necessity for cost-effective non-pharmacological pain management strategies, such as physiotherapy and psychological support, developed by multidisciplinary teams. This is particularly crucial for countries with low or middle incomes (Walters et al., 2018).

Pain Neuroscience Education (PNE) is a commonly used education strategy applied by physical therapists in the rehabilitation of chronic pain. It is recommended as the first phase in pain management (Malfliet et al., 2017). The purpose of PNE is to challenge maladaptive beliefs held by patients with chronic pain and educate them about the biopsychosocial factors that influence the underlying mechanisms and the perception of pain (Louw, Zimney, et al., 2016; Moseley & Butler, 2015; Nijs et al., 2014). Briefly, it includes information on the process of how pain is generated by the brain and even how pain can exist in the absence of any actual tissue injury (Louw, Zimney, et al., 2016; Moseley & Butler, 2015; Nijs et al., 2014). Through

the acquisition of new knowledge about pain mechanisms, patients are able to reconsider maladaptive and fearful responses to pain, and turn these into adaptive and fearless responses. Recent studies of adults with chronic pain have shown that PNE is a promising approach to improve quality of life, and decrease the level of fear, pain, kinesiophobia, pain catastrophizing, and passive pain coping strategies (den Hollander et al., 2016; Louw, Zimney, et al., 2016; Robins et al., 2016; Siddall et al., 2022; Watson et al., 2019).

Several intervention studies (Andias et al., 2018; Pas et al., 2020; Selhorst et al., 2020) and school-based inquiries (Kisling et al., 2021; Louw et al., 2020; Louw et al., 2018; Louw et al., 2019; Podolak et al., 2019; Rheel et al., 2021; Wager et al., 2018) originating from Western cultures have explored the impact of PNE on the pediatric population. These investigations indicate that PNE can enhance pain knowledge (Andias et al., 2018; Kisling et al., 2021; Louw et al., 2020; Louw et al., 2018; Louw et al., 2019; Podolak et al., 2019; Rheel et al., 2021; Wager et al., 2018) and pain thresholds (Pas et al., 2020; Rheel et al., 2021), improve functional pain beliefs (Louw et al., 2018; Louw et al., 2019; Podolak et al., 2019) and school engagement (Louw et al., 2020), mitigate catastrophizing of pain (Selhorst et al., 2020), diminish fear of pain (Pas et al., 2020) and fear of physical activity (Louw et al., 2019), and reduce functional disability (Pas et al., 2020) and the frequency of medication use (Louw et al., 2020). Moreover, these studies utilized a variety of pain education materials, including interactive, non-interactive, and mixed approaches (Ickmans et al., 2022). The PNE4Kids developed by Pas et al. (2018) stands out as an interactive educational tool specifically designed for pediatric pain education.

Culture has a considerable impact on various aspects of pain, including how individuals express pain and react to others' pain, pain severity, pain tolerance, pain coping mechanisms, and pain catastrophizing (Sharma et al., 2018). Moreover, culture has a significant impact on behaviors, attitudes, and how parents react towards their children with disabilities (Kolhatkar & Berkowitz, 2014; Susanty et al., 2021). Turkish families exhibit more permissive and protective behaviors compared to Western families when their child has a chronic condition (Yuksel & Demircioglu, 2019). A child's pain experience is significantly influenced by parental protective behaviors, overstressed reactions to pain (such as worry, depression, catastrophizing), pain coping strategies, and beliefs (Natalucci et al., 2020; Robins et al., 2016). Children who are raised with more protective behaviors are more likely to suffer from chronic pain (Natalucci et al., 2020). Therefore, a common approach to family-child education methods may not be successful in different cultural contexts. This highlights the importance of culturally

adapting family and child education programs to meet various cultural perspectives (Susanty et al., 2021).

