UNIVERSITY OF TURKU

DEVELOPMENT OF A PEDIATRIC PAIN EDUCATIONAL PROGRAM FOR NURSES IN A RESOURCE-LIMITED SETTING

Abigail Kusi Amponsah

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
SARJA – SER. D OSA – TOM. 1516 | MEDICA – ODONTOLOGICA | TURKU 2020

UNIVERSITY OF TURKU

DEVELOPMENT OF A PEDIATRIC PAIN EDUCATIONAL PROGRAM FOR NURSES IN A RESOURCE-LIMITED SETTING

Abigail Kusi Amponsah

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
SARJA – SER. D OSA – TOM. 1516 | MEDICA – ODONTOLOGICA | TURKU 2020

University of Turku

Faculty of Medicine
Department of Nursing Science
Nursing Science
Doctoral Programme in Health Science

Supervised by

Associate Professor, Anna Axelin, RN, PhD
Department of Nursing Science
University of Turku
Turku, Finland

Senior Lecturer, Victoria Bam, RN, PhD
Department of Nursing
Kwame Nkrumah University of Science and Technology
Kumasi, Ghana

Reviewed by

Docent, Kristina Mikkonen, RN, PhD
Research Unit of Nursing Science and Health Management
University of Oulu
Oulu, Finland

Senior Lecturer, Stefan Nilsson, RN, PhD
Institute of Health and Care Sciences
University of Gothenburg
Göteborg, Sweden

Opponent

Associate Professor, Sigríður Zoëga, RN, PhD
Faculty of Nursing
University of Iceland
Reykjavík, Iceland

The originality of this publication has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
ISBN 978-951-29-8218-9 (PRINT)
ISBN 978-951-29-8219-6 (PDF)
Painosalama Oy, Turku, Finland 2020

To my family

UNIVERSITY OF TURKU
Faculty of Medicine
Department of Nursing Science
ABIGAIL KUSI AMPONSAH: Development of a pediatric pain educational program for nurses in a resource-limited setting
Doctoral Dissertation, 166 pp.
Doctoral Programme in Nursing Science
October 2020

ABSTRACT

This study aimed at developing an evidence and theory-based pediatric pain educational program (PPEP) for nurses in a resource-limited setting, guided by the MRC's framework. The PPEP was developed by identifying the evidence of need, identifying an existing theory and modelling the process and outcomes of the educational intervention. The first sub-study was an integrative literature review on the effectiveness of nursing educational interventions on pediatric pain management. The second and third studies examined the pediatric pain educational needs of nurses using quantitative and qualitative research approaches. The fourth was an ethnographic study examining the culture and context of pediatric pain management at four Ghanaian hospitals. A review of existing literature was also conducted to identify an appropriate behavioral change theory to guide the development of the PPEP. The proposed PPEP and its evaluation outcomes were then modeled to serve as a guide for the piloting (feasibility and acceptability) phase in the future.

The integrative review of 37 primary studies revealed that nursing educational interventions mostly led to positive changes in nurses' knowledge, attitudes and practice of managing children's pain. The quantitative cross-sectional survey, identified insufficiency in pediatric pain knowledge and attitudes with a mean (SD) score of 36.7% (6.9%). In sub-study III, nurses expressed competencies and deficiencies in various aspects of children's pain assessment and management. The ethnographic study revealed a variety of power-imbalances and resources affecting the assessment and management of children's pain within the pediatric care settings. The social cognitive theory was chosen based on a review of behavior change theories to guide the educational program. The proposed PPEP was modeled to be pilot-tested as a two-arm cluster, randomized controlled trial with a three-month follow-up that will compare the same content of education delivered via different modes. Anticipated measurement outcomes include knowledge and attitudes regarding pediatric pain, self-efficacy, and evaluation of the acceptability of the educational program. The findings reveal a trend of unsatisfactory pediatric pain knowledge, attitude, and practice of assessment, management and documentation in Ghanaian hospitals and the urgent need and readiness of Ghanaian pediatric nurses to receive a pediatric pain educational intervention in the nearest future.

KEYWORDS: Children, education, nurses, pain, pain assessment, pain management.

TURUN YLIOPISTO
Lääketieteellinen tiedekunta
Hoitotieteen laitos
ABIGAIL KUSI AMPONSAH: Koulutusohjelman kehittäminen lasten kivun hoitoon kehittyvän maan sairaanhoitajille
Väitöskirja, 166 s.
Hoitotieteen tohtoriohjelma
Lokakuu 2020

TIIVISTELMÄ

Tämän tutkimuksen tavoitteena oli kehittää MRC:n viitekehyksen ohjaamana tutkimusnäyttöön ja teoriaan pohjatuva lasten kivun hoidon koulutusohjelma (Pediatric Pain Educational Program, PPEP) sairaanhoitajille toimintaympäristöön, jossa resurssit ovat rajalliset. Ensimmäinen osatutkimus oli integratiivinen kirjallisuuskatsaus, jossa tarkasteltiin sairaanhoitajille kehitettyjen lasten kivun hoidon koulutusinterventioiden tehokkuutta. Toinen ja kolmas osatutkimus kartoittivat sekä määrällisin että laadullisin menetelmin sairaanhoitajien oppimistarpeita lasten kivun hoidossa. Neljäs osatutkimus oli fokusoitu etnografia, missä tarkasteltiin lasten kivun hoidon kulttuuria ja toimintaympäristöä neljässä ghanalaisessa sairaalassa. Lisäksi tehtiin kirjallisuushaku soveltuvan käyttäytymisen muutosta selittävän teorian löytämiseksi. Tämä teoria ohjasi osaltaan koulutusohjelman kehittämistä. Tämän jälkeen koulutusohjelma kuvattiin ja sille laadittiin arviointiviitekehys tulevaisuudessa tehtävää pilottitutkimusta varten.

Integratiiviseen kirjallisuuskatsaukseen valikoitujen 37 artikkelin perusteella lasten kivun hoitoon kehitetyt koulutusinterventiot saavat useimmiten aikaan positiivisia muutoksia sairaanhoitajien lasten kivun hoitoon liittyvissä tiedoissa, asenteissa ja toimintatavoissa. Poikkileikkaustutkimuksena tehty kyselytutkimus osoitti, että sairaanhoitajien lasten kivun hoitoon liittyvät tiedot ja asenteet olivat puutteelliset, ka 36,7% (kh 6,9%). Kolmannessa osatutkimuksessa tehdyistä haastatteluista kävi ilmi, että hoitajat kokivat puutteita osaamisessaan liittyen lasten kivun arviointiin ja lievitykseen. Fokusoitu etnografia puolestaan toi näkyväksi valta- ja resurssitekijöitä, jotka vaikuttivat lasten kivun hoidon toteutumiseen. Banduran Sosiaalisen oppimisen teoria valittiin koulutusohjelman teoreettiseksi perustaksi. Seuraavaksi kuvattu PPEP-koulutusohjelma esitestataan klusteroidun satunnaistetun kontrolloidun tutkimusasetelman avulla. Sama oppimissisältö opetetaan kahdelle ryhmälle eri opetusmenetelmillä, ja oppimistuloksia seurataan kolme kuukautta koulutuksen jälkeen. Vastemuuttujina käytetään lasten kivun hoitoon liittyvää tietoa ja asenteita, minäpystyvyyttä, sekä koulutusohjelman toteutettavuutta ja hyväksyttävyyttä. Tämän tutkimuksen tulokset osoittavat lasten kivun hoitoon liittyvien tietojen, asenteiden ja käytäntöjen olevan puutteellisia ghanalaisissa sairaaloissa. Perheiden ja hoitajien tarpeisiin vastaamiseksi on ghanalaisille lastensairaanhoitajille tarjottava aiheeseen liittyvää koulutusta mahdollisimman nopeasti.

AVAINSANAT: Lapset, koulutus, sairaanhoitaja, kipu, kivun arviointi, kivun hoito.

Table of Content

List of Figures, Tables and Appendices

Figures

Tables

Appendices

Abbreviations

ANOVA	Analysis of Variance
CENTRAL	Cochrane Central Register of Controlled Trials
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CHAG	Christian Health Association of Ghana
CHN	Community Health Nursing
D.R	Document Review
EN	Enrolled Nurse
EPM	Essential Pain Management
F.I	Formal Interviews
FLACC	Face-Legs-Activity-Cry-Consolability
GHS	Ghana Health Service
IASP	International Association for the Study of Pain
I.I	Informal Interviews
IMR	Infant Mortality Rate
KNUST	Kwame Nkrumah University of Science and Technology
MCQs	Multiple Choice Questions
MeSH	Medical Subject Heading
MoH	Ministry of Health
MRC	Medical Research Council
NCCC-R	Non-Communicating Children's Pain Checklist – Revised
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
PHPKASRP	Pediatric Healthcare Provider's Knowledge and Attitudes Survey Regarding Pain
PIPP	Premature Infant Pain Profile
PNKAS	Pediatric Nurses' Knowledge and Attitudes Survey regarding pain
PPEP	Pediatric Pain Educational Program
PRISMA-P	Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols
QRN	Qualified Registered Nurse
RCT	Randomized Control Trial
RGN	Registered General Nurse

S	Search query
SCT	Social Cognitive Theory
SD	Standard Deviation
SET	Self-Efficacy Tool
TH	Teaching Hospital
U5MR	Under-five Mortality Rate

List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals I–IV:

I Kusi Amponsah, A., Björn, A., Bam V. & Axelin, A. The effect of educational strategies targeted for nurses on pain assessment and management in children: An integrative review. *Pain Management Nursing,* 2019; 20: 604–613.

II Kusi Amponsah, A., Oduro, E., Bam V., Kyei-Dompim, J., Ahoto, C. K. & Axelin, A. Nursing students and nurses' knowledge and attitudes regarding children's pain: A comparative cross-sectional study. *PLoS ONE*, 2019; 14(19): e0223730.

III Kusi Amponsah, A., Kyei-Dompim, J., Bam V., Kyei, E. F., Oduro, E., Ahoto, C. K. & Axelin, A. Exploring the educational needs of nurses on children's pain management: A descriptive qualitative study. *Nursing Open*, 2020; 7: 841–849.

IV Kusi Amponsah, A., Oduro, E., Bam V., Kyei-Dompim, J., Ahoto, C. K. & Axelin, A. Dynamics on the field: A focused ethnographic study of pediatric pain management at four Ghanaian hospitals. *BMC Pediatrics*, 2020 (submitted).

1 Introduction

In spite of the exponential increase in pediatric pain research and the discovery of cost-effective interventions over the past decades (Chiaretti et al., 2013; Friedrichsdorf & Postier, 2019), many children experience needless pain during hospitalization (Birnie et al., 2014a; Groenewald et al., 2012; Kozlowski et al., 2014; Mazhin et al., 2018; Vejzovic et al., 2020). Earlier studies report of an acute pain prevalence between 38.0% and 94.0% among hospitalized children (Huang et al., 2013; Kozlowski et al., 2014; van der Heijden et al., 2018; Vejzovic et al., 2020).

Although the documented prevalence of acute pain among hospitalized children is very limited in resource-constrained settings (Huang et al., 2013), it is likely to be worse in many of such places rates due to the high prevalence of pain-causing illnesses such as sickle cell disease (Williams, 2016), deficient or limited pain care services, few pediatric pain specialists (Albertyn et al., 2009; Audibert & Mathonnat, 2012) all of which worsen the plight of vulnerable children. Pediatric pain is considered as a global health challenge as vulnerable children are more likely to be inadequately assessed and or treated for their pain when compared with their adult counterparts (Srouji et al., 2010; Ternullo and DiAntonio 2015).

Apart from pain signifying an actual or potential tissue damage (International Association for the Study of Pain, 1979), it is of no relevance to children as it can result in negative consequences on their physical, psychological, socio-economic, and spiritual well-being (Racine et al., 2016; Sessle, 2011; Sinatra, 2010). Inadequately treated acute pain has been linked with multiple body organ system complications, impaired body functioning (Sinatra, 2010), development of chronic pain (Sessle, 2011), disturbed quality of life (Racine et al., 2016), decreased work ability, diminished social interactions, anxiety, increased use of resources (Langley et al., 2011), avoidance of healthcare with its associated morbidity and mortality (Friedrichsdorf & Postier, 2019). By virtue of the above-mentioned effects, the relevance of appropriate pain assessment and management cannot be overemphasized in children. Apart from reducing or eradicating the many sequelae of unrelieved pain, effective pain management can avert avoidable complications and improve the quality of life of such children (Kahsay, 2017). Moreover, the

escalating cost of healthcare to families, healthcare systems and nations would also be reduced if not eliminated (Dusek et al., 2018).

Nurses as the majority of frontline healthcare providers play a critical role in the assessment and management of children's pain as they work directly and indirectly with hospitalized children, their families and other healthcare workers to provide care on a 24-hour basis. As major stakeholders in the healthcare delivery system, nurses are confronted in their daily work with the responsibility of caring for hospitalized children in pain (Hockenberry et al., 2019). Thus, they are required to implement appropriate pain assessments, utilize cost-effective pharmacological and non-pharmacological interventions, and regularly evaluate the effectiveness of such interventions (Hockenberry et al., 2019; Namnabati et al., 2012). Nevertheless, numerous studies have shown that nurses do not possess the requisite competences to adequately assess and manage children's pain (Alotaibi et al., 2019; Ekim and Ocakci 2013; Ortiz et al. 2015; Stanley and Pollard 2013). This may be attributed to the insufficient pediatric pain education received during nursing education and the limited post-qualification educational opportunities on the subject (Alzghoul & Abdullah, 2015; Aziato & Adejumo, 2014), all of which contributes to sub-optimal pediatric pain assessment and management in practice (Srouji et al., 2010; Ternullo and DiAntonio 2015).

Fortunately, diverse educational interventions have been shown to improve nurses' pediatric pain management competences (knowledge, attitudes and practices) in different parts of the globe (Dongara et al. 2017; Heinrich et al., 2016; Vael and Whitted 2014). While one-third of earlier studies reported on their approach to pediatric pain educational program (PPEP) development, they did not provide sufficient details about the approaches mentioned. Furthermore, a greater proportion of nursing-directed PPEPs (two-thirds) did not report on the approach used in developing their interventions. Comprehensive reporting on intervention development provides guidance for dependable implementation, enhances replication in other settings (Hoffmann et al., 2014) and offers an opportunity for further refinement (Hoffmann et al., 2017). Intervention development also serves as a necessary pre-requisite for the feasibility and piloting stages (Möhler et al., 2015).

Children's pain assessment and management, albeit a global challenge, is affected by factors that operate at the local level, such as prevailing socio-cultural practices, health policies, resources and educational structures available to the nurses and other health personnel involved in the care of children (Kruk et al., 2018; Kannampallil et al., 2011; Lipsitz, 2012). Thus, it is vital to consider the context within which pediatric pain care transpires. Based on the identified deficiencies and the limited studies in resource-constrained settings, the Medical Research Council's (MRC's) framework (Craig et al., 2020) will serve as a guide in the development of a pediatric pain educational program (PPEP) that is underpinned by research

evidence, relevant theory and adaptive to the local context. It will also be valuable for subsequent phases of piloting, evaluation and implementation in these settings.

I am a registered general nurse (RGN) and a lecturer at the Department of Nursing, Kwame Nkrumah University of Science and Technology (KNUST) in Ghana. My interest in pain management was developed during the Master of Science program in Advanced Nursing which I pursued in the United Kingdom at the School of Nursing, Midwifery and Physiotherapy, University of Nottingham. This led me to systematically review literature on the efficacy of music as a postoperative pain management intervention for adult patients. My interest in children's pain management was stimulated during a terrible experience when my first son was circumcised; he virtually cried for 24 hours and I blamed myself as a mother as I felt this could have been avoided as we did not put in place effective pain relief measures before, during and after the procedure. My encounters with other children who were undergoing various skin-breaking procedures in the hospital setting and their ordeal further propelled me to be part of the solution for bringing pain relief to these vulnerable children, especially when there are safe and cost-effective methods for doing so. Inspired by these, the present study sought to develop an evidence and theory-based PPEP for nurses in a resource-constrained setting using the MRC's framework as a guide. It is hoped that this study will guide subsequent piloting, evaluation and implementation of the educational intervention so as to bring the needed changes we desire in pediatric pain practice.

This dissertation will commence with the background to the study in chapter two followed by a review of relevant literature in chapter three. Chapter four will address the aims and research questions. Chapter five will focus on the study materials and methods followed by the results in chapter six. Discussion of the main study findings together with the validity, reliability and trustworthiness associated with the study procedures will be described in chapter seven. Finally, the dissertation will end with a concluding chapter (eight) highlighting the implications of the study for nursing education, practice, research and policy.

2 Background

Background information for a study expands the central points stated at the beginning in the introduction. It provides general information and context about the research problem with reference to the existing literature (Sudheesh et al., 2016). While the background information is not a substitute for a comprehensive review of relevant literature, it places the research problem in a proper context for readers to appreciate the study's relevance. This sub-section provides a brief overview on Ghana (a developing country), the general healthcare delivery, pediatric healthcare, and the progress made in pediatric nursing as an area of specialization in the country.

2.1 Brief description of the developing country called Ghana

Found in West Africa, Ghana was formed as an amalgamation of the British colony of the Gold Coast and the Togoland Trust Territory in 1957 at the independence of the country (Central Intelligence Agency, 2020). In early June 2019, the population of Ghana was estimated at 30,280,482 (Ghana Statistical Service, 2019). Ghana is divided into sixteen (16) administrative regions with each region having a capital (refer to Figure 1). However, the ethnic roots of the country have created a social system where citizen usually prefer to be identified with their group. With English as the official language, the country boasts of 79.0% literacy rate as at the year 2018 (World Bank, 2019); the citizens speak varied ethnic languages such as Twi, Ga, Adamgbe, Ewe, Guan, Dagomba, Dagarte, Grusi among others. The country is found close to the equator and borders on the Atlantic Ocean, thus creating two distinct weather seasons (dry and rainy). These two seasons affect life in the country in all sectors including healthcare and is evidenced by some diseases becoming more prevalent in one season than in the other (Darkoh et al., 2017; Dukić et al., 2012).

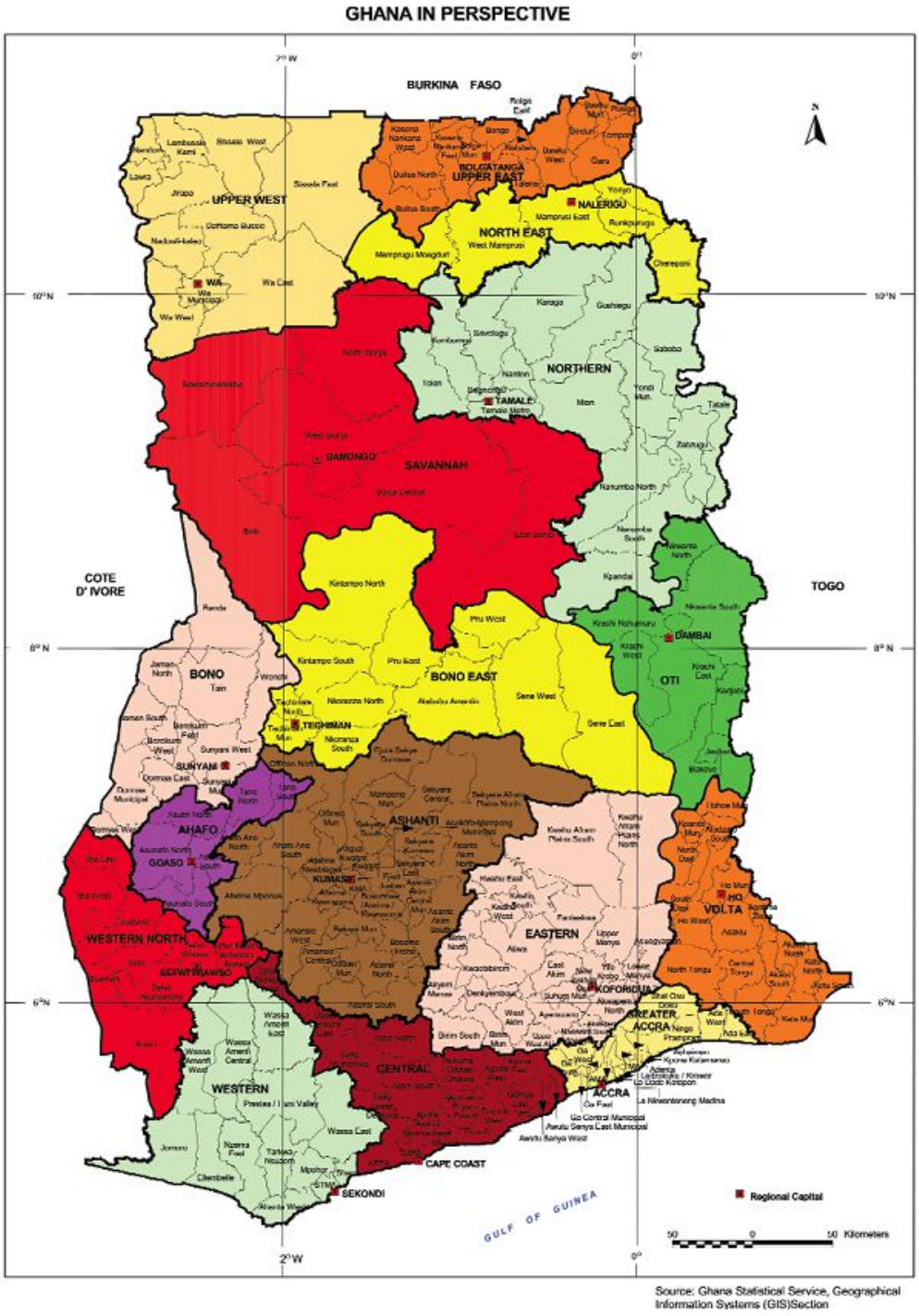

Figure 1. Map of Ghana.