To the best of our knowledge, there is no culturally sensitive PNE program specifically designed for Turkish children, and no research has been conducted on adapted PNE4Kids material for this population. The cultural adaptation of PNE4Kids is emerging to facilitate the development of culturally sensitive, understandable, and appropriate materials tailored to the visual context and metaphors relevant to Turkish children with chronic pain. Therefore, the aim of this study was to conduct a modified Delphi study to collect and examine expert opinions on the content, appropriateness, clarity, understandability, and visual aspects of culturally sensitive PNE materials for Turkish children with chronic pain.

METHODS

Ethical approval

The study received approval from the Ethics Committee of University of Health Sciences Turkey, Antalya Training and Research Hospital (2022-127). All the study participants gave written consent in accordance with the Helsinki Declaration. The study was registered on clinicaltrials.gov (NCT05943587).

Study Design

A three-round modified Delphi-study involving both online and face-to-face interviews with experts was conducted between September 2023 and February 2024, in accordance with previous research (Dewitte et al., 2018; Hasson et al., 2000; Mukhtar et al., 2021; Orhan et al., 2019) and guidance for conducting and reporting Delphi studies (CREDES)(Jünger et al., 2017). The CREDES provide guidance in the assessment of the validity and accuracy of the methodology of the suggestions that are generated (Jünger et al., 2017).

Procedure

This study consisted of two main steps; the translation and cross-cultural adaptation of the original PNE4Kids, followed by the modified Delphi study.

1. Translation and cross-cultural adaptation of PNE4Kids

A focus group performed the Turkish translation and validation of the PNE4Kids program in the current study. The focus group consisted of OKK, CG, OE and the cooperation of KI and ER from the Pain in Motion Research Group at the Vrije Universiteit Brussel, Brussels, Belgium. The process of cross-cultural adaptation was carried out using both forward and backward translation approaches, based on previous guidelines (Beaton et al., 2000; Dunne et al., 2023). In Stage 1, two independent professional translators translated the original PNE4Kids from Dutch to Turkish. In Stage 2, two experts with at least 10 years of experience

in pediatric rehabilitation collaborated to develop the first version of the translated PNE4Kids through discussion and consensus with the translators. In Stage 3, a different bilingual translator with Dutch as native language performed a back-translation, and in Stage 4, the back-translation was reviewed by KI and ER. The final version of the PNE4Kids-Turkish was reviewed and discussed face-to-face by the first author (OKK) and KI and ER. In Stage 5, a modified Delphi-study was conducted to examine expert perspectives on the content, appropriateness, clarity, understandability, and visual aspects of the PNE4Kids-Turkish. In Stage 6, another researcher with Turkish language expertise revised the final version of the culturally adapted PNE4Kids-Turkish.

2. Modified Delphi Procedure

2.1.Experts

In line with previous studies, experts were included on the basis of national networks and personal connections of the researchers and peer-reviewed publications on children with chronic pain (Luedtke et al., 2016; Mukhtar et al., 2021; Orhan et al., 2019). No criteria have been established for determining the required expertise or specifying the number of experts needed (Hsu & Sandford, 2007; Luedtke et al., 2016). Using targetted sampling, experts from multiple disciplines and with varying experience were selected to assess the eligibility of PNE4Kids-Turkish from different viewpoints and perceptions. This study defined 5 crucial areas of expertise and selection criteria for experts based on previous studies (Mukhtar et al., 2021; Orhan et al., 2019) and face-to-face meetings involving OKK, CG, KI, ER, and OE. The 5 areas were (1) PNE, (2) Pediatric rehabilitation, (3) Pediatric medicine, (4) Clinical medicine, (5) Mothers and children. The criteria for the experts were: (1) expertise on PNE with a minimum of 5 years of experience in applying PNE, and at least one peer-reviewed publication on chronic pain including physiotherapists and anesthesiologists with specific expertise in the field of algology, (2) expertise on pediatric rehabilitation including pediatric physiotherapists with at least one peer-reviewed publication on children or a minimum of 5 years of experience in pediatric rehabilitation, (3) expertise on pediatric medicine including pediatric neurologists, pediatricists, child and adolescent psychiatry with expertise in children with chronic pain, (4) expertise on clinical medicine including nurses, psychologist, special education teachers with at least 5 years of clinical experience in managing children with chronic pain. All the experts were Turkish. The mothers of children with chronic pain and other children with chronic pain aged 10-12 years were also considered for selection. A total of 41 experts were invited to participate in the first round of the Delphi study, with a minimum of 5 experts from each group.

Round 1

The first author contacted the experts to inform them about round 1, the questionnaire, and PNE4Kids-Turkish. The questionnaire and PNE4Kids-Turkish were delivered to the experts either by email or hard copy and the experts were requested to complete the questionnaire within a two-week timeframe. A reminder e-mail and WhatsApp message were sent out to experts who did not complete the questionnaire within two weeks to increase the participation rate and one extra week for completion was given (Dewitte et al., 2018).

OKK and CG created and adapted the questionnaire based on the previous research (Mukhtar et al., 2021; Orhan et al., 2019). The questionnaire consisted of 5 items on demographic data and a combination of 16 closed and 7 open-ended questions to assess the relevance of information, feasibility of stories, visual information, and clarity of the message in four main areas (x): 1) normal pain biology, 2) pain modulation, 3) chronic pain, adaptations, central sensitization, and 4) the application of PNE4Kids and implications. Each section contained 4 multiple choice questions to answer on a 5-point Likert scale: strongly agree, agree, don't know, disagree, and strongly disagree (Mukhtar et al., 2021):

- i. *Do you think that the PNE4kids-Turkish material provides appropriate details on “x” in each section?*
- ii. *Do you think that the stories presenting the “x” are suitable for Turkish children?*
- iii. *Do you think that visual information for “x” in the PNE4kids is suitable for Turkish children with chronic pain?*
- iv. *Do you think that the message is clear and understandable for children?*

The open-ended questions allowed the experts to share their thoughts without restriction. An open-ended question was placed at the end of each section.

- i. *If you have any suggestions regarding the description of “x”, please write them in the box below.*

At the end of the questionnaire, three general open-ended questions were asked:

- i. *What are your thoughts on the sequence of topics and stories in the training material and the general concept? Is it understandable and rational?*
- ii. *What are your general statements?*
- iii. *Do you have any further suggestions?*

The experts' recommendations were discussed with OKK, ER, and KI in an online meeting for the next round. They decided how to modify the PNE4kids-Turkish according to the experts' ideas or provided a reasoned rebuttal to them.

Round 2

The first author developed a 32-slide PowerPoint presentation that described modifications and explanations linked to the expert suggestions. Subsequently, the experts received a second questionnaire, PNE4Kids-Turkish materials, and the presentation by e-mail. The experts completed the questionnaire with the same questions from round 1 within a two-week period.

Round 3

In the last round, experts were presented 3 multiple-choice questions: "How would you evaluate the clinical utility of the PNE4Kids-Turkish material?", "How would you evaluate the satisfaction level of the PNE4Kids-Turkish material?", "To what extent do the PNE4Kids-Turkish materials align with your expectations?".

Data analysis

MAXQDA software version 24 was used for the qualitative analysis of open-ended questions by MD and OKK. The material was collected, organized, and analyzed by OKK and MD under 4 main headings: 1) normal pain biology, 2) pain modulation, 3) chronic pain, adaptations, central sensitization, 4) the application of PNE4Kids, and implications, and general questions. The ESPEN consensus classification of consensus strength was applied to assess the level of consensus: >90% strong consensus, >75%-90% consensus, >50%-75% majority agreement, <50% no consensus (Forbes et al., 2017). [Schwermer et al. \(2019\)](#) recommended that sections with less than 75% agreement should be revised and resubmitted to the experts. The quantitative data were evaluated using IBM SPSS Statistics software, (version 25). Categorical variables were presented as frequencies, and quantitative data as mean and standard deviation values.