2.2 Healthcare structure and service provision in Ghana

Healthcare provision in Ghana is overseen by the country's Ministry of Health (MoH). The mandate of the MoH includes policy formulation, resource mobilization and allocation, regulation, monitoring and evaluation of healthcare sector's performance (Ministry of Health, 2020). Key among the MoH's agencies are the Ghana Health Service (GHS), Teaching Hospitals (THs), Christian Health Association of Ghana (CHAG), and regulatory bodies for healthcare facilities and professionals. The GHS manages primary, secondary and some specialist healthcare service provision in public hospitals and clinics. Teaching hospitals are semiautonomous agencies responsible for providing tertiary healthcare. CHAG is an autonomous agency consisting of Christian denominations; it provides healthcare to the vulnerable and underprivileged population, especially in the most remote areas of the country. The regulatory bodies are charged with the responsibility of accrediting healthcare facilities (public and private) as well as safeguarding the highest standards of healthcare education and practice. Thus, the MoH working through its agencies and departments promotes the Government of Ghana's vision of achieving universal health coverage and a healthy population.

The healthcare system in Ghana is operationalized at five structural and functional levels: these comprise of national, regional, district, sub-district and community levels (Ghana Health Service, 2020a). The healthcare delivery continuum shows a downward flow of authority and supervisory roles from the national, regional, district and sub-district levels, especially with the Ghana Health Service. Both private and public healthcare facilities operate as general or specialist centres depending on the scope of care provision. Similarly, pediatric healthcare takes place in general or specialist hospitals owned by private individuals and/ or the government of Ghana.

According to the 2011 edition of the Ghana Health Workforce Observatory report, more than 52,000 individuals formally work in Ghana's health sector (public and private) (Ministry of Health, 2011). Majority of these people work in the GHS, THs and CHAG. About two-fifths of these individuals are clinical staff while the remaining form the non-clinical support staff. Due to rural-urban inequalities, over two-thirds of the clinical staff work in urban dwellings whilst the remaining operate in rural areas of the country. There has been a slight improvement in the healthcare worker: population ratio over the past years. In the year 2016, the doctor: population ratio was 1:8,481 while that of the nurse: population ratio reached 1:542 (Ghana Health Service, 2017).

2.3 Pediatric healthcare in Ghana

Due to the unique needs of the pediatric population, various healthcare programs have been instituted in the country to enhance the growth and wellbeing of children aged 0-18 years (Ghana Health Service, 2020b). These include child welfare clinics for children under 5 years which is focused on the promotion of exclusive breastfeeding, complementary feeding, immunization, growth monitoring and nutrition rehabilitation, care of minor ailments and injuries. These have occasioned a tremendous reduction in the infant mortality rate (IMR) to 35 deaths per 1,000 live births and the under-five mortality rate (U5MR) to 47 per 1,000 live births over the past years (United Nations International Children's Emergency Fund et al., 2019).

School health services concentrates on screening and examination of school children and food vendors, immunization, health education on personal hygiene and public health issues, management of minor ailments and injuries, and referrals. Adolescent health service is responsible for the identification and management of common health problems affecting adolescents and the provision of health services (such as education, counselling and reproductive health issues). All these programs have been instituted to correct inequalities in pediatric healthcare and to address the United Nation's principle of "leaving no one behind" in their 2030 sustainable development agenda towards ensuring good health and well-being for all (goal 3) (United Nations Committee for Development Policy, 2018). In addition to these services, there are a number of specialist children's clinics and hospitals; dedicated to the care of children only. Furthermore, all teaching, regional, district and private hospitals have at least a ward dedicated to the admission and care of children.

2.4 Development of pediatric nursing as a specialty in Ghana

From its humble beginnings of state colonial nursing men, nursing practice in Ghana has witnessed remarkable increase in specialization and currently being practiced by both males and females. Despite this incredible leap, the nation did not have a dedicated pediatric nursing education program by the close of the first decade of the twenty-first century. According to Stevens and colleagues (2014), the idea of a pediatric nursing education program was proposed by Isaac Odame, a pediatrician based in Canada at the time. This led to the commencement of the Ghana SickKids Pediatric Nursing Training Program in 2011 as a four-year collaboration between the Hospital for Sick Children in Canada and the Ministry of Health in Ghana. The one-year program intensively trained practicing nurses in the pediatric nursing specialty, leading to the award of a certificate.

Currently, pediatric nursing services are provided by general nurses and pediatric nurse specialists who have received education from one of the higher educational

institutions accredited to offer the program within or outside of the country. However, the majority of nurses in the field of pediatric healthcare are general nurses due to insufficient number of pediatric nurse specialists. The general nurses receive at least a semester of lessons and a stipulated period of clinical practice on pediatric nursing per the current nursing and midwifery educational curriculum. Also, graduate nurses and midwives are required to practice for at least two weeks as part of their compulsory national service rotation of clinical schedules. Despondently, the educational content and exposure of trainee nurses and graduates on pediatric care has been reported to be inadequate (Atakro et al., 2019).

3 Review of the Literature

A review of the literature is conducted to identify existing knowledge and gaps on a topic so as to provide direction for the future (Sudheesh et al., 2016). In this chapter, the existing literature on nature and development of pediatric pain educational programs in developing countries as well as justification for the current study have been provided. Systematic literature searches using relevant key words were conducted initially in March 2018 and updated in April-May 2020 on four databases namely CENTRAL, CINAHL, PubMed (Medline) and Scopus (refer to Appendix I). The literature search was supplemented with searches of reference lists of primary studies and the internet in general.

3.1 Prevalence of pain among hospitalized children globally

Several studies have explored the prevalence of pain among hospitalized children (Birnie et al. 2014a; Groenewald et al., 2012; Kozlowski et al., 2014; Mazhin et al., 2018; Vejzovic et al., 2020). However, little is known about the prevalence of pediatric pain worldwide. The prevailing studies were conducted at individual hospitals making a global estimation of the problem challenging. Available studies that have attempted an estimation of national pediatric pain prevalence varied between 38.0% and 94.0% and these were done in the United States of America (Chang et al., 2014) Bosnia and Herzegovina, Croatia, Macedonia, and Sweden (Vejzovic et al., 2020).

Similarly developing countries, especially in Africa have reported the pain prevalence among children in this region. For instance, among secondary school children in southern Tunisia in Africa,(Ben Ayed et al., 2019) recorded a low back pain prevalence of 43.0%. Similarly, van der Heijden et al. (2018) found that among hospitalized children with burns in a South African hospital, as many as 81.0% of the children reported being in severe pain and regularly had to endure wound dressing and other painful procedures such as change of bandages without pain medications or distractions. Also, Huang et al. (2013) reported that 80.5% of hospitalised children in a national hospital in Kenya suffered from a degree of pain or another.

Till date, there are no published reports of pediatric pain prevalence in Ghana and most countries in the sub-Saharan Africa region. Speculatively, the problem is likely to be worse than than in developed countries due to the numerous challenges such as proliferartion of diseases, sub-optimal healthcare systems, conflict, and poverty facing pediatric healthcare in these countries (Audibert & Mathonnat, 2012; Chatterjee et al., 2012; Williams & Craig, 2016).

3.2 Effects of unrelieved pain in children

Inadequately managed pain has several negatives effects on the biological, physical, psychological and social well-being of children. These negative effects of pain are magnified in some children due to their inability to self-report the severity of their discomforting experience (Sinatra, 2010). Hence, there is a higher tendency for health professionals to ignore children's pain as they wait until the consequences are evident (Fitzgerald, 2011). To the chagrin of children in pain, their family, care givers and health professionals even downplay the psychological manifestations of their pain (Sessle, 2011; Williams et al., 2009). Meanwhile this lingering discomfort also affect the socio-cultural and cognitive interactions between the child and their environment.

Biologically, poorly managed pain can result in changes in neural pathways responsible for the perception of pain (Noel et al., 2015; Vega-Avelaira et al., 2012). These altered pathways have been suggested to contribute to delayed tissue healing (Berde et al., 2012) and the development of chronic pain (Fitzgerald, 2011; Thibodeau et al., 2013; Zhou et al., 2008) which children would have to live with for the rest of their lives.

The probable physical consequence of an overlooked pain as reported by (Mulvaney et al., 2006) is the steady increase in severity, which eventual affects physical function and the quality of life of such children (Solé et al., 2016). Sustained periods of unrelieved pediatric pain can also activate the stress response and adversely affect various body organ systems including the cardiovascular, respiratory, gastrointestinal, renal, neuroendocrine and the autonomic nervous systems (Duggleby & Lander, 1994).

School children with chronic pain have also been noted to perform poorly in class and do not regularly attend class (Gorodzinsky et al., 2011) as a result of prolonged hospitalization. Such children are also likely to experience negative psychological effects due to prolonged periods of isolation and disconnection from their peers (Rubin et al., 2009). Campo et al. (2007) in a review of the social effects of pediatric pain on family interactions found that mothers of children who suffered chronic pain frequently experienced depression and other mental illnesses. These emotional and psychological stresses of the parents negatively affect the

development of the child (Sessle, 2011; Solé et al., 2016; Valeri et al., 2015). Comparatively, parents of such children made more out of pocket payment in their care and had less time to carry out economic activities relative to parent who did not have such children (Darnell et al., 2019).

Inadequately managed pediatric pain also burdens existing healthcare system as it generates additional responsibilities for the healthcare providers (Wilmore & Kehlet, 2001) such as pressure from increased readmissions which may culminate into patient dissatisfaction staff exhaustion and its resultant sick leaves (Wilmore & Kehlet, 2001). Subsequently, these may increase the overall costs of hospitalization and place healthcare systems at a disadvantaged position, especially in today's competitive healthcare environment (Kowalczuk et al., 2020; Upadhyay et al., 2019). Resultantly, families, societies and nations of affected children are the most affected in such situations as it places undue financial burden on them (Von Baeyer et al., 2011).

3.3 Role of nurses in children's pain assessment, management and documentation

Children's pain management ideally should take a multidisciplinary approach involving doctors, nurses, family caregivers, psychologist, and physiotherapists among others (Dancel et al., 2017; Gaglani & Gross, 2018; Odell & Logan, 2013; Wren et al., 2019). However, the management children's pain in hospitals mostly rely on doctors and nurses.

As major stakeholders, nurses spend the most time providing direct care to sick children (Cahyani et al., 2018) and coordinates the activities of the other health personnel to achieve desired goals. From the assessment through management to the evaluation of pain management interventions, nurses are instrumental in meeting the comfort needs of affected children. As the personnel who are responsible for care coordination (Furåker, 2008), nurse managers ensure that the needed logistics such as pain tools, prescribed medications and distraction tools are available and used effectively to achieve targeted goals (Manges et al., 2017). In some instances, nurses serve as liaisons between family caregivers and other healthcare providers and helps family caregivers to communicate their children's pain concerns (Béranger et al., 2017).

Nurses play a critical role in children's pain assessment, management and documentation. In healthcare settings, nurses assess children's pain through self-report, behavioural and physiological parameters during the health assessment process (Rajasagaram et al., 2009; Zhou et al., 2008). This enables them to determine the nature of pain experienced by children if present at all (Beltramini et al., 2017; Manworren & Stinson, 2016). Furthermore, they critically serve as part of the chain

to ensure that children receive the right quantities and timing of prescribed pain medications (Berdot & Sabatier, 2018; Clancy, 2014; Schwappach et al., 2016; Thomas et al., 2015). Nurses have also been noted to guide parents, other family caregivers and children themselves to provide non-pharmacological pain management techniques such as breastfeeding, music therapy, guided imagery, massage, positioning, swaddling among others to vulnerable children (De Clifford-Faugère et al., 2019; Twycross et al., 2015). However, nurses complain the time-consuming nature of some of these methods discourage them from frequent usage (De Clifford-Faugère et al., 2019; He et al., 2005).

Documentation is an essential part of the pain assessment and management quest. Nurses report their pain assessment and management findings on charts, sheets an computer systems to be used by other members of the healthcare team (Stocki et al., 2018). Apart from providing the current pain status of the child, this helps in their pain care coordination and evaluation (Stocki et al., 2018).

3.4 Pain educational programs in developing countries

Although pain is a global health problem (Bond, 2011), disparities in pain care exist between developed and developing countries (Abdel Razeq et al., 2016). Even though, there are no established set of conventions in the classification of countries, developing countries typically have low per capita income and low growth output when compared with developed countries (United Nations, 2020). These disparities are mainly fueled by the availability of resources and education opportunities (Bond, 2011). As part of measures to reduce the pain care gaps in these two (developed and developing) regions of the world, the International Association for the Study of Pain (IASP) in 2002 planned toward the enhancement of pain education and clinical education support for developing economies (Bond, 2011). This led to several initiatives including the supportive centers for clinical education and research, pain educational grants for one-year projects in developing countries and financial assistance to external bodies involved in pain management projects taking place in emerging economies (Bond, 2011). As at the year 2019, the IASP has supported 159 one-year pain educational projects in 49 developing countries since 2005. It is significant to note also that, many of the projects satisfactorily achieved their educational goals. However, the focus of these educational programs has been diverse in nature and are dependent on the prevailing local needs of the destination country.

In consideration of the limited pain educational opportunities for healthcare providers in developing countries (Size et al., 2007), the Essential Pain Management (EPM) program was also developed to optimize pain care in resource-constrained

settings (Goucke et al., 2015). This program which was piloted in Papua New Guinea (Marun et al., 2020) has been implemented successfully in 30 countries (developing and developed) involving 1,600 participants and educating of 340 facilitators (Goucke et al., 2015). One of the strengths of the eight-hour EPM program is that it uses interactive educational methods that supports adult learning. However, it addresses general pain management topics and not specifically focused on pediatric pain. Considering the distinct needs of the vulnerable pediatric population and competencies required of children's nurses, tailor-made nursing educational programs on this subject are required. Furthermore, there are no existing regular continual educational programs for nurses in Ghana on children's pain management. Hence, the need for such a program to equip nurses with the essential competencies for improved pediatric pain care in this resource-constrained setting.

In Ghana, nursing education on pain management is taught as part of basic nursing courses and not given sufficient attention as reported in earlier studies (Aziato & Adejumo, 2014). Inadvertently, the subject of pediatric pain is barely addressed as it is unlikely for it to receive the needed attention within the limited time dedicated to the entire scope of pain management. Thus, graduates of nursing programs are more likely to be inadequately prepared which may reflect in their clinical practice. This may be partly responsible for the suboptimal pediatric pain care given to the vulnerable children during hospitalization. As advocated by the World Health Organization and the International Association for the Study of Pain (IASP), it is unethical and a breach of the fundamental human rights of all persons including children to experience unrelenting pain without appropriate management (Pfund & Fowler-Kerry, 2010), especially when there exist safe and cost-effective relief measure(Chiaretti et al., 2013; Kahsay, 2017).

3.5 The nature of pediatric pain educational programs in developing countries

Compared with developed countries, there is paucity of research studies examining the effect of PPEP directed at nurses in developing countries (Dongara et al., 2017; He et al., 2008; Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015). This can be attributed to the limited funds available for research in low-resource settings (Ranson et al., 2008). Nurses in these settings also work under challenging circumstances due to the relatively high patient to nurse ratios and shortages of medical supplies (Buchan & Aiken, 2008). All of these situations may affect their prioritization of pediatric pain management in clinical practice.

As a result of previous reports of insufficient nursing competences (knowledge, attitudes and practices) on pediatric pain in developing countries (Lunsford, 2015; Mathew et al., 2011), some educational interventions have been conducted to address

these competency gaps and improve pain care for the vulnerable pediatric population (Dongara et al., 2017; He et al., 2008; Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015). Results of these studies have all been positive and highlight the potential of education in improving targeted outcomes for improved pediatric pain care. The limited studies in developing economies have been conducted in Brazil (Predebon et al., 2015), China (He et al., 2008), India (Dongara et al., 2017), Mexico (Huth et al., 2010) and Mongolia (Lunsford, 2015). Brazil and Mexico are geographically situated in South America whilst India, Mongolia and China are classified under the Asian region (Finegold et al., 2013). Deducing from the reviewed literature, there is no published report of PPEP for nurses in the sub-Saharan Africa, of which Ghana is a part of. Considering that pediatric pain is a global health issue, examination of the effects of nursing educational programs are required.

The pre-post quasi-experimental designs have been used in all the five published studies that evaluated the consequence of the PPEP among targeted nurses in developing countries. While this design is preferred when it is impractical to randomize participant or when dealing with small sample sizes, it is less robust in establishing causality (Harris et al., 2006). Randomized control trials, therefore, holds promise in educational research as it provides a more robust method of establishing the causality of such interventions (Deaton & Cartwright, 2018).

It is significant to note that different educational facilitators, contents, delivery modes, durations and frequencies were used in the earlier studies. According to the investigators, the educational facilitator was the lead pain researcher (He et al., 2008), program educators (Huth et al., 2010), pain team members (Predebon et al., 2015) and unspecified in two studies (Dongara et al., 2017; Lunsford, 2015). Even though some studies did not disclose the identity of the facilitator, it can be deduced from those that specified that the resource persons were knowledgeable about the educational content. As best practice dictates, intervention deliverers should possess competencies in both the subject matter and the pedagogical approaches that support learning among the targeted group (Serdenciuc, 2013).

Earlier related studies in developing countries have emphasized on educational contents pertaining to basic principles of pediatric pain management, pain assessment, pharmacological (Predebon et al., 2015) and non-pharmacological management approaches (He et al., 2008; Huth et al., 2010; Lunsford, 2015; Dongara et al., 2017). These content areas are consistent with the IASP's curriculum which have been classified into four distinct areas namely: multi-dimensional nature of pain, pain assessment, pain management and clinical conditions. Justifiably, pediatric pain as a complex phenomenon requires sufficient knowledge and appreciation of all content areas during educational engagements.

Apart from Dongara et al. (2017) who did not specify the medium of educational delivery, the other four studies reported on the delivery mechanism (He et al., 2008;

Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015**).** Reporting studies used group-based **(**He et al., 2008; Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015), face to face **(**He et al., 2008; Huth et al., 2010; Lunsford, 2015**)** and blended learning (combination of face-face and online) approaches (Predebon et al., 2015). Although one-one educational sessions promote rapid learning (Diamond et al., 2007), group-based educational activities enhance group-thinking and team work (Laal & Ghodsi 2012) which are greatly needed in clinical practice. According to Johnson, Aragon, Shaik, & Palma-Rivas (2000), learners in face to face teaching modules show more positive views and opinions about the course and the teacher when compared with those who received instruction online. Face to face learning also provided more contact and communication between learners when compared to those in online learning. Online learning engages students with a high level of cognitive and critical thinking by allowing them more time to think on the lesson being received, before adding on more information (Severino & Messina, 2011; Thomas, 2002). Notwithstanding the pros and cons of both face-to-face (classroom) and face-to-screen (online), earlier studies have reported comparable learning outcomes from each of these two delivery modes (Johnson et al., 2000; Thomas, 2002). Thus, the choice of any one of them or a combination of approaches should be dependent on the socio-demographic characteristics of the learners, instructional approach, content, competence development, resources (classroom space, technology support among others) and safety (Mayer, 2010). Both interactive (Huth et al., 2010; Predebon et al., 2015) and non-interactive (He et al., 2008; Lunsford, 2015) teaching methods were used in the earlier reported studies. Interactive teaching methods have been shown to promote critical thinking, autonomy, retention and collaboration among learners (Kawinkoonlasate, 2019). However, its use is limited especially when dealing with large audiences, and when the learners have little or no knowledge about the content (Bandiera et al., 2010; Petrović & Pale, 2015). Thus, educationist should assess the teaching and learning situations before deciding on the method to adopt.

The educational sessions were held at a single point in time (He et al., 2008; Huth et al., 2010; Lunsford, 2015; Dongara et al., 2017) and seven times in the case of Predebon et al. (2015). Also, one study did not specify the duration of the educational program (He et al., 2008) while the other four studies did (Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015; Dongara et al., 2017). With the exception of Predebon et al.'s (2015) educational session which lasted for 37 hours over the seven different time points, studies occurred over a minimum period of 2 hours and a maximum of 4 hours (Lunsford, 2015; Dongara et al., 2017; Huth et al., 2010). While there are no established or recommended specifications for the frequency or duration of an educational intervention, choices should be dependent on the amount of time involved or the intensity of the education (Brown- Chidsey et al., 2015). Moreso, the

probability of achieving intervention fidelity (Carroll et al., 2007) should be considered especially with those interventions which are conducted at multiple frequencies or involve an extended duration at a single point in time.