RESULTS

A total of 41 experts agreed to participate in the study, although 3 experts (1 pediatrician, 2 PNE experts) did not complete the questionnaire in round 1. Thus, 38 experts participated in all rounds, with 6 to 9 experts contributing to each area of expertise (i.e., PNE, pediatric rehabilitation, pediatricians, clinicians, and mothers/children). The characteristics of the experts are presented in Table 1. Most of the experts were women. Over 50% of experts indicated their involvement in the study was for clinical purposes. Eleven experts had over 5 years of experience with PNE, and 8 experts had at least 1 year of experience with PNE.

Results from round 1

Table 2 shows the quantitative data gathered in round 1. Over 80% of the experts strongly agreed or agreed with the appropriateness of relevant information, the feasibility of stories, visual information, and clarity of the message in the sections on normal pain biology, pain modulation, chronic pain, adaptations, central sensitization, and the application of PNE4Kids and implications. Only a few experts disagreed with the appropriateness of the

information and stories under the sections ‘normal pain biology’ and ‘pain modulation’. One expert disagreed with the clarity of the message under the heading of the application of PNE4Kids and implications. Four experts indicated that they were undecided about the appropriateness of stories and visual information under the headings of chronic pain, adaptations, and central sensitization, while 4 to 6 experts were unclear about the appropriateness of information, stories, and visual materials under the heading of the application of PNE4Kids and implications (Table 2).

Based on the ESPEN classification for the strength of consensus, there was a consensus to strong consensus on the relevance of information, feasibility of stories, visual information and clarity of the message in the sections ‘normal pain biology’, ‘pain modulation’, ‘chronic pain, adaptations, central sensitization’, and ‘application of PNE4Kids and implications’. However, the experts gave suggestions within the open-ended questions of round 1. The qualitative data from round 1 are summarised in Figure 1.

Suggestions about terminology;

Many experts were concerned about children's comprehension of the terms "general" and "officer".

“The terms "lieutenant" and "general" may be difficult to understand in the context of soldiers. Children may lack knowledge about the duties of an officer. It would be more rational to use "commander" instead of "general" and "officer" instead of "lieutenant" from an organizational perspective (Expert Clinician).”

“Boys tend to show a greater interest in toys related to the military, such as army figures, soldiers, commanders, and officers. It may be beneficial to clarify the hierarchy among these levels to help children's understanding. If the original training set is to be utilized, this form can also be employed (Expert on PNE)”

We therefore replaced the term "general" with "commander." Another suggestion from one of the PNE experts was to replace the expression "the soldiers are well-trained" with "they have developed a heightened sensitivity". In addition, the pediatric rehabilitation expert suggested that “For children of different ages, some words can be taught in easier ways.” For example, "The officer is on alert" might not be clear to a child aged 7 to 8, so simpler phrases like "the officer is paying attention" can be used instead.” We revised both expressions as suggested.

Suggestions about normal pain biology;

Four experts provided recommendations for improving current knowledge on normal pain biology.

“I feel like the part that acute pain plays in healing isn't talked about enough. Stories can help you understand the pain-inflammation-healing cycle better (Expert on PNE).”

“In the cases, it should also be made clear that if someone doesn't feel pain, they are more likely to do things that are bad for their health (Expert on Pediatrics).”

“There are more examples that can be used. You can add new stories with different catastrophes and events (Expert on PNE).”

OKK, KI and ER discussed these suggestions in depth in an online meeting. They decided that these can be included for clinical usage but are unnecessary for the PNE4Kids material. One expert on PNE said that “The child may also be asked to mark up a picture of a person to help find the origin of the pain.” This suggestion is also unnecessary because PNE4Kids also includes a game model as a child.