Educational outcomes of earlier PPEP in developing countries have been measured at two (He et al., 2008; Huth et al., 2010; Lunsford, 2015; Predebon et al., 2015) and three time points (Dongara et al., 2017). The goals of these researchers were to assess the immediate and medium-to-long-term outcomes of the educational interventions. While the measurement of immediate outcomes is convenient and cheaper (in terms of time involved and resources), medium-to-long-term sustainability of educational interventions should also be considered as a measure of accountability as they can serve as a basis for improving the quality of programs for continual benefits (Delgado, 2007).

Outcomes of previous studies on the subject have measured nurses' knowledge and attitudes regarding pediatric pain (Huth et al., 2010; Lunsford, 2015; Dongara et al., 2017), accuracy of pain diagnosis (Predebon et al., 2015) and their use of non-pharmacological pain management strategies in practice (He et al., 2008). Although the assessment of nurses' pediatric pain knowledge and attitudes is important, it is equally relevant to measure how these translate into practice. This is critical as earlier studies have shown that enhanced knowledge and attitudes does not always reflect on improved practice (Francis & Fitzpatrick, 2013; Overmeer et al., 2011). While the accuracy of pain diagnosis and use of non-pharmacological pain management strategies have been previously assessed in developing countries, there is no documented report on nurses' use of pharmacological pain management strategies is these countries. Other equally important outcomes such as the nurses' self-efficacy, satisfaction with pain management and evaluation of the programs were not reported in these studies. Moreover, the reported outcomes (knowledge and attitudes regarding pediatric pain, accuracy of pain diagnosis, use of non-pharmacological pain management strategies) have been singularly measured. Hence, the need for a study that will measure multiple outcomes of a nursing-directed PPEP in a single study to establish some causal and non-causal associations.

3.6 Development of pediatric pain educational programs in developing countries

Intervention development is an important step in the process of facilitating improved pediatric pain care by means of education. Through a systematic methods review, O'Cathain et al. (2019) have identified eight categories of approaches to intervention development. These include that of partnership, target population-based, theory and evidence-based, implementation-based, efficiency-based, stepped or phase-based, intervention-specific and combination of existing approaches. In light of reducing

the risk of research and resource waste associated with the implementation and evaluation of flawed interventions, thorough examination of intervention development approaches is critical (Knowlton & Phillips, 2013). Intervention development process should therefore capitalize on the likelihood that an intervention will be feasible, acceptable, relevant, engaging, effective, sustainable and transferable (O'Cathain et al., 2019).

A couple of nursing-directed pediatric pain educational development approaches have been reported in resource-limited studies. He and colleagues (2008) recounted the development of their educational intervention based on a review of existing literature on the subject. While this approach is commendable, it did not consider the peculiar educational needs of the targeted group and the local context within which healthcare transpires. Furthermore, they did not report of using any guiding theory in the development process. As illustrated in earlier literature (Birckmayer & Weiss, 2000; Mayne, 2001), theory-driven interventions have the added advantage of enhancing our comprehension of how an intervention influences the achievement of measurement outcomes. Thus, there is the need for future researchers in this region to consider the combination of both evidence and theory in guiding their educational intervention programs in this area.

Upon the findings of a qualitative need assessment with the targeted hospitals, two studies (Huth et al., 2010; Lunsford, 2015) developed their PPEPs for nurses. Apart from providing evidence on the current, desired, and preferred characteristics of education by the learners, the assessment of educational need stimulates ownership and interest in the subject for improved outcomes (Azimi & Rahmani, 2013; Nugraha et al., 2018). Similar to He et al. (2008), these subsequent studies (Huth et al. 2010; Lunsford, 2015) did not use theory in guiding their educational program development. The use of both evidence and theory are important as "theory without practice is empty" and "practice without theory is blind" (Lloyd, 2017).

The educational program development approaches used by Predebon et al. (2015) and Dongara et al. (2017) have not been reported in the existing literature. This is critical as comprehensive reporting on intervention development processes provides guidance on reliable implementation (especially for novice intervention developers) and replication of interventions in subsequent research studies (Hoffmann et al., 2014). Additionally, they provide an opportunity for refinement in the intervention development approaches (Hoffmann et al., 2017) and can serve as a useful guide for subsequent feasibility and acceptability assessment (Möhler et al., 2015).

3.7 Justification for current study

Several educational interventions have demonstrated success in improving nurses' competences (knowledge, attitudes and practices) pertaining to children's pain

assessment and/ or management in many developed (Corwin et al., 2012; Heinrich et al., 2016; Rosenberg et al., 2016; Taddio, 2015) and few developing countries (Dongara et al., 2017; Huth et al., 2010). Till date, the effectiveness of pediatric pain educational programs has not yet been studied in the sub-Saharan African region.

One-third of published PPEPs for nurses have reported on a variety of approaches that were used in developing their interventions. Approaches used in developing the PPEP in advanced countries include the use of existing evidence (Gallo, 2003; Huth et al., 2010; Kingsnorth et al., 2015; Ramira et al., 2016), theories (He et al., 2011; He et al., 2010; Van Hulle et al., 2011), specific programs (Le May et al., 2009; Simons & MacDonald, 2006), target users and partnership (Deindl et al., 2013; Rosenberg et al., 2016). Intervention developers in emerging economies have also used evidence (Huth et al., 2010; Lunsford, 2015) and theories (He et al., 2008) in their PPEP development. Moreover, many of these nursing-directed PPEPs did not provide sufficient details about their intervention development processes. While each of the intervention development approaches has its related benefits and challenges, educational program developers should consider using the approach that best fulfils their needs and context.

It is significant to also mention that two-thirds of the PPEP did not report on their intervention development approaches (Dongara et al., 2017; Habich et al., 2012; Habich & Letizia, 2015; Heinrich et al., 2016; Lunsford, 2015; Scott et al., 2013; Vael & Whitted, 2014). As mentioned early on, comprehensive reporting on the developmental processes provides guidance on reliable implementation (especially for novice intervention developers) and replication of interventions in subsequent research studies (Hoffmann et al., 2014). Moreover, they provide an opportunity for refinement in the intervention development approaches (Hoffmann et al., 2017). Intervention development is also a necessary pre-requisite for the feasibility and piloting stages of a research study (Möhler et al., 2015). Thus, it is critical for researchers and educators to report on their intervention development approaches.

Children's pain assessment and management, albeit a global challenge, is affected by factors that operate at the local level, such as prevailing socio-cultural practices, health policies, resources and educational structures available to the nurses and other health personnel involved in the care of children (Kannampallil et al., 2011; Kruk et al., 2018; Lipsitz, 2012). In view of this, an evaluation of the current practices is essential to ensure that any educational intervention is tailored to make use of available resources and to ensure that the change in practice is acceptable to the intended audience. In view of this and the points raised above, it is imperative for a nursing-directed PPEP to be developed in resource-limited settings so that it can inform the feasibility, evaluation and implementation phases in the future.

4 Aims and Research Questions

The study ultimately aimed at developing an evidence and theory-based pediatric pain educational program (PPEP) for nurses in a resource-limited setting, guided by the Medical Research Council's (MRC's) framework (Craig et al., 2020). The study comprised of four sub-studies (I, II, III and IV). Sub-study I aimed at reviewing the effects of educational interventions directed at nurses on children's pain management. Sub-studies II and III aimed at assessing the nursing educational needs on children's pain management using quantitative and qualitative approaches respectively. Sub-study IV aimed at characterizing the cultural and contextual factors that influence the management of children's pain at four selected Ghanaian hospitals. The purpose of all these sub-studies is to develop a PPEP for subsequent piloting, evaluation and implementation.

On the basis of the MRC's framework (Craig et al., 2020), the detailed research questions were:

1. What is the evidence base in support of a PPEP for nurses in resource-limited setting? (Sub-studies/ Original Publications I, II, III and IV). Specific underpinning questions were as follows:
    - What are the effects of educational interventions targeted toward nurses on children's pain management? (Sub-studies/ Original Publication I)
    - What are the nursing educational needs on children's pain management? (Sub-studies/ Original Publication II and III)
    - How does cultural and contextual factors influence the management of children's pain at Ghanaian hospitals? (Sub-studies/ Original Publication IV)
2. Which of the existing theories support how the developed intervention can assist in achieving the desired outcomes?
3. What is the nature of the developed intervention (PPEP) and expected measurable outcomes?

5 Materials and Methods

To guide future studies and to ensure replicability, a presentation of the methods, processes, tools and considerations used in the research is important. Diverse materials and methods were used in addressing the study aims and research questions. The study's methodological framework was also guided by the MRC's framework for developing and evaluating complex interventions(Craig et al., 2020). This framework which consist of four critical steps (refer to Figure 2) was adopted due to its comprehensive guidance on developing and evaluating complex interventions. Its particular focus on evidence and theory-based intervention additionally made it suitable for the study's intended purpose. This study focused on the development phase of the framework that cover identifying the evidence base (original publications I, II, III and IV), identifying a theory, and modelling the process and outcomes of the intervention (refer to Table 1). This chapter presents the study designs, settings, participants, data collection methods and instruments, data analysis and ethical considerations for the different phases of the study. The materials and methods used involved in the development of the PPEP has been presented based on three processes involved in this stage: identifying the evidence-base, identifying an existing theory and modeling the process and outcomes of the educational intervention.

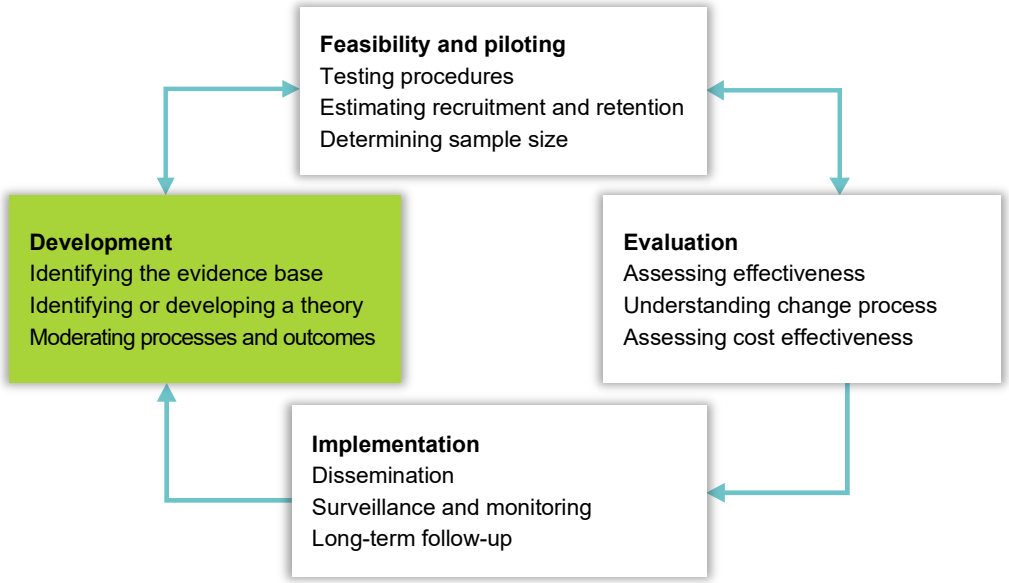

Figure 2. Medical Research Council's (MRC's) framework for developing and evaluating complex interventions (Craig et al., 2020).

5.1 Materials and methods used in identifying the evidence base in support of a PPEP for nurses in resource-limited setting (Sub-studies I, II, III and IV)

A concurrent mixed method study design (Timans et al., 2019) was used in identifying the evidence which served as a catalyst for the intervention development. The major advantage of this approach is that the deficiencies in one method can be overcome by another method, thereby complementing each other and enriching the outcomes of the study (Polit & Beck, 2012). As indicated at Table 1, four sub-studies were conducted using quantitative and qualitative research methods and materials to answer different research questions. An integrative review was initially performed to examine the combined effect of PPEP and the factors that contribute to its effectiveness among nurses (sub-study I). Subsequently, nurses were surveyed and interviewed to identify their pediatric pain educational needs using quantitative (sub-study II) and qualitative (sub-study III) research approaches. The culture and context of pediatric pain management was also examined at four purposefully selected hospitals to understand the facilitators and challenges in practice so as to optimise pain care for vulnerable children in Ghana (sub-study IV). All of these sub-studies helped in identifying the evidence base that justified the need for the study and also guided the intervention development process.

Table 1. Materials and methods used in the study.

Design	Setting	Sample	Data collection method (instrument)	Analysis
Identifying the evidence-base (sub-studies I, II, III and IV)				
Integrative review (sub-study I)	Existing literature on four databases (Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed/Medline and Scopus)	37 primary studies	Systematic literature search using keywords and MeSH terms in four relevant databases, and critical appraisal of retrieved studies.	Narrative synthesis
Cross-sectional survey (sub-study II)	Eight hospitals in Ghana	65 nurses	Survey (Pediatric Nurses' Knowledge and Attitudes Survey regarding pain (PNKAS) questionnaire)	Descriptive and inferential statistical analysis
Descriptive qualitative study (sub-study III)	Four hospitals in Ghana	28 nurses	Individual and group interviews (semi-structured interview guide)	Braun and Clark's method of thematic analysis
Focused ethnographic study (sub-study IV)	Four hospitals in Ghana	F.I - 28 nurses, 12 physicians, 20 hospitalized children between 5 and 13 years, 20 families of affected children; I.I - 40 nurses, 12 physicians, 72 hospitalized children between 5 and 13 years, 72 families of affected children; D.R - 108 hospital records	Formal and informal interviews (semi-structured interview guide), participant observations and review of hospital records (semi-structured observational checklist)	Bourdieu's theory of practice

Design	Setting	Sample	Data collection method (instrument)	Analysis
Identifying an existing theory				
Literature review	Existing studies on three databases (EMBASE, PubMed/ Medline and Psychology database (ProQuest))	1 primary theory	Literature search using keywords and medical subject heading (MeSH) terms in four relevant databases, and critical appraisal using Risjord's (2019) criteria for theory evaluation.	Narrative synthesis
Modelling the process and outcomes of the proposed pediatric pain educational program				
Iterative consensus process underpinned by evidence and theory	Existing literature, eight hospitals and offices of research team	37 primary studies, participants involved in sub-studies II, III and IV, social cognitive theory and existing curricular on pain for nursing	Findings from the reviewed literature, quantitative cross-sectional survey, qualitative interviews, participant observation notes, audit report and think aloud sessions.	Narrative synthesis

NB: CENTRAL – Cochrane Central Register of Controlled Trials; CINAHL – Cumulative Index to Nursing and Allied Health Literature; MeSH – Medical Subject Heading; PNKAS – Pediatric Nurses' Knowledge and Attitudes Survey regarding pain; F.I – Formal Interviews; I.I – Informal Interviews; D.R – Document Review.

5.1.1 Study designs, settings samples and data collection

This study employed a mixed method design to gather and analyze data from various settings based on the study aims and research questions.

5.1.1.1 Sub-study/ Original Publication I

An integrative review (Whittemore & Knafl, 2005) was conducted to identify and summarize existing evidence on the effect of educational strategies directed at nurses on children's pain management. This approach was chosen in order to gain a comprehensive understanding on the nature of published studies in the field, examine the outcomes of such studies and the components of education that contributes to its effectiveness. Under the guidance of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols 2015 (PRISMA-P 2015) (Shamseer et al., 2015), the integrative review protocol was developed.

In the month of March 2018, a systematic literature search was conducted on four databases: Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed/Medline, and Scopus on published primary studies from January 2000 up to February 28, 2018 with restrictions to English, Finnish and Swedish languages. Details of the search terms and study selection process have been reported in original publication I. At the end of the critical appraisal process by three reviewers, 37 studies were included in the review. Relevant data were extracted from the included studies based on the recommendations by the Centre for Reviews and Dissemination (Tacconelli, 2010).

5.1.1.2 Sub-study/ Original Publication II

Between October and December 2018, a cross-sectional survey was conducted with the aim of assessing the educational needs of nurses on children's pain management in the Ghanaian context. Guided by Yamane's (1967) formula for cross-sectional studies, the study purposively sampled all 70 registered nurses from eight healthcare facilities (a regional hospital, two specialist children's hospital, a university hospital, a faith-based hospital and three district hospitals) in the Ashanti region of Ghana. Of the 70 sampled participants, 65 returned the questionnaire, yielding a response rate of 92.9%. Apart from participants' socio-demographic characteristics, their knowledge and attitudes regarding children's pain were also collected using the 42-item Pediatric Nurses Knowledge and Attitude Survey regarding pain (PNKAS) instrument (Manworren, 2001). The PNKAS instrument comprises of 25 items

which require a true or false answer, 13 multiple choice questions (MCQs) and two case studies extended into four MCQs. Correctly answered questions were scored one (1) and wrongly answered questions were scored zero (0), resulting in a maximum attainable score of forty-two (42) for all questions. Consistent with previous studies (Hroch et al., 2019; Ung et al., 2016), the scores obtained by the participants were converted to percentages and a total score of eighty percent (80.0%) was set as the benchmark for sufficient pediatric pain knowledge and attitudes.

5.1.1.3 Sub-study/ Original Publication III

This sub-study was a descriptive qualitative study that involved 28 nurses who were purposively sampled at four hospitals in the Ashanti Region of Ghana. The hospitals were a specialist private-owned, government, quasi-government (university hospital) and faith-based; they were located in the urban, peri-urban and rural areas within the region. With the exception of the private specialist hospital, the others were general hospitals which had a children's department within the hospital structure. Nurses who had worked in their respective hospitals for more than two (2) months were purposively sampled for the study as this period considered sufficient for them to share their pediatric pain related educational needs. With the aid of a semi-structured guide, both individual and group interviews were audio-recorded with participants' permission and lasted between 10 and 30 minutes per session. Between October and December 2018, participants were interviewed regarding their views on the prevalence of pain among hospitalized children, strengths and weaknesses in pediatric pain management as well as their preferences on a proposed pediatric pain educational program (facilitator, content, delivery methods, frequency and duration). At the end of each interview, participants were briefed about the main points discussed during the session to obtain feedback on their precision and to correct any erroneous areas as deemed necessary.

5.1.1.4 Sub-study/ Original Publication IV

Under the guidance of Bourdieu's (1977), a focused ethnographic study was conducted at four Ghanaian hospitals over a period of five months (October 2018 – February 2019). This sub-study aimed at understanding the culture and contextual factors that influence of the management of children's pain through the use of three foundational concepts of "field", "capital" and "habitus". As detailed in original publication IV, "field" represents the social spaces within which individual's act; "capital" refers to power or resources operating within a field whilst "habitus" denotes an individual's disposition to act in particular way within a field over a

period of time. Based on their diverse locations and healthcare ownership (i.e. specialist children's, university-health, faith-based, and general), these hospitals were chosen as a representation of hospitals in the region. To reduce observer bias, a minimum of two researchers were present at each observation or interview and a period of non-recording of participation by researchers was undertaken on the ward, following approvals.

Field data for this sub-study consisted of participant observations, interviews (formal and informal) and review of hospital records (audit). A total of 144 hours (36 hours per each hospital) were spent by three researchers who actively kept a moderate level of participation with check-list assisted observations. The observations focused on the ward environment, number of participants (nurses, physicians, hospitalized children and their families) present during each fieldwork, pain assessment and management (drug and non-drug) methods, documentations, interactions and the emotions exhibited by the participants in the unit. Formal interviews of 10–40 minutes in duration were conducted by four researchers among 28 nurses, 12 physicians, 20 children aged over five years and 20 corresponding family members using a semi-structured guide. Individual interviews occurred over a shorter period of time compared to group interviews as they involved more than one person. Informal interviews were carried out among 40 nurses, 12 physicians, 72 children and 72 corresponding families. Participants responded to questions on their opinion on the prevalence and extent of children's pain, methods of assessing and managing children's pain, communication among themselves and their roles regarding children's pain management. A total of 108 patient folders, 36 nursing reports and 36 physician notes were reviewed in addition to documents displayed on the notice boards of the pediatric units.

5.1.2 Data Analysis

5.1.2.1 Narrative Synthesis (Original Publication I)

A narrative synthesis method (Snilstveit et al., 2012) was used in combining the results of the included primary studies. This approach was chosen as statistical meta-analysis was not feasible due to the heterogeneous nature of the materials and methods used in earlier nursing-directed PPEPs. Thus, a narrative synthesis approach was used in analyzing the review results. The content of the interventions that resulted in positive outcomes were further analysed using NVivo version 12 software to identify educational elements which contributed to its effectiveness. The detailed report of the educational programs of the primary studies were exported into NVivo version 12 software and coded at their basic unit of meaning. Subsequently, the

generated codes were combined into categories and finally into themes which described the factors that contributed to the PPEP's effectiveness.

5.1.2.2 Statistical Analysis (Original Publication II)

In sub-study II, both descriptive and inferential statistics were used in analyzing the data. Categorical variables were illustrated using frequencies and percentages; continuous variables were displayed as means, standard deviations and ranges (minimum – maximum). The association between any two categorical variables was examined using the Chi-square test of independence. Differences in the primary outcome variable (PNKAS scores) between any two groups were analysed using the independent samples t-test as the data fulfilled the assumptions for parametric testing. Differences in the outcome variable (PNKAS scores) between any three or more groups were explored using the one-way analysis of variance (ANOVA) method. All statistical analyses were conducted assuming a two-tailed distribution and the probability for making a type I error (p value) was considered at 5.0%.

5.1.2.3 Qualitative data analysis (Original Publications III & IV)

In original publication III, each recorded interview was transcribed verbatim and analysed before moving on to the next data collection session. Saturation of the data was considered to have occurred when no new findings emerged within and across participants and study sites. Four researchers who facilitated the interview sessions independently coded the transcripts using NVivo 12 Plus software. Discrepancies in the generated codes were resolved through consensus building. The codes were deductively analysed into themes (Braun & Clarke, 2006) based on conceptual interest in participants' educational needs which was directed at three main areas: their present competencies, desired competencies and preferences regarding the nature of the proposed pediatric pain educational program (Grant, 2002).

In original publication IV, Bourdieu's (1977) theory as a theoretical lens and Leininger's (2006) method of analyzing ethnographic data, guided an iterative process of data collection and analysis. Documented field notes, interview transcripts and review reports were exported into NVivo 12 Plus software for data management and analysis. Coding was independently conducted by three researchers who inductively analysed the codes into themes; clarifications and revisions occurred continuously during the entire period of data collection and analysis. Documented personal reflections guided the researchers in their data analysis process in order to minimize potential biases in participants' account.

5.1.3 Ethical considerations

The topic for this doctoral study was chosen based on the researchers' unpleasant experience with the son during circumcision and her observation of other hospitalized children who endure painful procedures without the needed pain care. Considering the harmful effects of unrelieved pediatric pain and the important role of nurses who spend a greater amount of the time providing direct and indirect care to hospitalized children and their families, this study aimed at developing a nursing-directed PPEP to assist in improving pain care for the vulnerable pediatric population in a developing country (with limited resources). The study provides an important addition to the efforts to improve pediatric pain management globally. The developed PPEP will serve as a guide for subsequent evaluation and implementation to equip nurses with the much-needed competences for improved pain care outcomes for children, their families, healthcare systems and society as a whole.

Responsible conduct and principles of research ethics were taken into consideration during the entire research study. Ethical approval with reference number CHRPE/AP/574/18 was obtained from the Committee on Human Research, Publication and Ethics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana to ensure that guidelines for the protection of study participants were adhered to. Administrative approvals were also obtained from the managements of the hospitals and educational institutions involved in the study. Permission to use the validated survey questionnaire (PNKAS) was obtained from the instrument developer through email communication on August 16, 2018.

Class representatives, hospital administrators, nurse managers and ward-in-charges were consulted for permission to engage participants during each data collection session in the sub-studies (II, III and IV). The aims and procedures involved at the various stages of the study were explained to participants before giving their informed consent verbally and / or in written form. In the case of the participants who were minors, consent was sought from both family members and the children themselves. Participants who were engaged in the survey returned their completed questionnaire as evidence of their consent. Those who were formally interviewed gave both verbal and written consent. Verbal consent was also sought from participants who were observed and interviewed informally.

As part of measures to ensure anonymity and confidentiality, participants were not required to write their names, or contacts on the data collection instruments. Participants' right to privacy, self-determination (autonomy) and voluntary participation were respected by assuring them that they could withdraw at any stage of the data collection process without receiving any form of sanctions for doing so. The researchers were guided by the principle of "veracity" and remained truthful in all phases of the study. Alteration of participants' behaviour that are associated with the researchers' presence were minimized through familiarization before the

commencement of the ethnographic data collection (sub-study IV). Hard copies of the research data were kept in a locked cabinet accessible to the principal investigator and three members of the research team only. Soft copies of the data were password-protected and stored on an external hard drive.

5.2 Materials and methods used in identifying an existing theory

A literature review was conducted in April-May 2020 to identify existing behavioural change theories, models and frameworks. Relevant keywords (such as behaviour, character, competence, ability, skill, change, amendment, modification, framework, model, conceptual framework) were combined and searched on three databases namely: EMBASE, PubMed/ Medline and Psychology database (ProQuest) without any date and language restrictions. This yielded 602,888 articles after which after which 4,232 duplicates were removed, leaving 596,656. Details of the search terms and study selection process have been reported in Appendix I. Upon critical analysis of three potential theories using Risjord's (2019) criteria for analyzing and evaluating middle-range theories, the social cognitive theory was selected as it had the highest score among them (refer to Table 2).

Table 2. Evaluation of three theories using Risjord's (2019) criteria.

Criteria	Meaning	SCT	TPB	KLCM
Usefulness	Ability of the theory to answer the research questions	Y	P	P
Abstraction	The quality of dealing with ideas rather than reality	N	N	N
Values	Principles or standards of behaviour based on moral or political judgments	Y	Y	Y
Operationalization	Ability of the theoretical constructs to be observed or measured in dependable ways	Y	Y	Y
Precision	Theory's ability to predict how change in one construct causes change in others	Y	Y	Y
Empirical support	Evidence demonstrating that the phenomenon works as proposed by the theory	Y	Y	Y
Theoretical support	Ability of the theory to draw on concepts and relationships established by current science or knowledge	Y	Y	Y
Score	Total score on the 7 stipulated criteria	7	6.5	6.5

Note
Theory: SCT – Social Cognitive Theory, TPB – Theory of Planned Behaviour, KLCM – Kolb's Learning Cycle Model.
Grading: Y – Yes, N – No, P – Partly yes.

5.3 Materials and methods used in modelling the process and outcomes of the PPEP

This stage was informed by the findings from the four sub-studies conducted to identify the evidence-base and the chosen behavioural change theory together with the IASP's curriculum outline on pain in nursing. With regards to the decision-making on the nature of the PPEP and its evaluation outcomes, consideration was given to established instruments of educational success, gaps in the existing evidence, participants' desires, local context, tenets of the chosen social cognitive theory and existing curricular on pain for nursing (Huijer et al., 2012). The research team deliberated on the preliminary design for piloting based on the above-mentioned factors. In situations where there were divergent views from the evidence gathered, the hierarchy or weight given to the type of evidence and options which were preferred by majority of the participants guided the choices made in the proposed PPEP.

6 Results

This chapter presents a summary of the study results according to the MRC's framework for developing complex interventions: evidence-base in support of a PPEP for nurses in a resource-limited setting (research question 1), theory in support of PPEP development intervention (research question 2), and modelling the process and outcomes of the PPEP educational intervention (research question 3). The evidence base in support of a PPEP for nurses in pediatric wards in a developing country addressed underpinning areas of the effects of nursing-directed PPEPs, educational needs of nurses, and context of pediatric pain management at four selected Ghanaian hospitals. Also, the theory which support how the developed intervention (PPEP) will yield the intended outcomes have been detailed in this section. Finally, the processes and outcomes of the PPEP have been presented to complete the development phase of the MRC's framework.

6.1 Evidence base in support of a PPEP for nurses in a resource-limited setting

As part of efforts in identifying the evidence base for the proposed PPEP, four sub-studies were conducted. The first sub-study reviewed earlier literature regarding the effect of educational interventions directed at nurses on children's pain management. The second and third sub-studies examined the educational needs of nurses on children's pain management using both quantitative and qualitative approaches. The fourth sub-study characterized the cultural and contextual factors that influence the management of children's pain at four selected Ghanaian hospitals. Results of each of the four sub-studies have been presented below.

6.1.1 Effect of nursing educational interventions on children's pain management (sub-study I)

Findings from the integrative review showed that diverse educational interventions improve nursing competencies (knowledge, attitudes and practices) regarding children's pain management (Refer to Figure 3). Nevertheless, the magnitude of the improvement in pediatric pain related knowledge, attitudes and practices using meta-

analytic procedures could not be determined due to the heterogeneous nature of the materials and methods used in the published studies. Participants positively evaluated the educational programs as carefully planned, involving, comprehensible, usable and satisfying. Patient/ family satisfaction improved in one study while no difference was observed in another study. Patients' pain report at discharge improved in the study that reported on this outcome. No difference was observed in the duration of mechanical ventilation, length of hospitalization and adverse outcomes of pain management interventions in a study that evaluated these outcomes.

Six factors which served as instruments of success for the educational interventions included: the involvement of multidisciplinary teams in the program development and delivery, assessment of learning needs, thorough planning, measures of enhancing inclusiveness, system incorporation and sustainability. Further details on the results can be found in original publication I.

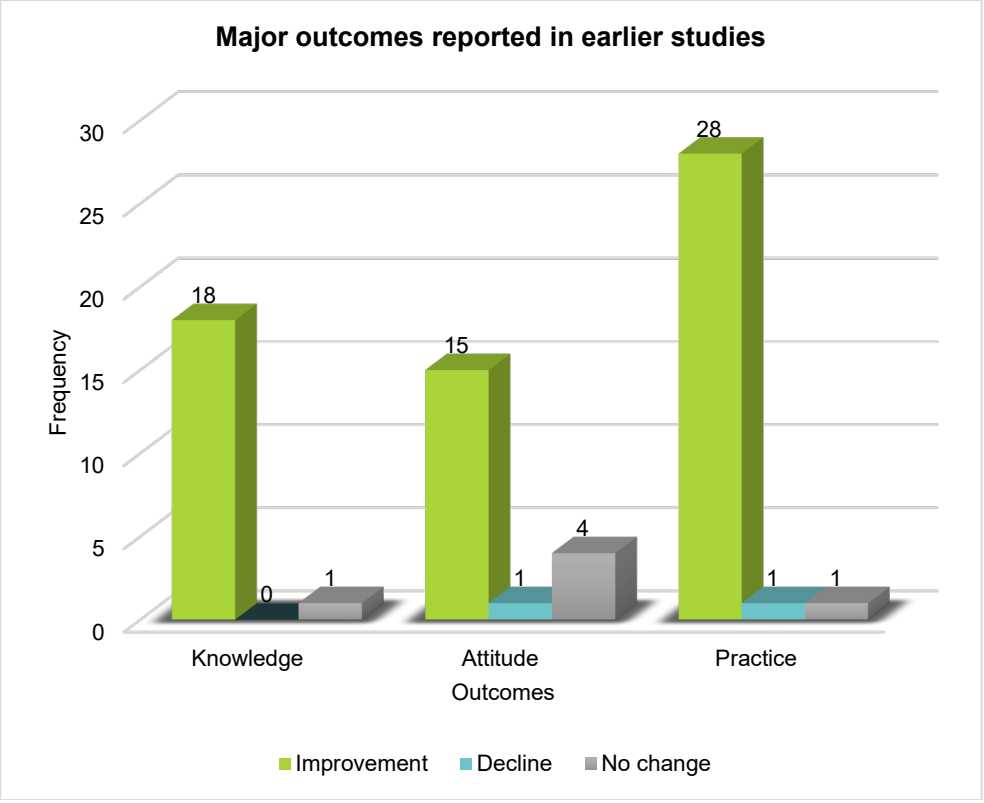

Figure 3. Major outcomes reported in earlier studies.

6.1.2 Educational needs of nurses on children's pain management (sub-studies II and III)

In sub-studies II and III, quantitative and qualitative data were respectively collected from the nurses to assess their educational needs on children's pain management (Publications II and III).

The quantitative results showed a generally unsatisfactory pediatric pain knowledge and attitudes relative to the 80.0% pass mark. On the 42-item PNKAS scale, the nurses had a mean (SD) correct score of 15.4 (2.9) [36.7% (6.9%)] with a minimum score of 9 (21.4%) and a maximum of 24 (57.1%) items. Statistical analysis using independent samples t-test and one-way analysis of variance (ANOVA) showed that there were no statistically significant differences in the mean PNKAS scores on the basis of the nurses' gender (male and female) ($p=.674$), age classification ($p=.164$), highest educational qualification (certificate, diploma, Bachelor's/ Master's degree) ($p=.798$) and working years in the nursing profession (Group 1: up to five working years and Group 2: above five working years) ($p=.638$). However, there was a statistically significant difference in the mean PNKAS scores of the nurses on the basis of the type of hospital they were working in ($p<.001$). Nurses who were working in general hospitals ($M=38.8\%$, $SD=7.0\%$) had significantly greater PNKAS scores than those who were working in specialist pediatric hospitals [Mean (SD) of 38.8% (7.0%) versus 32.7% (4.5%)].

Five questions that were most often answered correctly by the nurses through the quantitative survey were related to the complex nature of pain sensation, pain management and role of pre-emptive analgesia (see Table 3). On the other hand, the interviewed nurses in the qualitative study narrated their strengths in pediatric pain assessment and management. With regards to pain assessment, they described their ability to assess pain among children who have functional speech, and to use physiological and behavioural cues in pain assessment. They were also familiar with some pain assessment tools and involved parents and guardians in non-pharmacological pain management, such as non-nutritive suckling, swaddling, cuddling, consoling, oral glucose solution, watching television with child-friendly programs, and playing with toys.

The nurses also reported on their ability to administer commonly (such as Paracetamol and Ibuprofen) and occasionally (for instance, Morphine and Tramadol) prescribed analgesics.

Table 3. Items most often answered correctly by the nurses (n=65)

Items (correct answer)	f (%) Correct; Rank
Combining analgesics and non-drug therapies that work by different mechanisms may result in better pain control with fewer side effects than using a single analgesic agent *(True)*	48 (73.8): 1st
After the initial recommended dose of opioid analgesic, subsequent doses should be adjusted in accordance with the individual patient's response *(True)*	47 (72.3); 2nd
Children who will require repeated painful procedures should receive maximum treatment for the pain and anxiety of the first procedure to minimize the development of anticipatory anxiety before subsequent procedures *(True)*	45 (69.2); 3rd
The child/adolescent with pain should be encouraged to endure as much pain as possible before resorting to an opioid for pain *(False)*	43 (66.2); 4th
Comparable stimuli in different people produce the same intensity of pain *(False)*	41 (63.1); 5th

Source: Original Publication II

The quantitative study further revealed that the nurses frequently answered incorrectly on five items which were centred on pharmacokinetics (drug administration, distribution, metabolism and elimination), pain assessment and estimation on the proportion of patients who over-report pain (refer to Table 4). The qualitative findings reiterated some of the quantitative results as the nurses indicated their desire to receive additional education on pain assessment for children with non-functional speech (such as those who are unconscious, critically-ill, pre-verbal and non-verbal). Furthermore, they requested for further education on analgesic dosing and other non-pharmacological pain management interventions during the qualitative interviews.

Table 4. Items most often answered incorrectly by the nurses (n=65)

Items (correct answer)	f (%) Incorrect; Rank
The usual time to peak effects for traditional analgesics given orally is: *(30 minutes)*	65 (100.0); 1st
Which of the following IV doses of morphine administered would be equivalent to 15 mg of oral morphine? *(Morphine 5 mg IV)*	65 (100.0); 1st
Two hours after a child received morphine 2 mg IV, his pain ratings consistently ranged from 6 to 8 with no clinically significant side effects. His physician's order for analgesia is "morphine IV 1-3 mg q1h PRN pain relief". The most appropriate action by the nurses is to: *(Administer morphine 3 mg IV now)*	65 (100.0); 1st
The percentage of patients who over report the amount of pain they have is: *(0–10%)*	62 (95.4); 4th
A 15-year old Andrew smiles on his first day post-abdominal operation. Upon entering his room, he smiles with you and continues talking and joking with his visitor. He rates his pain as 8 on a scale of 0 to 10 (0 = no pain, 10 = worst pain) during assessment, how would you rate Andrew's pain? *(8)*	60 (92.3); 5th

Note: f – frequency; % – percentage; mg – milligram; IV – Intravenous; q1h – Hourly; PRN – When necessary.

Source: Original Publication II

The qualitative study exceptionally inquired about the preferred nature of the proposed PPEP from the interviewed nurses. The participants indicated diverse inclinations toward the educational facilitator, content, delivery mode, duration and frequency. Participants generally preferred an educational facilitator who had expertise in both the subject matter (pediatric pain assessment and management) and the pedagogical approaches to facilitate the educational process. They additionally indicated their desire for education in all content areas related to pediatric pain assessment and management; rankings of these areas were additionally provided by the participants (refer to Figure 4). Both individual and group sessions delivered through face-to-face medium using interactive and non-interactive educational approaches were favoured by the participating nurses. Preference was also given for an educational duration ranging from a minimum of one hour to a maximum of 12 hours over a period of time. The participants expressed diverse opinions on the frequency of the educational program: these included monthly, quarterly, four-monthly, six-monthly and yearly intervals.

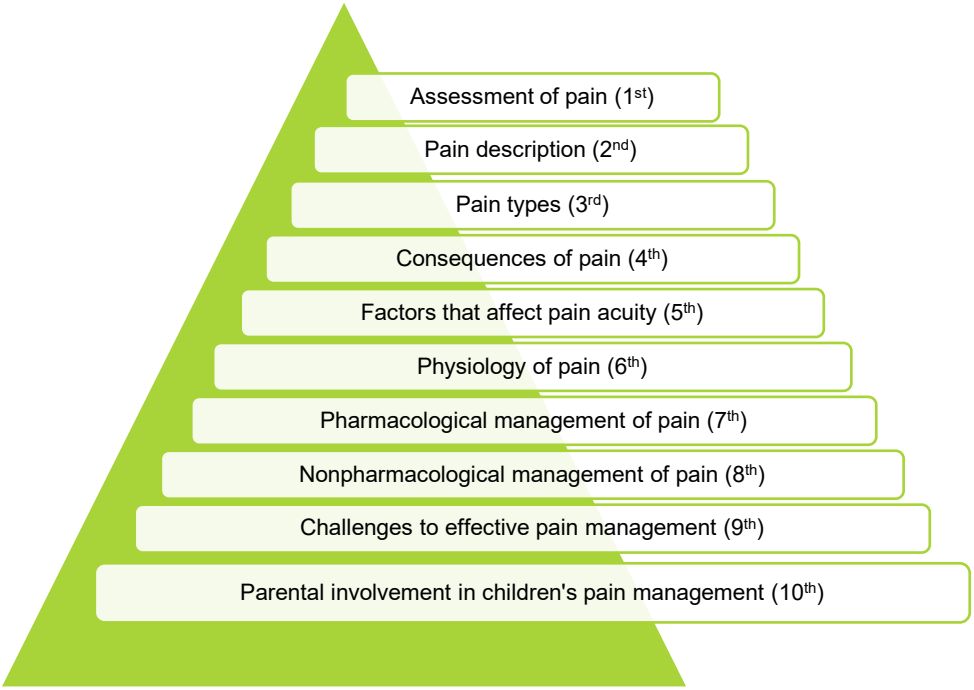

Figure 4. Ranking of the educational content areas greatly desired by the nurses.

6.1.3 Cultural and contextual factors that influence the management of children's pain at four Ghanaian hospitals

Findings from the focused ethnographic study revealed several cultural and contextual factors operating at the individual, interpersonal and organizational levels that affected the management of children's pain within the healthcare environment. These factors which have been outlined in Table 5, served as facilitators or impediments to children's pain management in the pediatric care settings.

Majority of the nurses admitted their inability to assess pain among children with non-functional speech. That notwithstanding, we observed a prevailing culture of insufficient pain assessment for all categories of hospitalized children in this context; audit of folders revealed only a few documented pain assessments and the nurses were rarely observed to be actively assessing pain. It was also observed that there were few pain assessment tools, thereby contributing to the culture of limited pain assessment among the hospitalized children. The nurses also admitted they avoided administering prescribed opioid analgesics because they feared that the opioids posed greater danger such as addiction and respiratory depression to the children. However, they readily administered NSAIDs, thereby creating a culture of over-dependence on NSAIDs, despite the availability of other effective analgesics and non-pharmacological methods. The nurses complained of heavy workload and limited time, which impeded their ability and willingness to use non-pharmacological methods to manage the children's pain.

In spite of their impeded ability to use some non-pharmacological modalities, the nurses frequently involved the parents and family caregivers of the children to swaddle, cuddle, breastfeed, and distract the children, among others in efforts to alleviate the pain of the children. None of the nurses were, however, observed to be providing education or information to the parents on the appropriate ways to carry out these tasks. The parents were also observed assessing for pain in their children by observing behavioral cues and reporting them to the nurses. Therefore, there was a teamwork and cordiality between family caregivers and the healthcare personnel, as well as among the health personnel, which served as a facilitator to optimal pain assessment and management. It was also observed that the ward settings were nicely painted and decorated to put children at ease. There were also toys and recreational materials for the children as a form of distraction to aid in pain management.

Table 5. Barriers and facilitators to pediatric pain assessment and management.