There was a conflicting suggestion about the military metaphor between experts. Specifically, experts on PNE and pediatrics found this metaphor useful and suitable for Turkish children;

“I really like it. I think the metaphors, method, and material are fun and easy for children to understand (Expert on Pediatric Rehabilitation).”

“Metaphors are extremely rational. The story is extremely understandable (Expert on PNE).”

However, one mother of a child with chronic pain stated, *“I believe the army metaphor is inappropriate for girls.”* We discussed this with KI and ER, and it was concluded that more than one metaphor could be offered depending on the child's interest, e.g., army, smurfs, princesses.

Suggestions about pain modulation;

One expert on PNE and three experts on pediatrics suggested adding additional details.

“Pain isn't just an illness. A feeling that is unpleasant. It might not be zero at all. However, it is important to make it so low that it doesn't hurt (Expert on PNE).”

“It is crucial to highlight that this system serves as protection against possible dangers” and “I think the word "hurt" should be added too (Expert on Pediatrics).”

“The role of past experiences and overprotective parental attitudes in pain perception can be added (Expert on Pediatrics).” We also mentioned this in the PNE4Kids- Turkish.

An expert on PNE said, *“Adding happy and unhappy face images to the pain description may be useful to give an idea about the severity of the pain.”* We decided this was unnecessary for the PNE4Kids-Turkish.

Suggestions about chronic pain, adaptations and central sensitization;

One mother of a child with chronic pain stated, *“When explaining pain adaptations, different examples from children's enjoyable and attention-getting activities may be applied as examples, besides the bicycle racer.”* She was unfamiliar with PNE. However, we accept this suggestion. One expert on PNE suggested using a bigger commander to improve children’s understanding. We decided to use different colours for soldiers and commanders, to make the differences in rank within the military clear.

Suggestions about the application of PNE4Kids and implications?;

Three experts on PNE recommended talking with children more comprehensively;

“The patient should be asked about their experience. Imagining the changes that will happen, especially when exercise and other physical activities are added, can help people remember the treatment information and get a better sense of the goals (Expert on PNE).”

“Following the PNE4Kids discussion, the clinician may be requested to use metaphors to explain the child's difficult situation or how he or she feels during the therapy procedure. In the clinic, I use this procedure frequently. Before the treatment, the child associated the pain to that of a lion, but afterward, the child compared it to that of a turtle. I believe it is critical to pay attention to the child's words (Expert on PNE).”

“Among my recommendations are including distraction strategies such as employing music during exercise treatments, describing the physical activity/exercise balance, and improving sociability through group exercise practice (Expert on PNE).”

We discussed these suggestions with KI and ER, and decided to use these suggestions when applying the PNE4Kids clinically.

Suggestions about general questions;

The experts’ ideas about the PNE4Kids-Turkish were summarised as a word cloud in Figure 2. The experts stated that the PNE4Kids-Turkish is easily understood, sensible, and useful for Turkish children. In addition, metaphors and visual materials are fun and easy for children to understand, and the sequence and explanation of the concept in PNE4Kids is well organized.

“I believe this pain education program can help teach Turkish children about pain, and it does a good job of explaining how pain acts (Expert on PNE).”

“It is important to adapt pain neuroscience education to the Turkish child population. I think that the visual information and analogies given are understandable and descriptive for the Turkish child population (Expert on Pediatrics).”

“The story sequence is adequate and repeated training should be beneficial for children (Expert on PNE).”

Round 2

Based on the quantitative findings, there was strong consensus for the relevance of information, feasibility of stories, visual information and clarity of the message on normal pain biology, pain modulation, chronic pain, adaptations, central sensitizations and the application of PNE4Kids and implications. No additional suggestions were made by the experts through the open-ended questions in round 2.

Round 3

There was determined to be over 95% consensus on the clinical usefulness, satisfaction level, and consistency with experts' expectations of the PNE4Kids-Turkish material.