Level	Barriers	Facilitators
Individual	1. Inability to assess pain among children with non-functional speech 2. Over-reliance on drugs (analgesics) 3. Fear of opioids use 4. Limited use of non-pharmacological pain management techniques. 5. Time consuming nature of some non-pharmacological pain management. 6. Limited pain documentation 7. Insufficient knowledge and education	1.Acknowledged usefulness and the necessity for continuing education on pediatric pain management 2.Belief in the therapeutic effect of drugs
Interpersonal	8. Ill -prepared children and family roles	3.Constant parental presence 4.Participation of parents in non-pharmacological pain management 5.Cordial communication between family caregivers and health personnel
Organizational	8.Imbalances between workload and pediatric pain care 9. Inadequate pain assessment tools 10. Insufficient nursing staff	6. Child friendly hospital/ward settings 7. Availability of pain medication

6.2 Theory in support of how the developed intervention (PPEP) will yield the intended outcomes

Upon examination of three behaviour change theories using Risjord's (2019) criteria for theory evaluation, the Social Cognitive Theory (SCT) (Bandura, 1989) was selected to guide the proposed PPEP for nurses. This theory posits that human behaviour is shaped by a continual interaction between three dynamic and reciprocal factors (personal, environmental and behavioural). The main assumption of the theory is that, people learn from their own experiences in addition to observing the actions of others and the consequences of those actions. The theory considers the distinct ways in which individuals acquire and maintain behavior as well as the social environment in which individuals execute the behavior. One of the advantages of this theory is that, it integrates concepts and processes from the cognitive, behavioral and emotional models of behavior change. Key concepts of SCT include reciprocal determinism (reciprocal interaction between an individual, the environment and

behaviour), behavioral capability, observational learning, reinforcement, expectations and self-efficacy.

Improvements in the nursing management of children's pain will be manifested through the continual interaction between the three dynamic and reciprocal factors (personal, environmental and behavioural) (refer to Figure 5). Personal factors refer to the acquired competencies obtained through the PPEP by the nurses. Environmental factors represent the provision of resources such as pain assessment tools, documentation sheets, provision of additional non-pharmacological pain management interventions, resource persons to be consulted after the PPEP and management's support for the course. Behavioural factors denote the pain assessment, management and documentation competencies that will be exhibited by the nurses; these competencies will also be influenced by their evaluation of the educational program and self-efficacy in performing these tasks. It is hoped that through the PPEP, the nurses will reflect and learn from their own experiences and the consequences of other nurses and other healthcare providers' actions related to children's pain management.

Reciprocal determinism as a central concept of SCT refers to the reciprocal interaction between an individual, the environment and behaviour. This suggests that nurses' behaviour influences, and is in turn influenced by both the environment and personal characteristics. Behavioural capability represents an individual's authentic ability to perform a task based on the possession of essential knowledge and skills/ competencies. Thus, the competences acquired by the nurses during the PPEP will equip them to sufficiently manage children's pain in practice. Observational learning emphasizes an individual's ability to reproduce an action they observed from others. Hence, nurses' (including those who could not participate in the PPEP) will be able to imitate actions (pain assessment, management and documentation competencies) observed from other nurses and healthcare providers in practice.

Reinforcements describe the addition (positive) or removal (negative) of a factor that affect the likelihood of an individual's behaviour to continue or discontinue. Implicitly, nurses who exhibit appropriate behaviours (pediatric pain assessment, management and documentation) should be offered praises as a form of positive reinforcement to encourage the likely continuation of such behaviours. Expectations signify the anticipated consequences of an individual's behaviour. Thus, the benefits associated with improved pediatric pain management (such as improved functioning, enhanced quality of life, reduced length of hospitalization, decreased cost of healthcare among others), previous experience and value placed on them will influence nurses' engagement in appropriate pain assessment, management and documentation of children's pain.

Self-efficacy refers to an individual's level of confidence in his/ her ability to successfully perform a task (pediatric pain assessment, management and

documentation); it is influenced by an individual's specific capabilities (pediatric pain competences) and environmental factors (that serve as barriers and facilitators). It is hoped that the nurses' acquisition of the relevant competencies (pediatric pain competences) during the PPEP and the provision of resources in practice (pain assessment tools, documentation sheets, additional non-pharmacological pain management interventions and resource persons to be consulted after the PPEP) will boost their confidence to adequately manage children's pain.

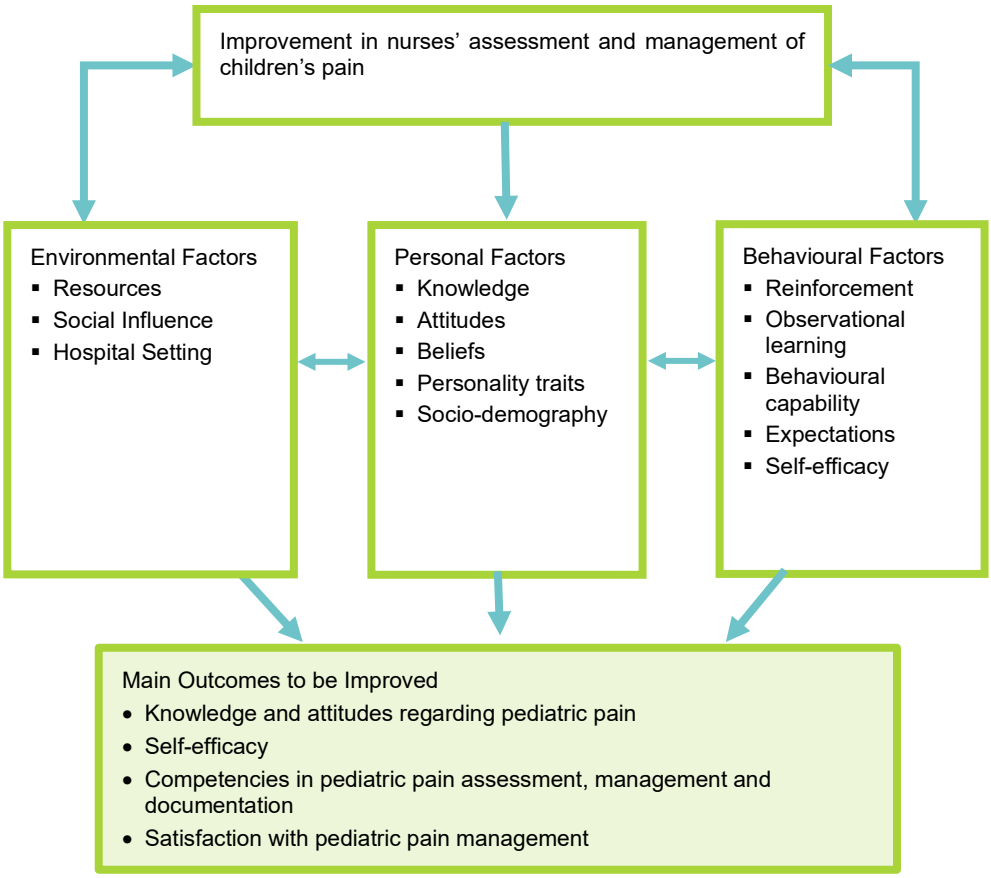

Figure 5. Diagrammatic representation of the proposed application of the Social Cognitive Theory.

6.3 Modelling the process and outcomes of the PPEP

Prior to full-scale evaluation and implementation, modelling helps to provide important information about the nature and outcomes of the intervention (Craig et al., 2020). This process of modeling may involve a series of studies to refine the design.

Thus, a pilot and feasibility modelling approach were chosen to assist in further refinement of the developed intervention components before the large-scale evaluation phase. As mentioned early on, consideration was given to gaps in the existing evidence, participants' desires, local context, tenets of chosen social cognitive theory and existing curricular on pain for nursing (Huijer et al., 2012) in the decision making on the proposed nature of the PPEP and its evaluation outcomes (refer to Table 6). The components of the proposed pilot study have been detailed below.

Table 6. Consideration factors that influenced the proposed design and outcomes of the intervention.

Factors	Findings
Existing evidence	○ The need for the proposed PPEP to be guided by established instruments of effectiveness such as multidisciplinary collaboration in intervention ○ Additional primary studies are required in developing countries due to the ○ The need for true experimental study designs of high methodological quality on this subject due to the abundance of less robust experimental studies with ○ Examination of innovative teaching and learning approaches as majority of ○ The need for studies to report on extended outcomes that are important to the
Desires of participants	○ Need for a pediatric pain educational program to address the existing nursing knowledge and attitude gaps to equip nurses to improve children's pain care ○ The need for the educational facilitator to possess knowledge in the subject matter as well as the pedagogical approaches to be used. ○ The nurse's desire for education in all content areas related to pediatric pain although some topics were rated more highly than others. ○ Diverse preferences on the delivery mode, timing and duration of the proposed pediatric pain; thus, consideration was given to the feasible choices that were preferred by the participants.
Local context	○ The need for nurses to prioritize the assessment and management of children's pain because of the negative effects on children, their families and ○ Based on practice deficiencies, there is the need for provision of education and resources (management support in the provision of pain assessment tools, documentation sheets, additional playing (recreational) materials, and resource persons post-intervention) to equip nurses and enhance children's
Tenets of the social cognitive theory	○ Nurses' behaviour (pediatric pain assessment, management and documentation skills) influences and is influenced by both the environment (reinforcements in the form of resources and social interactions) and personal characteristics (knowledge, skills, attitudes, self-efficacy, behavioral capability, observational learning and experiences)
Existing curricular	○ IASP curriculum on pain for nursing with emphasis on four content areas: "multidimensional nature of pain, pain assessment and measurement, management of pain, clinical conditions"

6.3.1 Design, setting and participants

This will be pilot-tested as a two-arm cluster, randomized controlled trial (RCT) with a three-month follow-up (refer to Figure 6). The choice of this design is influenced by the rigorous nature of true experimental studies in eliminating threats to internal and external validity (Lorenz et al., 2018). The choice of the RCT is influenced by the finding of abundance of less robust study designs (mainly pre-post quasi-experimental) identified in sub-study I. The hospitals will comprise of the clusters with the unit of randomization being one cluster (hospital) to minimize the risk of contamination (Craig et al., 2013). A cluster randomization with a 1:1 allocation will be performed: each of the hospitals will be randomly allocated to the Flipped classroom method (intervention group) or the lecture method (control group) using a computer-generated randomization sequence. Comparison of these two delivery approaches was based on the recommendations from the integrative review to examine innovative (flipped classroom) and traditional (lectures) educational methods (original publication I).

Data on project outcomes will be collected at baseline, immediately after intervention and at follow-up three months after the educational intervention so as to evaluate the program's immediate and medium-long term sustainability. Depending on the accessibility and amount of funding in the future, the PPEP will be conducted at a minimum of two hospitals in the Ashanti Region of Ghana, where the educational needs of nurses have been previously assessed (original publications II and III). All nurses working in the pediatric departments of the included hospitals will be eligible for participation in the pediatric pain educational program.

6.3.2 Educational program intervention and control

Eligible nurses will receive the same content of a pediatric pain educational intervention facilitated by five resource persons (nurse-pain researcher, pediatrician, anesthesiologist, pharmacist and physiotherapist) over a 6-hour session in a day. In order to make the education accessible to as many nurses working in the pediatric units, the same content of education will be provided on two distinct days to allow for maximum participation without jeopardizing the work on the pediatric care settings. Based on our findings in sub-studies I to IV, the pediatric pain educational program (PPEP) will cover the following topics: "multidimensional nature of pain", "pain assessment and measurement", "management of pain" and "clinical conditions". However, the details under each topic will be underpinned by the findings from the four sub-studies, some of which have been outlined on Table 6. A handbook on the educational content will be distributed to all participants.

Prior to the classroom session, participants in the flipped classroom method (intervention group) will receive lectures outside the classroom through a variety of

multimedia modalities such as audio and video podcast lectures, lecture PowerPoints, case studies, assignments, reference articles, online links, YouTube videos among others. These educational resources will be provided to participants via their email or social media platforms (such as WhatsApp, Telegram, Facebook, Twitter, etc.) for at least two weeks before the classroom session. The classroom session will focus on active learning activities such as case studies, discussion, think-pair-share, problem-based learning and so on (Billings & Halstead, 2012; Caputi, 2010). A brief lecture or explanations will be provided by the facilitators in situations where they will be deemed necessary.

Participants in the lecture method will serve as the control group. This group will receive a face-to-face classroom session that comprise of lectures for approximately 80.0% of the class time. The remaining 20.0% of the classroom session will be devoted to questions being asked by the participants or facilitators with the goal of achieving the educational objectives. No educational resources will be provided to this group prior to the implementation of the education program; participants will thus receive the educational materials at the end of program.

6.3.3 Data collection

Data on participants' demographics (gender, age, educational qualification, profession, professional rank, working years in the profession, working years in the pediatric department), pediatric pain knowledge and attitudes, and self-efficacy will be collected at baseline (before the intervention), immediately after the educational intervention and three-months after the intervention. Nurses' competencies in pediatric pain assessment, management and documentation, as well as satisfaction with pediatric pain assessment and management will be evaluated before and three-months after the educational intervention. Satisfaction with pediatric pain assessment and management will also be assessed by hospitalized children who can effectively communicate and their family caregivers. Nurses will additionally evaluate the acceptability of the educational program they receive (flipped classroom or lecture method).

6.3.4 Outcome measures and data collection instruments

On the basis of the integrative review (original publication I), recommendations were made for the assessment of educational outcomes that are important for major stakeholders in pediatric pain management. Thus, the following outcomes were proposed for assessment: knowledge and attitudes regarding pediatric pain, self-efficacy, competencies in pediatric pain assessment, management and documentation, satisfaction with pediatric pain management, and evaluation of the acceptability of the educational program.

6.3.4.1 Knowledge and attitudes regarding pediatric pain

Participants' pediatric pain knowledge and attitudes (primary outcome) will be measured using the 41-item Pediatric Healthcare Provider's Knowledge and Attitudes Survey Regarding Pain (PHPKASRP) instrument. This instrument is a revised version of the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain (PNKAS). The revised instrument (PHPKASRP) comprises of 25 binary response-type questions (True/ False), 12 multiple choice questions (MCQs), and two case studies extended into four MCQs. Participants are expected to choose the best option that corresponds to their preferred answer. A correctly answered item will be given a score of one (1), whereas an incorrectly answered item will attract a zero (0) score. The minimum score on this instrument is zero and the maximum score is 41; higher scores denote higher pediatric pain knowledge and attitudes. Content validity of the PHPKASRP has been established in the United States of America by national content experts comprising of physicians, pediatric nurses and pharmacists. The instrument has also demonstrated an acceptable level of content validity in the Ghanaian context after evaluation by 13 pediatric experts (manuscript submitted). According to the instrument developer (Manworren, R.C.B.), the instrument has been translated into other languages and permitted for use in many organizations around the world. The instrument has been recently used to assess changes in healthcare providers' knowledge and attitudes after a multidisciplinary educational program (Manworren et al., 2018).

6.3.4.2 Self-efficacy

Participants' (physicians and nurses) self-efficacy in the assessment and management of children's pain will be measured using the self-efficacy tool (SET) developed by Chiang and colleagues (2006). This tool comprises of six items which are directed towards pain assessment (three items), pain management (two items) and cooperation with the health care team (one item). Each item is scored on a five-point Likert scale option from 1 (not confident at all) to 5 (extremely confident). The minimum score on this tool is six and the maximum score is 30; higher scores indicate higher self-efficacy in pediatric pain assessment and management. The instrument's content validity has been established by three pediatric pain nursing experts. The instrument has also demonstrated an acceptable level of internal consistency as measured by Cronbach's alpha values of 0.88 and 0.91 at pre-intervention and post-intervention respectively (L.-C. Chiang et al., 2006). Stanley & Pollard, (2013) also reported a post-intervention Cronbach's alpha value of 0.81, signifying an acceptable level of internal consistency.

6.3.4.3 Competencies in pediatric pain assessment, management and documentation

Nurses' competences in pediatric pain assessment and management will be evaluated using a developed procedures and skills manual that will be refined by the pediatric experts during the workshop. Validity (content) and reliability (internal consistency) of the developed instruments will be tested by experts and a sample of nurses before being used in the feasibility and acceptability phase. Documentation of pain assessment findings and assessment frequency, use of appropriate pain assessment tool, reassessment of pain management interventions for children with moderate-severe pain, pharmacological and non- pharmacological pain management interventions will be evaluated from nurses' notes or charts.

6.3.4.4 Satisfaction with pediatric pain management

The American Pain Society's patient satisfaction survey (Miaskowski et al., 1994) will be adapted to measure hospitalized children and their families' satisfaction with in-hospital pain management. This 17-item survey addresses pain experiences, pain treatment needs, satisfaction with pain relief measures, and healthcare providers' engagement and response. The resultant instrument's validity and reliability will be evaluated, following the amendment of the survey items, before use in the educational program's feasibility testing. Nurses will evaluate their satisfaction with pain assessment and management on a five-point Likert scaled options with 1 being "not satisfied at all" and 5 being "extremely satisfied". The minimum score on the satisfaction with pain assessment or management will be 1 whereas the maximum score will be 5. Higher scores will denote increased satisfaction with pediatric pain assessment or management.

6.3.4.5 Evaluation of the acceptability of the educational program

The "Training Evaluation Form for participants in Iowa ESL Regional Trainings" 2020) will be adapted to assess nurses' evaluation of the pediatric pain educational program. This instrument consists of 16 items: 11 Likert scaled items and five open-ended questions. The Likert scaled items assesses views on the clarity of program and educational objectives, level of participation, relevance of topics covered, organization, usefulness of educational materials and experience, expertise and preparedness of the facilitator(s), timing and conduciveness of the education environment. The Likert scaled items require participants to indicate their level of agreement with statements made on a five-point options ranging from 1 (strongly disagree) to 5 (strongly agree). The minimum score on the Likert scaled items is 11 and the maximum score is 55; higher scores denote higher evaluation of the educational program. The remaining five open-ended questions focus on what participants liked most about the education,

aspects of the education that could be improved, changes they intend to incorporate in their practice due to the education, additional pediatric pain education they will prefer in the future and an opportunity for other comments.

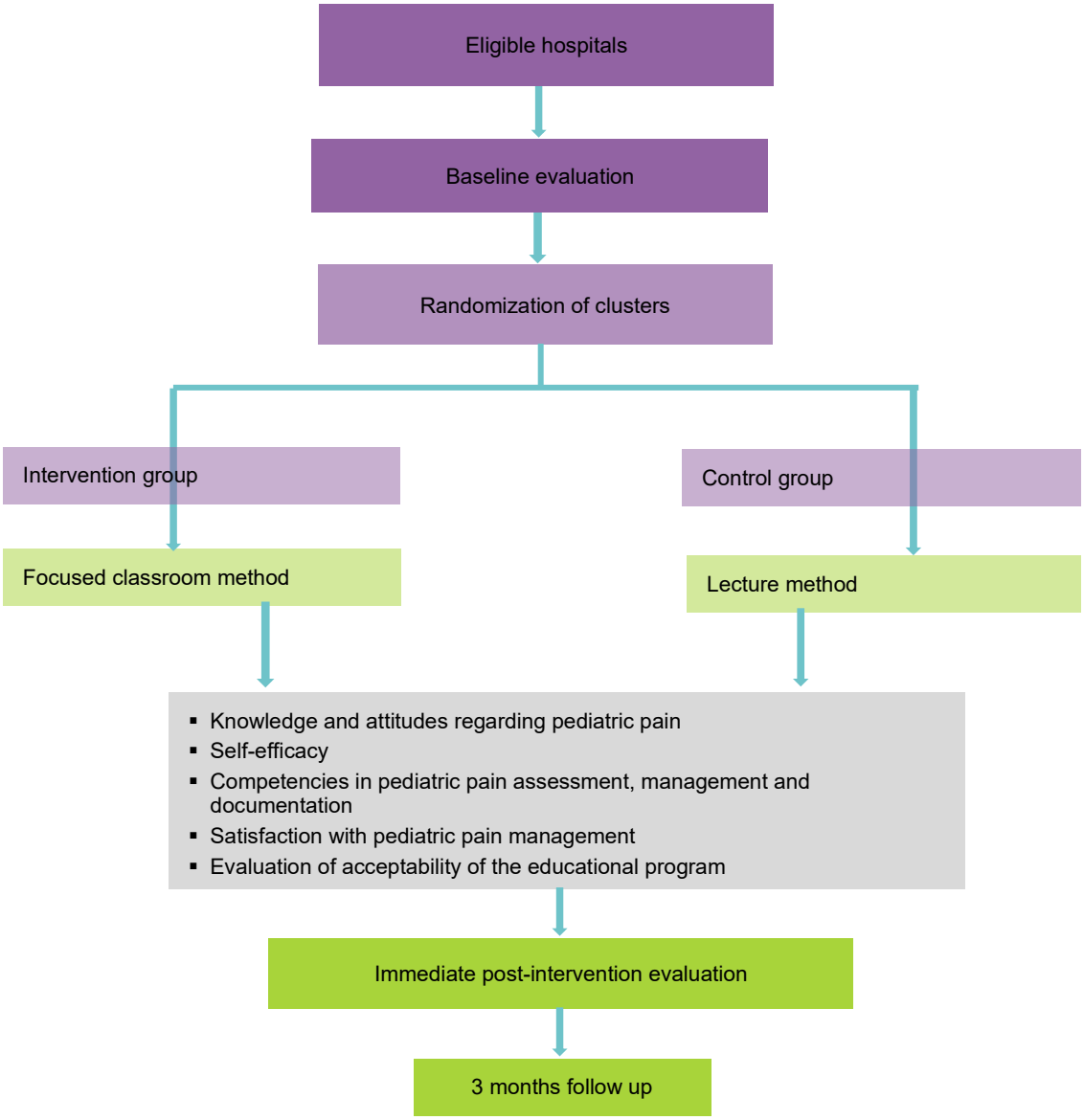

Figure 6. Proposed design of the educational program.

Summary of the main results

The main findings of this study are summarized in Table 7.

Table 7. Results summary.

Identifying the evidence-base	Identifying a theory	Modelling the process and outcomes
▪ The reviewed educational interventions mostly led to positive changes in nurses' knowledge, attitudes and practice of managing children's pain; the reported improvement were influenced by six factors namely: well-designed educational intervention, measures of enhancing inclusiveness, multidisciplinary collaboration, responsive program development, system integration and securing sustainability (sub-study I). ▪ The nurses had areas of satisfactory and unsatisfactory knowledge and attitudes regarding children's pain (sub-studies II and III); they further indicated diverse preferences on the nature of the proposed PPEP (sub-study III). ▪ Several socio-cultural factors operating at the individual, interpersonal and organizational levels affected the management of children's pain at four Ghanaian hospitals.	▪ Under the guidance of the social cognitive theory, it is anticipated that improvement in the nursing management of children's pain will be manifested through the continual interaction between three dynamic and reciprocating factors (personal, environmental and behavioural).	▪ The proposed PPEP was modelled to be pilot-tested as a two-arm cluster, randomized controlled trial with a three-month follow-up that will compare the same content of education delivered via different modes (flipped classroom: intervention group versus lecture: control group). ▪ Anticipated measurement outcomes consisted of knowledge and attitudes regarding pediatric pain, self-efficacy, competencies in pediatric pain assessment, management and documentation, satisfaction with pediatric pain management, and evaluation of the acceptability of the educational program.

7 Discussion

The ultimate aim of this study was to develop an evidence and theory-based PPEP for nurses in a resource-limited setting, guided by the MRC's framework (Craig et al., 2020). The study comprised of four sub-studies (I, II, III and IV). Sub-study I aimed at reviewing the effects of educational interventions directed at nurses on children's pain management. Sub-studies II and III aimed at assessing the nursing educational needs on children's pain management using quantitative and qualitative approaches respectively. Sub-study IV aimed at characterizing the cultural and contextual factors that influence the management of children's pain at four selected Ghanaian hospitals.

This section presents a discussion on the findings from the four sub-studies that were undertaken to identify the evidence-base for the proposed PPEP. Subsequently, it will be followed by a deliberation on the proposed application of the social cognitive theory and modelling phase of the development process. A review of the trustworthiness, validity and reliability measures involved in the varied procedures and processes of the study has also been provided.

7.1 Identifying the evidence-base

In this section, the findings from the four sub-studies that were conducted to provide the evidence and justify the need for the study will be discussed. The first sub-study reviewed earlier literature regarding the effect of educational interventions directed at nurses on children's pain management. The second and third sub-studies examined the educational needs of nurses on children's pain management using both quantitative and qualitative approaches. The fourth sub-study characterized the cultural and contextual factors that influence the management of children's pain at four selected Ghanaian hospitals. Discussion of the four sub-studies has been presented below.

7.1.1 Effect of nursing educational interventions on children's pain management (Original Publication I)

Findings from the integrative review showed that diverse educational interventions improve nursing competencies (knowledge, attitudes and practices) regarding

children's pain management, highlighting the efficacy of nursing-directed PPEPs. Although, majority of the studies measured pediatric pain knowledge and attitudes or practices, none of the earlier studies measured all these three outcomes (knowledge, attitudes, and practice) in a single study. Intervention planning and delivery in the future should consider focusing on nurses' knowledge, attitudes, and practice of children's pain management concurrently since these aspects complement each other to ensure optimal pain management. Moreso, other outcomes (such as child-family satisfaction, duration of hospitalization among others) that are equally important to stakeholders should be assessed in future studies. Furthermore, relatively few of the studies were carried out in developing countries, with none carried out in the sub-Saharan Africa region. Considering that pediatric pain is a global problem, more efforts should be invested to improve pediatric pain management especially in developing countries due to the limited resources in this region.

Multidisciplinary collaboration and measures of enhancing inclusiveness enhanced the effectiveness of the identified educational interventions as they helped the nurses to conceptualize their roles and complement the work of other practitioners (Bedwell et al., 2012). Also, a responsive program development in the form of needs assessment and well-designed educational intervention improved the educational appeal to the learners. Moreover, the tailoring of lessons to the needs and adoption of sustainability measures such as unit-based coaches ensured that the new knowledge and competences were inculcated into existing practice and sustained (Chan et al., 2013; Hanson et al., 2009; Tricco et al., 2016). These measures greatly influenced the success of the programs.

7.1.2 Nursing educational needs on children's pain management (Original Publications II and III)

Educational needs assessment is essential to ensure that the nature and content of the educational program addresses the actual problems of the audience and that its nature is suitable for the recipients' preferences (Grant, 2002). As part of attempts at achieving the overall aim of the research, it was imperative that an educational needs assessment of nurses on pediatric pain management be conducted.

Contrary to the findings by Peirce et al. (2018) and Notejane & Bernadá (2019) among Australian and Uruguayan nurses respectively, pediatric nurses in Ghana did not have sufficient knowledge and attitudes pertaining to pediatric pain. However, the findings are consistent with the majority of studies in various parts of the world (Alotaibi et al., 2019; Ekim and Ocakci 2013; Gadallah et al., 2017; Manworren, 2000; Ortiz et al., 2015; Stanley & Pollard, 2013) indicating that pediatric nurses generally were limited in their knowledge, competences and attitudes on pediatric

pain management. It was found that nurses who worked in general hospitals were significantly more knowledgeable on pediatric pain than those in the specialist hospitals. This may be explained by the fact that nurses in the general hospitals commonly had higher educational background compared to those in specialist pediatric hospitals. Our findings are unsurprising since Vickers (2011) and Greenberger et al. (2006) have identified level of education to influence pain knowledge and attitudes.

During interviews with the nurses, they were confident in their competence in the assessment of pain, mainly in children with functional speech, and management of pain using Non-steroidal anti-inflammatory drugs (NSAIDs), thereby relying on the children and family caregivers to notify them on the existence of pain to administer help. The nurses also relied on physiological and behavioural cues to assess pain, some of which have been shown to be effective (Srouji et al., 2010; Subramaniam et al., 2018), especially among children who have non-functional speech. However, these cues are not exclusive to pain existence and may lead to duplicity of interpretation of results (Ranger et al., 2007). In this regard, the use of appropriate pain assessment tools such as Premature Infant Pain Profile (PIPP), and the Face-Legs-Activity-Cry-Consolability (FLACC) scale must be promoted for use by nurses on the pediatric wards. The reliance of the nurses on family caregivers demonstrates the important role of family caregivers in pediatric pain management and as such they should not be left out of educational interventions.

Although the nurses routinely used non-steroidal anti-inflammatory drugs (NSAIDs) in managing children's pain, they expressed knowledge insufficiency and desired further education on pediatric analgesic medications, similar to nurses in other settings (Larjow et al., 2016; Samarkandi, 2018). Also noteworthy is the fact that though the partciating nurses were familiar with a range of available non-pharmacological modalities of pediatric pain management, they still desired further knowledge about these methods, similar to findings in other studies (Oliveira & Linhares, 2015; Srouji et al., 2010). Educational inteventions in the future should take into account the competencies of the nurses and build on them to promote the incorpartion of the new information into practice for improved the management of pain in children.

Consistent with their desire for further education on pediatric analgesic medications, a large number of the participants scored poorly on sections of the quantitative study that centred on opioid drug administration. They also scored poorly on pain assessment and pain perception sections. Similarly, Ortiz et al. (2015), Smeland et al. (2018) and Alotaibi et al. (2019) reported these deficiencies in their studies, suggesting that careful attention should be paid to these areas in the development and implementation of educational interventions to address this subject.

Also, none of the participating nurses could determine correctly the right time of onset of action of oral analgesics, equianalgesic dose of orally administered morphine, and the right prescription dosage of morphine for a child who consistently reports moderate to severe pain. The nurses also revealed in interviews that they were inept at assessing pain in non-verbal children because of the children's inability to verbalize their pain due to their developmental stage or some medical conditions. The alarming situation may be due to insufficient curricula content and time dedicated to the teaching and learning of pediatric pain assessment and management in nursing educational institutions (Mackintosh-Franklin, 2017; Twycross & Roderique, 2013). Contributing to this insufficient knowledge, competences and attitudes among the nurses was lack of regular continuing educational opportunities for practicing nurses as reported by earlier studies (Alotaibi et al., 2019; Aziato & Adejumo, 2014; Eid et al., 2014; Samarkandi, 2018). These findings are alarming and show an urgent need for educational interventions for nurses on this topic to help improve the current situation.

The nurses expressed their desires to be educated in many areas of pediatric pain management, including assessment of pain for children of varying ages, the fundamental aspects of pain such as definition, and effects of pain. Knowledge on such basic principles will promote the understanding of pediatric pain problems and guide the administration of effective pediatric pain management therapies (Málek et al., 2017). The nurses also shared that the involvement of parents in pain management was an important area that should be considered in an educational program. Determining by rank the preference for an educational content helps to focus the intended education towards meeting the most urgent needs (Noh et al., 2018). In this light, more hours should be dedicated to addressing the areas the nurses considered to be of high priority such as pain assessment.

On the nature of the educational program, the nurses desired to learn from experts on the topics that will be taught since the experts had the appropriate knowledge and competences on the content and the pedagogical approaches to be used (D'emeh et al., 2016). They generally preferred a face to face, interactive session delivered in a group. As shown by Graham (2019) and Hodges (2018), a group, face to face, and interactive educational session provides an opportunity for the members of the group to collaboratively learn from one another, while at the same time ensuring prompt feedback. This approach also promotes the fundamental purpose of continual professional development, which aims to update nurses' knowledge and competences to optimise patient care (Filipe et al., 2014).

Also, the nurses indicated varying preferences on the duration and frequency of the program, thereby making it difficult to determine the optimum duration and frequency for the intervention. This further demonstrates the complex nature of education as an intervention (Mattick et al., 2013; Tarquinio et al., 2015). For any

educational intervention to be useful to its recipients (Lunsford, 2015; Taddio et al., 2015), be of adequate duration (Kahan & McKenzie, 2015; Menheere & Hooge, 2010) and ensure a relatively permanent change in behavior, consideration should be given to timing available to the majority of the participants, learning resources and facilitators available in the development of the program.

7.1.3 Cultural and contextual factors that influence the management of children's pain at four Ghanaian hospitals (Original Publication IV)

Healthcare systems operate in varied and highly connected personal and socio-political environments and hence for any educational intervention for nurses to be effective, these factors must be taken into account (Kannampallil et al., 2011; Lipsitz, 2012). A predominant lack of educational opportunities on pediatric pain management was identified as the norm among the nurses, which had negative individual, interpersonal and organizational consequences. This was shown in various misconceptions they held about some pharmacological pain management, and the dispositions the nurses held towards certain aspects of pediatric pain assessment and management practice. Fortunately, the nurses were willing to participate in an educational program to help improve their pain management practice. Hurley-Wallace and colleagues (2019) from their review of the impact of pediatric pain education concluded that such education is important for the improvement of pediatric pain management among healthcare workers.

It was found that similar to previous studies (Clancy, 2014; Katende & Mugabi, 2015; Matula et al., 2018), the nurses rarely carried out pain assessments on the wards, coupled with limited pain assessment tools (Harrison et al., 2009; Stevens et al., 2012; Taylor et al., 2008). Moreover, the few pain assessments done by the nurses were not documented, indicating that pain was accorded little relevance in this setting. The prevailing culture of insufficient pediatric pain assessment and documentation identified here and in other countries (Clancy, 2014; Katende & Mugabi, 2015; Matula et al., 2018) point to a global problem of unacceptable prolonged suffering of children in pain.

Also, contrary to their routine use of NSAIDs, the nurses were reluctant to use opioids due to the fear of side effects. The fears and misconceptions shown by these nurses have also been shown in other settings (Bell & Salmon, 2009; Dongara et al., 2017; Forgeron et al., 2009). However, these attitudes have been shown to be unfounded and some of the perceived side effects of opioid analgesic use can be safely alleviated by adopting multimodal pain management approaches (Kraemer, 2010; White, 2008). Furthermore, the nurses indicated unwillingness to use non-pharmacological pain management methods because they were deemed time-

consuming. Although an individual factor, this has implications on the management of the hospitals to aim at improving the nurse-patient ratios to afford the nurses more time to provide this essential care.

Interpersonally, the presence of family caregivers was a factor that promoted the assessment and management of pain on the wards. As indicated in several studies (Birnie et al., 2014b; Palermo et al., 2014), parents and family caregivers promote pain management by helping to communicate the needs of the children to the healthcare personnel and also get involved in some pain management modalities. On the contrary, Simons et al. (2001), reported that the involvement of parents in the pain care of their children was superficial and limited. This may be due to the fact that the parents may possess insufficient knowledge on pediatric pain, as has been identified in this study (Lauzon Clabo, 2008), and this may hinder instead of promoting optimal pain management in children. Promisingly, the nurses acknowledged the important role of parents in pediatric pain management. Parents may also benefit from educational interventions to improve their collaboration with the nurses and other healthcare professionals, to optimize their roles in the pain care of their children (He et al., 2010).

On the organizational level, almost all of the hospitals did not have pediatric pain assessment tools. This may be a reflection of the general lack of resources for children's care in this setting. This, coupled with the lack of playing (recreational) resources for the children, which may serve as a form of pain management, challenged and hindered the children's habitus of benefiting from these non-pharmacological methods. As such, the leadership and management of these hospitals and healthcare in general must allocate more resources and mentorship influence to provide assessment and management tools, educate and encourage nurses to make pediatric pain assessment a priority, and also provide the needed tools and charts for its assessment and documentation.

7.2 Identifying a theory to support the proposed PPEP

Behaviour theories are influential in the development and implementation of educational programs that aim at improving pediatric pain management. In this regard educators must be cognizant about behaviour theories and how they influence educational outcomes (Kay & Kibble, 2016). Like all behaviour changes, targeted improvements in pediatric pain management can be achieved when the developers consider the aspects of the chosen theory and its tenets, and judiciously use them to predict the processes that will lead to the attainment of their goals (Burke & Mancuso, 2012). Although the three potential theories shared some similarities in terms of their level of abstraction, values, operationalization, precision, theoretical

support and usefulness, the Social Cognitive Theory provided sufficient empirical support for our study purposes

7.3 Modelling on the process and outcomes of the proposed intervention

Having established the need for an educational program for nurses on children's pain management, the choice to pilot-test a two-arm cluster randomised controlled trial was informed by the robustness of this design in establishing causality (Deaton & Cartwright, 2018). The proposed settings were chosen as educational needs have already been established in those settings; this will additionally provide us the opportunity to evaluate the effect the proposed PPEP. The use of two different delivery methods provides an avenue for the evaluation both traditional (lecture) and innovative (flipped classroom) educational methods in the nursing-directed PPEP. The validity and reliability of data collection tools will be assessed before they are used to ensure that the intended outcomes are measured in an honest and consistent manner.

The proposed pediatric pain educational program for pediatric nurses in Ghana is very crucial as it would be the first of its kind to be conducted in the sub-Saharan African region. Based on the rigorous processes involved in the development of the program, it is hoped that the program will not only improve nurses' competences but most importantly, help to alleviate the unnecessary suffering endured by vulnerable children and their families. Optimistically, this will also provide footprints for similar studies and educational programs in the future.

7.4 Trustworthiness, validity and reliability of the study

This was a mixed-methods study involving quantitative and qualitative research approaches. In this section, the trustworthiness, validity and reliability of the study are discussed from the perspective of the research designs, settings, sampling, data collection and analysis.

7.4.1 Validity and reliability of the study designs, settings and sampling techniques

The study was sub-divided into an integrative literature review, a cross-sectional survey, a descriptive qualitative design and a focused ethnographic design. This variation of design methods can be considered a strength of the study as the

limitations of one method can be compensated by the use of the other method (Timans et al., 2019).

In sub-study I, an integrative literature review was considered relevant as we intended to synthesize different types of studies that have assessed the effect of nursing educational interventions on pediatric pain management. Even though the complexity of combining different study designs to achieve one review affects the review's rigour and accuracy, and result in misleading conclusions (Beck, 1999; O'Mathúna, 2000). As part of measures to minimize these undesirable consequences, we used an appropriate critical appraisal tool for different study designs. For instance, the Wiley Appraisal tool (Greenhalgh et al., 2004) was used for action research studies, Mixed method appraisal tool (Pluye et al., 2011) for mixed-method studies and quality assessment tools from the National health institute (National Heart Lung and Blood, n.d.) for different types of experimental studies. This improved on the review's robustness and accuracy of the reported findings. The second and third sub-studies respectively employed cross-sectional and descriptive qualitative designs to describe the pediatric pain educational needs of nurses. The cross-sectional and descriptive qualitative designs were deemed appropriate for the sub-studies as we sought to correspondingly provide both general and detailed descriptions about their educational needs and not to establish causality (Levin, 2006; Wludyka, 2012). The fourth sub-study was designed as a focused ethnography to exclusively examine the cultural and contextual factors that influence the assessment and management of children's pain at four Ghanaian hospitals.

Both theoretical and empirical settings were used in the study as they were considered reasonable. In sub-study I, theoretical setting strengthened the assessment of education's effectiveness on pediatric pain management among nurses. The choice of the hospitals in the second, third and fourth sub-studies were important for assessing nurses' educational needs and context of children's pain care, as they represented the different types of pediatric healthcare provision in Ghana.

Yamane's (1967) formula for determining sample size guided the determination of the required sample size for the second sub-study in order to precisely estimate the parameters of interest (ie, nurses' knowledge and attitudes pertaining to children's pain). This was critical as inaccurate sample size estimation (small or very large) would lead to unreliable answers for the research hypothesis, questions or problems (Houle et al., 2005; Jones et al., 2003).

The study involved the use of a systematic literature search, consecutive sampling and purposive sampling techniques. In sub-study I, the integrative review was based on a comprehensive search strategy conducted on four relevant databases since the use of only one database is likely to result in the loss of more than half of available literature (Lawrence, 2008; Lemeshow et al., 2005). In the second sub-study, consecutive sampling was used in selecting nurses in the cross-sectional

survey. Purposive sampling technique was used in selecting participants for the third and fourth sub-studies. Even though consecutive sampling technique has been criticized for not guaranteeing an equal chance for participants' inclusion in a study (Setia, 2016), this shortfall was suppressed by approaching all nurses who met the study's inclusion criteria. Maximum variation techniques (Lewis et al., 2016) were employed in the purposive sampling technique to ensure a representative sample of the targeted participants (nurses, physicians, hospitalized children and their families).

7.4.2 Validity, reliability and trustworthiness of the data collection techniques, instruments and analysis

The collection and analysis data were marked by various processes aimed at ensuring validity, reliability and trustworthiness of the data collection approaches and instruments.

The integrative review protocol was detailed under the guidance of the Preferred Reporting Items for Systematic reviews and Meta-Analyses for Protocols 2015 (Shamseer et al., 2015). This enhanced validity and reliability as it guided the procedures and methods involved in the review. For instance, the inclusion and exclusion of published articles was based on the pre-established eligibility criteria (Atkinson & Cipriani, 2018) outlined in the protocol. An additional quality check measure was the use of standardized tools in appraising the methodological robustness of eligible studies. A narrative synthesis method was considered appropriate in combining the findings of the included studies due to the heterogeneity of the research methods and materials employed in those studies (van den Berg et al., 2013).

In sub-study II, the Pediatric Nurses Knowledge and Attitudes Survey on Pediatric Pain (Manworren, 2001) was used to collect data from participating nurses. The content validity of the PNKAS instrument has been established by five pain management experts in the United States of America (Manworren, 2001). The correlation coefficient of a test-retest reliability among twelve healthcare providers was reported as 0.67, signifying a level of instrument stability which was slightly below a recommended value to 0.7 (Oremus et al., 2012). The internal homogeneity of the instrument using data from two different groups of pediatric nurse specialists were 0.72 and 0.79, indicating an appreciable level of internal homogeneity. In the current study, 11 pediatric experts (six registered nurses, four nurse educators and one pediatrician) recommended the use of the tool after establishing its face validity (clarity, relevance, simplicity among others). The use of well-defined study variables in addition appropriate descriptive and inferential statistical analysis in the second sub-study justified its validity (Kim et al., 2017).