DISCUSSION

The aim of this study was to translate and culturally adapt PNE4Kids for Turkish children with chronic pain using a 3-round modified Delphi method. To the best of our knowledge, this is the first study to have developed and culturally adapted the PNE4Kids for Turkish children with chronic pain. Based on the ESPEN grading of consensus strength, all sections reached a strong consensus. The majority of experts in the Delphi rounds agreed that the PNE4Kids-Turkish is crucial, valuable, helpful, and understandable for Turkish children with chronic pain. In addition, the PNE4Kids-Turkish has the potential to close the gap in research and clinical areas for the target population of children with chronic pain.

Cultural adaptation consists of systematic modifications to interventions or programs to align with the cultural profile, values, and meanings of the patient (Susanty et al., 2021). Cultural factors can impact the acceptability and appropriateness of interventions aimed at influencing cognitive and behavioral changes (Sharma et al., 2018). Consequently, the efficacy and suitability of interventions designed by clinicians from one culture may be questionable when applied to another. These procedures must be modified to provide optimal effectiveness while treating patients from different cultural backgrounds. Orhan et al. (Orhan et al., 2018) demonstrated through a systematic review that coping strategies, illness perception, self-efficacy, fear avoidance beliefs, sense of control, pain attitudes, and behaviors vary among individuals with chronic musculoskeletal pain from different ethnic and cultural backgrounds. Hence, it is essential to culturally adapt biopsychosocial procedures and interventions before implementing them in clinical settings (Susanty et al., 2021). The Delphi technique is crucial for achieving expert consensus in developing guidelines for effective clinical practice when there is insufficient published evidence from randomized controlled trials (Jünger et al., 2017).

The majority of research on PNE training and clinical use originates from Western societies, including North America, Australia, Europe, and Canada (Louw, Puente-dura, et al., 2016; Meeus et al., 2010; Moseley, 2002; Sawhney et al., 2017). Research has shown variations

in pain thoughts, opinions, perceptions, and behaviors between Turkish immigrants in Europe and local patients (Sloots et al., 2009). For example, Dutch patients were less concerned with pain symptoms than Turkish immigrants (Sloots et al., 2009). In addition, significant cultural differences were seen between native Dutch patients and Turkish immigrants regarding external control focus and illness origins (Reich et al., 2015; Sloots et al., 2009). Turkish immigrants were seen to show lower levels of responsibility in managing pain, perceive themselves as having less ability to deal with the pain, and exhibit more external locus of control behavior compared to local patients (Reich et al., 2015; Sloots et al., 2009). In addition, Turkish patients tend to utilize passive coping mechanisms including massage, thermal agents, and herbal therapies more frequently (Ozturk Birge & Mollaoglu, Hastalarin agri inanclari ve agriyi yonetmede kullandiklari ilac disi yontemler./2018). Turkish immigrants in Germany with chronic headaches have been reported to rely more on passive coping strategies, such as the frequent use of medicines, compared to Germans (Kavuk et al., 2006).

Therefore, solely translating the pain interventions into Turkish may not be sufficient for the treatment of Turkish patients with diverse cultural backgrounds who face major cultural difficulties in comprehending pain (Kavuk et al., 2006). The reason for this may be attributed to low socioeconomic status, gender, and education level. Hence, the PNE application should include uncomplicated techniques and visuals that are tailored to the patient's native language and culture. Cultural adaptation is crucial for PNE to modify maladaptive pain thoughts and beliefs that are influenced by Turkish culture, as mentioned in the literature (Ozturk Birge & Mollaoglu, Hastalarin agri inanclari ve agriyi yonetmede kullandiklari ilac disi yontemler./2018). Orhan et al.(Orhan et al., 2019), developed culturally adapted PNE for Turkish adults with chronic pain. However, there are significant constraints in assessing and implementing biopsychosocial therapies for children with chronic pain in Turkey (Bakir, 2017). No research has been conducted in Turkey regarding the expression, behavior, and coping mechanisms of pain in children (Bakir, 2017). PNE4Kids is a biopsychosocial intervention that includes both the child and their family. From birth onwards, children develop their behavior by mirroring the characteristics of the culture that they are part of, their family, and via ongoing interaction with environmental influences. Pain is a highly worrying condition and the hospitalized experience of children, make it a challenging issue for healthcare providers to manage (Bakir, 2017). Cultural variables impact pain perception by influencing the transmission of nociceptive signals from the thalamus to the cortex (Bakir, 2017; Forgeron et al., 2009; Fortier et al., 2009a; Kristjánssdóttir et al., 2012).

Cross-cultural studies have demonstrated that the way children express pain, their behavior, and coping strategies are greatly influenced by culture (Cheng, Foster, & Hester, 2003; Cheng, Foster, Hester, et al., 2003; Gharaibeh & Abu-Saad, 2002; Khanom et al., 2020; Latimer et al., 2014). Previous research has identified significant differences, particularly among Asian and Western children. Asian children often conceal their emotions and ideas, whereas Western children are usually directed to openly express their feelings and views. Chinese children experiencing pain often mask and adapt to the pain, even if they feel like crying. In contrast to other groups, Muslim Arab boys aim to minimize their pain-related complaints, avoid crying, and display mature and tolerant attitudes (Fortier et al., 2009b; McCarty et al., 1999). No study of children aged 3-18 years has been conducted in Turkey (Bakir, 2017) and it is essential to conduct studies that examine how Turkish children aged 3-18 years react to pain and how they cope with it (Bakir, 2017). In the light of these findings, this modified Delphi study can be considered crucial for addressing the significant knowledge gap in the literature concerning Turkish children with chronic pain.

According to the closed-ended question findings in round 1, the relevance of information on implications reached a lower consensus rate than the other sections. The potential explanation for this might be that many experts on PNE suggested more explanation about the implications. At the end of round 1, there was an acceptable consensus (>75%-90%) for all sections, although the experts had some suggestions. Experts on PNE and pediatrics gave more suggestions than the other experts, including experts on pediatric rehabilitation, mothers/children, and clinicians. This may be explained by the fact that experts on PNE and pediatrics have more experience with PNE than others.

After round 2, the experts reached a consensus of over 90% about the relevance of information, feasibility of stories, visual information and clarity of message on normal pain biology, pain modulation, chronic pain, adaptations, central sensitizations, and the application of PNE4Kids implications. The feasibility of the stories and implications reached the lower consensus of 94.2% compared to the other sections. This might be because the mothers of children with chronic pain were not familiar with PNE.

A strong consensus was obtained in round 3 about the clinical usefulness, level of satisfaction, and compatibility with experts' expectations based on ESPEN. This can be considered to reflect the higher level of quality and design of the original PNE4Kids material, which successfully presents the concept of pain to children through play.

The major strengths of this Delphi study were the high response rate (92.7%; 38/41 experts completed all Delphi rounds) and high qualification level and multidisciplinary nature of the experts. In addition, MAXQDA software tool was used for qualitative analysis to prevent bias in the selection of words and judgements. At the end of the study, another researcher with expertise in the Turkish language assessed the PNE4Kids-Turkish, and stated that the PNE4Kids-Turkish is fluent and understandable, and is excellent in explaining the differences between pain and tissue damage. A possible limitation of the study was the close-ended and open-ended questionnaire were adapted from previous research focusing adults, therefore a few questions may not be appropriate for children with chronic pain. Another limitation is that the majority of the researchers that participated in the Delphi rounds were female. There is a possibility that the researchers' perceptions and experiences regarding pain, especially the differences between men and women, might be made apparent.

Conclusion

In conclusion, strong consensus was obtained on the relevance of information, feasibility of stories, visual information and clarity of the message on normal pain biology, pain modulation, chronic pain, adaptations, central sensitizations and the application of PNE4Kids and implications for PNE4Kids-Turkish. The PNE4Kids-Turkish is a culturally sensitive, understandable, and appropriate for visual context and metaphors for Turkish children with chronic pain. The effect of the PNE4Kids-Turkish and its clinical feasibility should be investigated by a further randomized controlled trial.

Implications to practice

This is the first study to have developed and culturally adapted the PNE4Kids for Turkish children with chronic pain. The majority of experts in the Delphi rounds agreed that the PNE4Kids-Turkish is crucial, valuable, helpful, and understandable for Turkish children with chronic pain. The PNE4Kids-Turkish has the potential to close the gap in research and clinical areas for the target population of children with chronic pain.

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Data statement Data are available upon reasonable request

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Declaration of Interest

The authors report there are no competing interests to declare.

Figure 1. The code system for basic concepts of PNE4KIDS; The circle images show the frequency of comments

Figure 2. The word-cloud for expert opinions from Delphi rounds.

Table 1*Demographics of the experts that participated in the Delphi-study*

	Round 1-2-3
	(n=38)
Age (M±SD)	36.60±9.05
Gender	n (%)
Male	6 (15.8)
Female	32 (84.2)
Country of residence	
Turkey	38 (100)
Role in pain education	
Clinical purposes	21 (55.3)
Research purposes	17 (44.7)
Experience in pain education	
Non-existing	7 (18.4)
Heard of it	10 (26.3)
Familiar with it, <1 year	2 (5.3)
Familiar with it, 1-5 years	8 (21.1)
Familiar with it, 6-10 years	5 (13.2)
Familiar with it, 11+ years	6 (15.8)
Applied/received pain education program	
Yes	12 (31.6)
No	26 (68.4)
Delphi experts' area	
PNE	9 (23.7)
Pediatric Rehabilitation	7 (18.4)
Pediatricians	8 (21.1)
Clinicians	6 (15.8)
Mother/children	4/4 (21.1)

Table 2. Results of the Delphi round 1 and round 2

	Normal Pain Biology (n=38)		Pain Modulation (n=38)		Chronic pain, adaptations, central sensitizations (n=38)		The application of PNE4kids and implications (n=38)	
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Relevance of information								
Strongly agree/agree	33 (86.84)	38 (100)	35 (92.1)	37 (97.4)	37 (97.4)	38 (100)	32 (84.2)	37 (97.4)
Don't know	3 (7.89)	0(0)	2 (5.3)	1(2.6)	1(2.6)	0(0)	6 (15.8)	1(2.6)
Disagree/ strongly disagree	2 (5.26)	0(0)	1(2.6)	0(0)	0(0)	0(0)	0(0)	0(0)
Feasibility of stories								
Strongly agree/agree	35 (92.1)	38 (100)	35 (92.1)	37 (97.4)	32 (89.5)	37 (97.4)	34 (89.5)	36 (94.2)
Don't know	2 (5.3)	0(0)	2 (5.3)	1(2.6)	4 (10.5)	1(2.6)	4 (10.5)	2 (5.4)
Disagree/ strongly disagree	1 (2.6)	0(0)	1 (2.6)	0(0)	0(0)	0(0)	0(0)	0
Visual information								
Strongly agree/agree	38 (100)	38 (100)	38 (100)	38 (100)	34 (89.5)	38 (100)	34 (89.5)	37 (97.4)
Don't know	0(0)	0(0)	0(0)	0(0)	4 (10.5)	0(0)	4 (10.5)	1(2.6)
Disagree/ strongly disagree	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Clarity of the message								
Strongly agree/agree	36 (94.7)	38 (100)	38 (100)	38 (100)	37 (97.4)	38 (100)	36 (94.8)	38 (100)
Don't know	2(5.3)	0(0)	0(0)	0(0)	1(2.6)	0(0)	1(2.6)	0(0)
Disagree/ strongly disagree	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(2.6)	0(0)