An interview guide was designed and used by the researchers in the qualitative descriptive and focused ethnographic studies (sub-studies III and IV). In both cases, pre-testing of interview guide and observational tools were done to identify potential challenges and to provide the needed solutions. The use of more than one interviewer or observer per session, multiple transcriptionists and coding techniques were employed to minimize biases and subjectivity inherent in qualitative data collection and analysis (Pannucci & Wilkins, 2010). Braun & Clarke's (2006) method and Leininger's (2006) method were respectively used in analyzing the descriptive qualitative and focused ethnographic data. These increased the trustworthiness of the qualitative research findings.

The trustworthiness of the sub-studies III and IV were ensured by adhering to Guba & Lincoln's (1989) principles of credibility, conformability, dependability and transferability. Credibility and conformability were achieved through triangulation of study sites, data collectors, and analysts as well as member-checking of the participants for clarifications and corrections as considered necessary. Feasibility and appropriateness of the data collection instruments were carried out in a hospital which had similar characteristics to our included study sites; the approach enhance the study's dependability. Dependability of the results was also enhanced by adding actual quotes from the participants and field work to support the findings. Detailed notes of the fieldwork also facilitated auditability of the study's findings and also promoted confirmability of the findings. Comparison of data collection and thematic analysis was done to ensure consistency of the identified themes. Although qualitative research does not aim at generalization, the settings and procedures involved in the sub-studies III and IV have been extensively described to enhance transferability of the findings into similar settings. Uniquely to the focused ethnography, the first three observations were not used in data analysis but used for familiarization so as to minimize the potential of participants to self-consciously alter their behaviours due to the researcher's presence.

As part of the measures to enhance the transparency and reliability of research results and associated interpretations (Simera et al., 2010), standardized checklists were used in guiding the reporting of the study's processes and findings. Under the guidance of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Moher et al., 2009), the integrative review procedures and findings were reported (sub-study I). The reporting of the cross-sectional survey procedures and results (sub-study II) was aided by the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) checklist (von Elm et al., 2007). Reporting of the descriptive qualitative (sub-study III) and focused ethnographic (sub-study IV) aspects of the study were guided by the COnsolidated criteria for REporting Qualitative research (COREQ) (Tong et al., 2007).

7.4.3 Validity and reliability of models and theories

There is contention in the models and theories literature about evaluating their validity and reliability as no model or theory can be generally described as either "good" or "bad" (Chiang et al., 2015). Theory evaluation as a comparative adventure is thus dependent on the usefulness, conciseness, abstraction level, among other prescribed qualities deemed sufficient for a particular situation or context (Waltz, 1997). Based on the compared models and theories, the selected approaches provided sufficient theoretical and empirical support for our study purposes.

8 Conclusions

Nurses play significant roles in the assessment, management and documentation of children's pain. In this regard continuing education is important for nurses to update their pediatric pain assessment and management practices as earlier pediatric pain educational programs have generally been effective in improving their capabilities. Judging by the paucity of studies and continuing educational opportunities on the subject in Ghana and the sub-Saharan region, this study was aimed at developing a nursing-directed pediatric pain education program for subsequent piloting, evaluation and implementation so as to improve pain care outcomes for affected children, their families, healthcare professionals and systems as a whole.

Ghanaian nurses demonstrated a sub-optimal level of competence (knowledge, attitudes and practice), creating a status quo where hospitalized children may be suffering unnecessarily. However, there is a willingness among the nurses to participate in an educational program to improve on their pediatric pain management capabilities. Guided by the evidence gathered from the sub-studies (I-IV) and the Social Cognitive Theory, the educational program promises to be beneficial in improving nurses' assessment, management and documentation of children's pain in the Ghanaian context (a resource-limited setting).

Based on the development phase of the Medical Research Council's framework, the information gathered in this study is the first step in the quest to improve children's pain management among Ghanaian nurses. However, this is a significant step and it is urged that all resources must be brought to bear in bringing to light the pediatric pain educational program for nurses in Ghana.

8.1 Implications for nursing education, practice, research and policy

The study has highlighted the following implications for nursing education, practice, research and policy.

8.1.1 Implications for nursing education

1. The findings from this study revealed that nurses in Ghana have a tremendous educational need with regard to pediatric pain assessment and management. In view of this, we call for amendments to the current curricula for nursing education to allow for more content and time dedicated to the teaching of pediatric pain assessment, management and documentation.
2. Children's nurses are willing to receive regular post-qualification education on pediatric pain management to enable them stay abreast with the practice. In this regard, interventions aimed at addressing pain management deficiencies should be intensified globally, with extra attention given to developing countries to bridge the gap that have been identified in this study. Nurse educators and researchers must take opportunity of this willingness to develop and implement regular continuous professional educational programs to improve pediatric pain management.
3. Established instruments of effectiveness such as multi-disciplinary collaboration, performance of needs assessment, measures of inclusiveness, and thorough planning should guide the development and implementation of nursing-directed pediatric pain educational programs. Educational programs should also be guided by identified areas of strengths, weaknesses and preferences of the target audience.

8.1.2 Implications for nursing practice

1. Nurses must prioritize pain among their pediatric patients to cultivate a culture of regular pain assessment, management and documentation. This will encourage other healthcare professionals to follow and optimize pain care for vulnerable children and their families.
2. This study identified insufficient resources such as pediatric pain assessment tools, documentation sheets and systems on the children's wards. Management of hospitals should provide sufficient quantities of pain assessment tools for diverse categories of children to enhance the identification and recognition of pain experienced by the vulnerable pediatric population. The availability of these tools can also increase nurses' willingness to use them to improve on their pain assessment.
3. Nurses reported limited time as one of the challenges they face in their bid to carry out some non-pharmacological pediatric pain management

interventions. The management of hospitals should improve the staff strength, especially pediatric nurses on the various wards to enable nurses more time to carry out non-pharmacological therapies for pediatric pain.

4. Provision of resources such as pain assessment tools, assessment sheets and systems, various categories of analgesics and playing (recreational) materials should be made available on the wards to assist in the assessment and management of children's pain.
5. Nurses involved in the care of children should engage family caregivers and the children on their role in the assessment and management of the children's pain.

8.1.3 Implications for future research

1. Most of the studies and interventions on pediatric pain management were done in developed countries with little attention paid to developing countries. Till date, there is no published report of such interventions in sub-Saharan Africa, of which Ghana is a part of. It is suggested that future studies should be focused on these developing countries to assess the impact of limited health resources on the nursing assessment and management of pediatric pain.
2. This study adds to the knowledge on nursing management of pediatric pain and the educational needs of nurses on pediatric pain management. There is the need for more robust experimental studies of high methodological quality so as to establish causality in these educational programs.
3. The use of one region in the Ghana poses a limitation to the generalizability and transferability of the study findings. In view of this, it is recommended that similar primary studies should be conducted in other regions of the country and other developing countries in general to provide a national and regional perspective on the issues affecting nursing assessment, management and documentation of children's pain.
4. Based on the limited outcomes assessed in earlier reviewed studies, there is the need for future studies to report on other equally important outcomes for the major stakeholders of pediatric pain other than nurses (such as children, family caregivers and doctors).

8.1.4 Implications for policy

1. There is the urgent need for implementation of existing protocols on pain management such as the World Health Organization's analgesic ladder to guide the management of children's pain in clinical practice.
2. The hospitals in this study lacked mandatory requirements for pain documentation. Policy makers for the hospitals should heighten advocacy on "pain as the fifth vital sign" and institute mandatory requirement for documentation of children's pain.
3. Majority of the nurses on the pediatric wards were general nurses with very little pediatric pain management education. There should be a review of current nursing curriculum by the Nursing and Midwifery council and nursing educational institutions, to allow for more content and time on pediatric pain assessment and management.

Acknowledgements

The road to commencing this PhD study was not an easy one as it was filled with so many uncertainties: losing my lectureship, beginning a program outside my country without sponsorship and not knowing what the future holds concerning my family and professional life after the completion of this program. Thankfully, my God who knew me while I was in my mother's womb helped in curtailing all these uncertainties in a timely manner. My determination, zeal and commitment to embark on this journey was underpinned by the assurance in the Holy Book (Isaiah 43:2) which states that "When you pass through the waters, I will be with you; and when you pass through the rivers, they will not sweep over you. When you walk through the fire, you will not be burned; the flames will not set you ablaze". Words even fail me in showing my endless gratitude to the Almighty God for His cloud of protection, love, compassion, grace, favor, mercies and the strength to carry on during the many difficult and challenging times that came along with this PhD journey.

My sincerest appreciation also goes to my supervisors, Associate Professor Anna Axelin, RN, PhD and Senior Lecturer Victoria Bam, RN, PhD for their unflinching support during the entire PhD study. Through their timely constructive criticisms, directions, encouragements, believe in me and friendship, I always had the zeal to perform better and to the best of my abilities. Thus, I will always have the confidence to tell others that I had one of the best PhD supervisory teams. I really hope that the future will offer possibilities for us to continue our enviable collaboration. I am also grateful to my vibrant follow up committee members, Professors Sanna Salanterä and Mats Eriksson for sharing their expertise with me and offering valuable advice whenever it was needed. In spite of their very busy schedules, they were always ready to offer support and inspired me to carry on; their passion for health science research is something I continuously admire. I am sincerely grateful to Senior research fellow, docent Kristina Mikkonen, RN, PhD from the University of Oulu-Finland and senior lecturer, Stefan Nilsson, RN, PhD from the University of Gothenburg, Sweden for officially reviewing this thesis, and providing constructive criticism and comments that helped to improve this thesis. I am also extremely grateful to Associate Professor Sigridur Zoëga from the University of Iceland, Iceland for accepting to serve as opponent for my PhD thesis. My warmest

appreciation also goes to Professor Helena Leino-Kilpi (Head) and all docents at the Department of Nursing Sciences, University of Turku-Finland for their diverse support during the PhD journey.

My sincerest thanks also go to my PhD student colleagues at the Department of Nursing Sciences, University of Turku-Finland for their constructive comments and criticisms especially during our seminars. The sessions were so refreshing and insightful that one always had the benefit of an internal peer review even before submitting a manuscript for publication in a journal. I am also grateful to the roommates in our doctoral office with whom we shared ideas, especially in times where one needed an up-to-the minute feedback on an issue. It has been a privilege to be connected to such skillful and ambitious people throughout this journey. I am also eternally grateful to my colleagues at the Department of Nursing, Kwame Nkrumah University of Science and Technology-Ghana; their advice, encouragement and guidance has been precious throughout the study.

My sincerest thanks to the participants who took time off their busy schedule and made the study a success, I am eternally grateful for their cooperation. No amount of words would be enough to express my profound gratitude to the team that assisted me in the data collection and entry processes: Joan, Evans and Collins, you mean the world to me. I knew you had your diverse plans and research interests, but you were dragged into the world of "pediatric pain management" even without being asked for consent officially. The love and enthusiasm with which you executed your diverse duties is truly commendable. Thanks for joining me in this lonely journey and making the study a great success. I am grateful to all the people whom I cannot mention here but whose paths crossed mine during the entire journey.

I cannot end this acknowledgment without saying "thank you" to my family, they mean the world to me. I am incredibly grateful to my dearest husband, Dr. Francis Diji for his love, selflessness and commitment towards my desire for higher education. Few husbands can barely do what you did, and I am forever grateful for accepting to single handedly take care of the family while I was away all these years. I owe a debt of gratitude to my lovely mother-in-law for leaving her job of many years and relocating from her own house to join my husband in caring for the family, Gladys Yeboah a.k.a Afia Manu, words elude me in showing how grateful I am to you for this sacrifice. Many onlookers think you are rather my mom and not my mother-in-law because of the love and passion we share. May the Almighty God forever bless you for all the sacrifices you have made because of me and our envious family. To my first son, Elyon Nana Kofi Nhyira Diji, thanks for your understanding in times when I couldn't be with you and the stories you continuously shared with me even when I was writing this thesis, I will never stop loving you. Othniel Nana Yaw Ayeyi Diji, my inseparable partner along this journey, thanks for being a good son both in-utero and outside and for constantly reminding me about the most

important things in life. In times when I felt alone, your constant kicks while in utero enabled me to come to the realization that I was not alone in this journey. You are indeed one of the proudest gifts I have received during this PhD journey. I am eternally grateful to my parents, especially my mother Vivian Nyamekye for single-handedly raising two resilient women. I am endlessly grateful for the educational seeds she sowed in my life which served as a good foundation for my current achievement. Her desire to make me a better person and my exceptional success as a measure of her success in life has propelled me thus far; mum, I am very grateful. And to the sister everyone needs in life, Diana Kusi Amponsah, thanks for the sisterly support and belief in me. I am profoundly grateful to all members of my extended family and my husbands' family for their advice and support. I want to express my deepest and sincere gratitude to all of them even though I cannot mention everybody here individually.

Also, I am heavily indebted to the KNUST for giving me the needed support to develop personally and professionally. The support of the Vice Chancellor, Provost of the College of Health Sciences, Dean of the Faculty of Allied Health Sciences, The Head of the Nursing Department, the members of the finance and administrative team will be forever cherished and remembered. Last but definitely not the least, I am grateful to the Department of Nursing Science of University of Turku, Turku University Foundation, University of Turku joint research grant fund and the IASP's (International Association for the Study of Pain) International Symposium on Pediatric Pain (ISPP) for financially supporting various facets of the study and making it a success.

30th October, 2020
Abigail Kusi Amponsah

References

Abdel Razeq, N. M., Akuma, A. O., & Jordan, S. (2016). Status of neonatal pain assessment and management in Jordan. *Pain Management Nursing*, *17*(4), 239–248. https://doi.org/10.1016/j.pmn.2016.02.050

Albertyn, R., Rode, H., Millar, A. J. W., & Thomas, J. (2009). Challenges associated with paediatric pain management in sub Saharan Africa. *International Journal of Surgery*, *7*(2), 91–93. https://doi.org/10.1016/J.IJSU.2009.01.005

Alotaibi, K., Higgins, I., & Chan, S. (2019). Nurses' knowledge and attitude toward pediatric pain management: A cross-sectional study. *Pain Management Nursing*, *20*(2), 118–125. https://doi.org/10.1016/j.pmn.2018.09.001

Alzghoul, B. I., & Abdullah, N. A. C. (2015). Pain management practices by nurses: An application of the Knowledge, Attitude and Practices (KAP) model. *Global Journal of Health Science*, *8*(6), 154–160. https://doi.org/10.5539/gjhs.v8n6p154

Atakro, C. A., Armah, E., Menlah, A., Garti, I., Addo, S. B., Adatara, P., & Boni, G. S. (2019). Clinical placement experiences by undergraduate nursing students in selected teaching hospitals in Ghana. *BMC Nursing*, *18*, 1. https://doi.org/10.1186/s12912-018-0325-8

Atkinson, L. Z., & Cipriani, A. (2018). How to carry out a literature search for a systematic review: a practical guide. *BJPsych Advances*, *24*(2), 74–82. https://doi.org/10.1192/bja.2017.3

Audibert, M., & Mathonnat, J. (2012). Facilitating access to healthcare in low-income countries: A contribution to the debate. *Field Actions Science Report*, *8*(Suppl.), 0–5. http://factsreports.revues.org/2069

Aziato, L., & Adejumo, O. (2014). Determinants of nurses' knowledge gap on pain management in Ghana. *Nurse Education in Practice*, *14*(2), 195–199. https://doi.org/10.1016/j.nepr.2013.08.004

Azimi, H. M., & Rahmani, R. (2013). Importance of needs assessment for implementation of E-learning in colleges of education. *International Journal of Information and Computation Technology*, *3*(5), 377–382. https://www.ripublication.com/irph/ijict_spl/03_ijictv3n5spl.pdf

Bandiera, O., Larcinese, V., & Rasul, I. (2010). Heterogeneous class size effects: New evidence from a panel of university students. *The Economic Journal*, *120*(549), 1365–1398. https://doi.org/10.1111/j.1468-0297.2010.02364.x

Bandura, A. (1989). Social cognitive theory. In R. Vasta (Ed.), Annals of child development: Six theories of child development - Revised formulations and current issues (pp. 1–60). Elsevier Science Ltd.

Beck, C. T. (1999). Facilitating the work of a meta-analyst. *Research in Nursing & Health*, *22*(6), 523–530. https://doi.org/10.1002/(SICI)1098-240X(199912)22:6<523::AID-NUR9>3.0.CO;2-9

Bedwell, W. L., Wildman, J. L., DiazGranados, D., Salazar, M., Kramer, W. S., & Salas, E. (2012). Collaboration at work: An integrative multilevel conceptualization. *Human Resource Management Review*, *22*(2), 128–145. https://doi.org/10.1016/j.hrmr.2011.11.007

Bell, K., & Salmon, A. (2009). Pain, physical dependence and pseudoaddiction: Redefining addiction for "nice" people? *International Journal of Drug Policy*, *20*(2), 170–178. https://doi.org/10.1016/j.drugpo.2008.06.002

Beltramini, A., Milojevic, K., & Pateron, D. (2017). Pain assessment in newborns, infants, and children. *Pediatric Annals*, *46*(10), e387–e395. https://doi.org/10.3928/19382359-20170921-03

Ben Ayed, H., Yaich, S., Trigui, M., Ben Hmida, M., Ben Jemaa, M., Ammar, A., Jedidi, J., Karray, R., Feki, H., Mejdoub, Y., Kassis, M., & Damak, J. (2019). Prevalence, risk factors and outcomes of neck, shoulders and low-back pain in secondary-school children. *Journal of Research in Health Sciences*, *19*(1), e00440. https://europepmc.org/article/med/31133629

Béranger, A., Pierron, C., de Saint Blanquat, L., Jean, S., & Chappuy, H. (2017). Communication, informations et place des parents en réanimation polyvalente pédiatrique : revue de la littérature. *Archives de Pediatrie*, *24*(3), 265–272. https://doi.org/10.1016/j.arcped.2016.12.001

Berde, C. B., Walco, G. A., Krane, E. J., Anand, K. J. S., Aranda, J. V., Craig, K. D., Dampier, C. D., Finkel, J. C., Grabois, M., Johnston, C., Lantos, J., Lebel, A., Maxwell, L. G., McGrath, P., Oberlander, T. F., Schanberg, L. E., Stevens, B., Taddio, A., Von Baeyer, C. L., … Zempsky, W. T. (2012). Pediatric analgesic clinical trial designs, measures, and extrapolation: Report of an FDA scientific workshop. *Pediatrics*, *129*(2), 354–364. https://doi.org/10.1542/peds.2010-3591

Berdot, S., & Sabatier, B. (2018). Medication errors may be reduced by double-checking method. *Evidence-Based Nursing*, *21*(3), 67–67. https://doi.org/10.1136/EB-2018-102901

Billings, D. M., & Halstead, J. A. (2012). *Teaching in nursing: A guide for faculty* (4th ed.). Elsevier.

Birckmayer, J. D., & Weiss, C. H. (2000). Theory-based evaluation in practice: What do we learn? *Evaluation Review*, *24*(4), 407–431. https://doi.org/10.1177/0193841X0002400404

Birnie, K. A. A., Chambers, C. T. T., Fernandez, C. V. V, Forgeron, P. A. A., Latimer, M. A. A., McGrath, P. J. J., Cummings, E. A. A., & Finley, G. A. A. (2014). Hospitalized children continue to report undertreated and preventable pain. *Pain Research and Management*, *19*(4), 198. https://doi.org/10.1155/2014/614784

Birnie, K. A., Noel, M., Parker, J. A., Chambers, C. T., Uman, L. S., Kisely, S. R., & McGrath, P. J. (2014). Systematic review and meta-analysis of distraction and hypnosis for needle-related pain and distress in children and adolescents. *Journal of Pediatric Psychology*, *39*(8), 783–808. https://doi.org/10.1093/jpepsy/jsu029

Bond, M. (2011). Pain education issues in developing countries and responses to them by the International Association for the Study of Pain. *Pain Research & Management*, *16*(6), 404–406. https://doi.org/10.1155/2011/654746

Bourdieu, P., & Nice, R. (1977). *Outline of a Theory of Practice*. Cambridge University Press. https://doi.org/10.1017/CBO9780511812507

Braun, V., & Clarke, V. (2006). *Using thematic analysis in psychology*. *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown- Chidsey, R., Andren, K. J., & National Professional Resources, I. (2015). Assessment for intervention: A problem solving approach. Second edition. In *National Professional Resources, Inc.* http://proxy.libraries.smu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED571661&site=ehost-live&scope=site

Buchan, J., & Aiken, L. (2008). Solving nursing shortages: A common priority. *Journal of Clinical Nursing*, *17*(24), 3262–3268. https://doi.org/10.1111/j.1365-2702.2008.02636.x

Burke, H., & Mancuso, L. (2012). Social cognitive theory, metacognition, and simulation learning in nursing education. *Journal of Nursing Education*, *51*(10), 543–548. https://doi.org/10.3928/01484834-20120820-02

Cahyani, S. L., Yaputra, F., & Widyadharma, I. P. E. (2018). The nurse' role in pain assessment and management of pediatric patient: A literature review. *International Journal of Medical Reviews and Case Reports*, *3*(3), 104–108. https://doi.org/10.5455/IJMRCR.role-nurse-pain-pediatric

Campo, J. V., Bridge, J., Lucas, A., Savorelli, S., Walker, L., Di Lorenzo, C., Iyengar, S., & Brent, D. A. (2007). Physical and emotional health of mothers of youth with functional abdominal pain. *Archives of Pediatrics & Adolescent Medicine*, *161*(2), 131–137. https://doi.org/10.1001/archpedi.161.2.131

Caputi, L. (2010). *Teaching nursing: The art and science* (2nd ed.). College of DuPage Press.

Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. *Implementation Science*, *2*(1), 40. https://doi.org/10.1186/1748-5908-2-40

Central Intelligence Agency. (2020). *Africa :: Ghana — The world factbook*. https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html

Chan, S., Pielak, K., McIntyre, C., Deeter, B., & Taddio, A. (2013). Implementation of a new clinical practice guideline regarding pain management during childhood vaccine injections. *Paediatrics and Child Health*, *18*(7), 367–372. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84884520129&partnerID=40&md5=b34c05e06b900019f49b27abcab849e6

Chang, H.-Y., Daubresse, M., Kruszewski, S. P., & Alexander, G. C. (2014). Prevalence and treatment of pain in EDs in the United States, 2000 to 2010. *The American Journal of Emergency Medicine*, *32*(5), 421–431. https://doi.org/10.1016/j.ajem.2014.01.015

Chatterjee, P., Biswas, T., Datta, A., & Sriganesh, V. (2012). Healthcare information and the rural primary care doctor. *South African Medical Journal*, *102*(3), 138–139. https://doi.org/10.7196/SAMJ.5672

Chiang, I.-C. A., Jhangiani, R. S., & Price, P. C. (2015). *Phenomena and theories*. BCcampus.

Chiang, L.-C., Chen, H.-J., & Huang, L. (2006). Student nurses' knowledge, attitudes, and self-efficacy of children's pain management: evaluation of an education program in Taiwan. *Journal of Pain & Symptom Management*, *32*(1), 82–89. https://doi.org/10.1016/j.jpainsymman.2006.01.011

Chiaretti, A., Pierri, F., Valentini, P., Russo, I., Gargiullo, L., & Riccardi, R. (2013). Current practice and recent advances in pediatric pain management. *European Review for Medical and Pharmacological Sciences*, *17 Suppl 1*, 112–126.

Clancy, M. A. (2014). Difficulty, despair and hope – An insight into the world of the health professionals treating paediatric pain in sub-Saharan Africa. *Journal of Research in Nursing*, *19*(3), 191–210. https://doi.org/10.1177/1744987113486472

Corwin, D. J., Kessler, D. O., Auerbach, M., Liang, A., & Kristinsson, G. (2012). An intervention to improve pain management in the pediatric emergency department. *Pediatric Emergency Care*, *28*(6), 524–528. https://doi.org/10.1097/PEC.0b013e3182587d27

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2013). Developing and evaluating complex interventions: The new Medical Research Council guidance. *International Journal of Nursing Studies*, *50*(5), 587–592. https://doi.org/10.1016/j.ijnurstu.2012.09.010

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2020). Developing and evaluating complex interventions: Following considerable development in the field since 2006, MRC and NIHR have jointly commissioned an update of this guidance to be published in 2019. https://mrc.ukri.org/documents/pdf/complex-interventions-guidance/

D'emeh, W. M., Yacoub, M. I., Darawad, M. W., Al-Badawi, T. H., Shahwan, B., D'emeh, W. M., Yacoub, M. I., Darawad, M. W., Al-Badawi, T. H., & Shahwan, B. (2016). Pain-related knowledge and barriers among Jordanian nurses: A national study. *Health*, *08*(06), 548–558. https://doi.org/10.4236/health.2016.86058

Dancel, R., Liles, E. A., & Fiore, D. (2017). Acute pain management in hospitalized children. *Reviews on Recent Clinical Trials*, *12*(4), 277–283. https://doi.org/10.2174/1574887112666170816151232

Darkoh, E. L., Larbi, J. A., & Lawer, E. A. (2017). A weather-based prediction model of malaria prevalence in Amenfi West district, Ghana. *Malaria Research and Treatment*, *2017*, 7820454. https://doi.org/10.1155/2017/7820454

Darnell, D., Parker, L., Engstrom, A., Fisher, D., Diteman, K., & Dunn, C. (2019). Evaluation of a Level I trauma center provider training in patient-centered alcohol brief interventions using the behavior change counseling index rated by standardized patients. *Trauma Surgery & Acute Care Open*, *4*(1), e000370. https://doi.org/10.1136/tsaco-2019-000370

De Clifford-Faugère, G., Aita, M., & Le May, S. (2019). Nurses' practices regarding procedural pain management of preterm infants. *Applied Nursing Research*, *45*, 52–54. https://doi.org/10.1016/J.APNR.2018.11.007

Deaton, A., & Cartwright, N. (2018). Understanding and misunderstanding randomized controlled trials. *Social Science and Medicine*, *210*, 2–21. https://doi.org/10.1016/j.socscimed.2017.12.005

Deindl, P., Unterasinger, L., Kappler, G., Werther, T., Czaba, C., Giordano, V., Frantal, S., Berger, A., Pollak, A., & Olischar, M. (2013). Successful implementation of a neonatal pain and sedation protocol at 2 NICUs. *Pediatrics*, *132*(1), e211-218. https://doi.org/10.1542/peds.2012-2346

Delgado, M. R. (2007). Reward-related responses in the human striatum. *Annals of the New York Academy of Sciences*, *1104*, 70–88. https://doi.org/10.1196/annals.1390.002

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science*, *318*(5855), 1387–1388. https://doi.org/10.1126/SCIENCE.1151148

Dongara, A. R., Nimbalkar, S. M., Phatak, A. G., Patel, D. V., & Nimbalkar, A. S. (2017). An educational intervention to improve nurses' understanding of pain in children in western India. *Pain Management Nursing*, *18*(1), 24–32. https://doi.org/10.1016/j.pmn.2016.10.003

Duggleby, W., & Lander, J. (1994). Cognitive status and postoperative pain: Older adults. *Journal of Pain and Symptom Management*, *9*(1), 19–27. https://doi.org/10.1016/0885-3924(94)90142-2

Dukić, V., Hayden, M., Forgor, A. A., Hopson, T., Akweongo, P., Hodgson, A., Monaghan, A., Wiedinmyer, C., Yoksas, T., Thomson, M. C., Trzaska, S., & Pandya, R. (2012). The role of weather in meningitis outbreaks in Navrongo, Ghana: A generalized additive modeling approach. *Journal of Agricultural, Biological, and Environmental Statistics*, *17*(3), 442–460. https://doi.org/10.1007/s13253-012-0095-9

Dusek, J. A., Griffin, K. H., Finch, M. D., Rivard, R. L., & Watson, D. (2018). Cost savings from reducing pain through the delivery of integrative medicine program to hospitalized patients. *The Journal of Alternative and Complementary Medicine*, *24*(6), 557–563. https://doi.org/10.1089/acm.2017.0203

Eid, T., Manias, E., Bucknall, T., & Almazrooa, A. (2014). Nurses' knowledge and attitudes regarding pain in Saudi Arabia. *Pain Management Nursing*, *15*(4), e25–e36. https://doi.org/10.1016/j.pmn.2014.05.014

Ekim, A., & Ocakcı, A. F. (2013). Knowledge and attitudes regarding pain management of pediatric nurses in Turkey. *Pain Management Nursing*, *14*(4), e262–e267. https://doi.org/10.1016/j.pmn.2012.02.004

Filipe, H. P., Silva, E. D., Stulting, A. A., & Golnik, K. C. (2014). Continuing professional development: best practices. *Middle East African Journal of Ophthalmology*, *21*(2), 134–141. https://doi.org/10.4103/0974-9233.129760

Finegold, J. A., Asaria, P., & Francis, D. P. (2013). Mortality from ischaemic heart disease by country, region, and age: Statistics from World Health Organisation and United Nations. *International Journal of Cardiology*, *168*(2), 934–945. https://doi.org/10.1016/j.ijcard.2012.10.046

Fitzgerald, M. (2011). The neurobiology of chronic pain in children. In *Handbook of Pediatric Chronic Pain* (pp. 15–25). Springer New York. https://doi.org/10.1007/978-1-4419-0350-1_2

Forgeron, P. A., Evans, J., & Finley, G. A. (2009). Children's pain assessment in Northeastern Thailand : perspectives of health professionals. *Qualitative Health Research*, *19*(1), 71–81.

Francis, L., & Fitzpatrick, J. J. (2013). Postoperative pain: Nurses' knowledge and patients' experiences. *Pain Management Nursing*, *14*(4), 351–357. https://doi.org/10.1016/j.pmn.2012.05.002

Friedrichsdorf, S. J., & Postier, A. C. (2019). Recent advances in pain treatment for children with serious illness. *Pain Management*, *9*(6), 583–596. https://doi.org/10.2217/pmt-2019-0029

Furåker, C. (2008). Registered nurses' views on their professional role. *Journal of Nursing Management*, *16*(8), 933–941. https://doi.org/10.1111/j.1365-2834.2008.00872.x

Gadallah, M. A., Hassan, A. M., & Shargawy, S. A. (2017). Undergraduate nursing students' knowledge and attitude regarding pain management of children in Upper Egypt. *J Nurs Educ Pract*, *7*(6), 101–108.

Gaglani, A., & Gross, T. (2018). Pediatric pain management. *Emergency Medicine Clinics of North America*, *36*(2), 323–334. https://doi.org/10.1016/j.emc.2017.12.002

Gallo, A. (2003). The fifth vital sign: Implementation of the Neonatal Infant Pain Scale. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, *32*(2), 199–206. https://doi.org/10.1177/0884217503251745

Ghana Health Service. (2017). *The health sector in Ghana: Facts and figures*. Ghana Health Service. https://www.ghanahealthservice.org/downloads/FACTS+FIGURES_2017.pdf

Ghana Health Service. (2020a). *Organisational structure*. https://www.ghanahealthservice.org/ghs-subcategory.php?cid=&scid=43

Ghana Health Service. (2020b). *Reproductive and child health department*. https://www.ghanahealthservice.org/division-scat.php?ghs&ghsscid=26&ghsdid=2

Ghana Statistical Service. (2019). *Demography: Population projection*. https://www.statsghana.gov.gh/nationalaccount_macros.php?Stats=MTA1NTY1NjgxLjUwNg==/webstats/s679n2sn87

Gorodzinsky, A. Y., Hainsworth, K. R., & Weisman, S. J. (2011). School functioning and chronic pain: A review of methods and measures. *Journal of Pediatric Psychology*, *36*(9), 991–1002. https://doi.org/10.1093/jpepsy/jsr038

Goucke, C. R., Jackson, T., Morriss, W., & Royle, J. (2015). Essential pain management: An educational program for health care workers. *World Journal of Surgery*, *39*(4), 865–870. https://doi.org/10.1007/s00268-014-2635-7

Graham, D. A. (2019). Benefits of online teaching for face-to-face teaching at historically black colleges and universities. *Online Learning*, *23*(1), 144–163. https://files.eric.ed.gov/fulltext/EJ1211047.pdf

Grant, J. (2002). Learning needs assessment: Assessing the need. *British Medical Journal*, *324*(7330), 156–159. https://doi.org/10.1136/bmj.324.7330.156

Greenberger, C., Reches, H., & Riba, S. (2006). Levels and predictors of knowledge and attitudes regarding pain among Israeli baccalaureate nursing students and nurses pursuing specialty certification. *International Journal of Nursing Education Scholarship*, *3*(1), Article 8. https://doi.org/10.2202/1548-923X.1221

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly*, *82*(4), 581–629. https://doi.org/10.1111/j.0887-378X.2004.00325.x

Groenewald, C. B., Rabbitts, J. A., Schroeder, D. R., & Harrison, T. E. (2012). Prevalence of moderate-severe pain in hospitalized children. *Pediatric Anesthesia*, *22*(7), 661–668. https://doi.org/10.1111/j.1460-9592.2012.03807.x

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Sage Publications, Inc.

Habich, M., & Letizia, M. (2015). Pediatric pain assessment in the emergency department: A nursing evidence-based practice protocol. *Pediatric Nursing*, *41*(4), 198–202. http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=108944067&site=ehost-live

Habich, M., Wilson, D., Thielk, D., Melles, G. L., Crumlett, H. S., Masterton, J., & McGuire, J. (2012). Evaluating the effectiveness of pediatric pain management guidelines. *Journal of Pediatric Nursing*, *27*(4), 336–345. https://doi.org/10.1016/j.pedn.2011.06.002

Hanson, H. M., Salmoni, A. W., & Volpe, R. (2009). Defining program sustainability: Differing views of stakeholders. *Canadian Journal of Public Health*, *100*(4), 304–309. https://doi.org/10.1186/1748-5908-8-117

Harris, A. D., McGregor, J. C., Perencevich, E. N., Furuno, J. P., Zhu, J., Peterson, D. E., & Finkelstein, J. (2006). The use and interpretation of quasi-experimental studies in medical informatics. *Journal*

of the American Medical Informatics Association, *13*(1), 16–23. https://doi.org/10.1197/jamia.M1749

Harrison, D., Loughnan, P., Manias, E., & Johnston, L. (2009). Utilization of analgesics, sedatives, and pain scores in infants with a prolonged hospitalization: A prospective descriptive cohort study. *International Journal of Nursing Studies*, *46*(5), 624–632. https://doi.org/10.1016/j.ijnurstu.2008.11.001

He, H.-G., Jahja, R., Lee, T.-L., Ang, E. N. K., Sinnappan, R., Vehviläinen-Julkunen, K., & Chan, M. F. (2010). Nurses' use of non-pharmacological methods in children's postoperative pain management: Educational intervention study. *Journal of Advanced Nursing*, *66*(11), 2398–2409. https://doi.org/10.1111/j.1365-2648.2010.05402.x

He, H.-G., Jahja, R., Sinnappan, R., Ang, E. N. K., Lee, T.-L., Chan, M. F., & Vehviläinen-Julkunen, K. (2011). Singaporean nurses' provision of guidance to parents on non-pharmacological postoperative pain-relief methods: An educational intervention study. *Nursing & Health Sciences*, *13*(3), 344–351. https://doi.org/10.1111/j.1442-2018.2011.00624.x

He, H.-G., Polkki, T., Vehvilainen-Julkunen, K., & Pietila, A.-M. (2005). Chinese nurses' use of non-pharmacological methods in children's postoperative pain relief. *Journal of Advanced Nursing*, *51*(4), 335–342. https://doi.org/10.1111/j.1365-2648.2005.03505.x

He, H., Vehviläinen-Julkunen, K., Pölkki, T., & Pietilä, A. (2010). Chinese parents' perception of support received and recommendations regarding children's postoperative pain management. *International Journal of Nursing Practice*, *16*(3), 254–261. https://doi.org/10.1111/j.1440-172X.2010.01838.x

He, H G, Vehvilainen-Julkunen, K., Pietila, A. M., & Polkki, T. (2008). Increasing nurses' knowledge and behavior changes in nonpharmacological pain management for children in China. *Journal of Nursing Care Quality*, *23*(2), 170–176. https://doi.org/10.1097/01.NCQ.0000313767.09891.0a [doi]

Heinrich, M., Mechea, A., & Hoffmann, F. (2016). Improving postoperative pain management in children by providing regular training and an updated pain therapy concept. *European Journal of Pain*, *20*(4), 586–593. https://doi.org/10.1002/ejp.770

Hockenberry, M. J., Wilson, D., & Rodgers, C. C. (2019). *Wong's nursing care of infants and children* (11th ed.). Elsevier.

Hodges, L. C. (2018). Contemporary issues in group learning in undergraduate science classrooms: A perspective from student engagement. *CBE - Life Sciences Education*, *17*(2), es3. https://doi.org/10.1187/cbe.17-11-0239

Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D. G., Barbour, V., Macdonald, H., Johnston, M., Kadoorie, S. E. L., Dixon-Woods, M., McCulloch, P., Wyatt, J. C., Phelan, A. W. C., & Michie, S. (2014). Better reporting of interventions: Template for intervention description and replication (TIDieR) checklist and guide. *BMJ*, *348*, g1687. https://doi.org/10.1136/bmj.g1687

Hoffmann, T. C., Oxman, A. D., Ioannidis, J. P., Moher, D., Lasserson, T. J., Tovey, D. I., Stein, K., Sutcliffe, K., Ravaud, P., Altman, D. G., Perera, R., & Glasziou, P. (2017). Enhancing the usability of systematic reviews by improving the consideration and description of interventions. *BMJ*, *358*, 2998. https://doi.org/10.1136/bmj.j2998

Houle, T. T., Penzien, D. B., & Houle, C. K. (2005). Statistical power and sample size estimation for headache research: An overview and power calculation tools. *Headache*, *45*(5), 414–418. https://doi.org/10.1111/j.1526-4610.2005.05092.x

Hroch, J., VanDenKerkhof, E. G., Sawhney, M., Sears, N., & Gedcke-Kerr, L. (2019). Knowledge and attitudes about pain management among Canadian nursing students. *Pain Management Nursing*, *20*(4), 382–389. https://doi.org/10.1016/j.pmn.2018.12.005

Huang, K. T. L., Owino, C., Gramelspacher, G. P., Monahan, P. O., Tabbey, R., Hagembe, M., Strother, R. M., Njuguna, F., & Vreeman, R. C. (2013). Prevalence and correlates of pain and pain treatment

in a western Kenya referral hospital. *Journal of Palliative Medicine*, *16*(10), 1260–1267. https://doi.org/10.1089/jpm.2013.0080

Huijer, H. A.-S., Miaskowski, C., Quinn, R., & Twycross, A. (2012). *IASP curriculum outline on pain for nursing*. IASP. https://www.iasp-pain.org/Education/CurriculumDetail.aspx?ItemNumber=2052

Hurley-Wallace, A., Wood, C., Franck, L. S., Howard, R. F., & Liossi, C. (2019). Paediatric pain education for health care professionals. *Pain Reports*, *4*(1), e701. https://doi.org/10.1097/PR9.0000000000000701

Huth, M. M., Gregg, T. L., & Lin, L. (2010). Education changes Mexican nurses' knowledge and attitudes regarding pediatric pain. *Pain Management Nursing*, *11*(4), 201–208. https://doi.org/10.1016/j.pmn.2009.11.001

International Association for the Study of Pain. (1979). Pain terms: A list with definitions and notes on usage. Recommended by the IASP Subcommittee on Taxonomy. *Pain*, *6*(3), 249.

Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research*, *11*(1), 29–49. https://www.learntechlib.org/primary/p/8371/

Jones, S. R., Carley, S., & Harrison, M. (2003). An introduction to power and sample size estimation. *Emergency Medicine Journal*, *20*(5), 453–458. https://doi.org/10.1136/emj.20.5.453

Kahan, D., & McKenzie, T. L. (2015). The potential and reality of physical education in controlling overweight and obesity. *American Journal of Public Health*, *105*(4), 653–659. https://doi.org/10.2105/AJPH.2014.302355

Kahsay, H. (2017). Assessment and treatment of pain in pediatric patients. *Current Pediatric Research*, *21*(1), 148–157. https://www.alliedacademies.org/articles/assessment-and-treatment-of-pain-in-pediatric-patients.html

Kannampallil, T. G., Schauer, G. F., Cohen, T., & Patel, V. L. (2011). Considering complexity in healthcare systems. *Journal of Biomedical Informatics*, *44*(6), 943–947. https://doi.org/10.1016/J.JBI.2011.06.006

Katende, G., & Mugabi, B. (2015). Comforting strategies and perceived barriers to pediatric pain management during IV line insertion procedure in Uganda's national referral hospital: A descriptive study. *BMC Pediatrics*, *15*(1), 122. https://doi.org/10.1186/s12887-015-0438-0

Kawinkoonlasate, P. (2019). *English language teaching*. *12*(11). https://doi.org/10.5539/elt.v12n11p23

Kay, D., & Kibble, J. (2016). Learning theories 101: Application to everyday teaching and scholarship. *Advances in Physiology Education*, *40*(1), 17–25. https://doi.org/10.1152/advan.00132.2015

Kim, N., Fischer, A. H., Dyring-Andersen, B., Rosner, B., & Okoye, G. A. (2017). Research techniques made simple: Choosing appropriate statistical methods for clinical research. *Journal of Investigative Dermatology*, *137*(10), e173–e178. https://doi.org/10.1016/j.jid.2017.08.007

Kingsnorth, S., Joachimides, N., Krog, K., Davies, B., & Higuchi, K. S. (2015). Optimal pain assessment in pediatric rehabilitation: implementation of a nursing guideline. *Pain Management Nursing*, *16*(6), 871–880. https://doi.org/10.1016/j.pmn.2015.07.009

Kitaj, M. B., & Klink, M. (2005). Pain thresholds in daily transformed migraine versus episodic migraine headache patients. *Headache*, *45*(8), 992–998. https://doi.org/10.1111/j.1526-4610.2005.05179.x

Knowlton, L. W., & Phillips, C. C. (2013). The logic model guidebook: Better strategies for great results. SAGE.

Kowalczuk, K., Krajewska-Kułak, E., & Sobolewski, M. (2020). Working excessively and burnout among nurses in the context of sick leaves. *Frontiers in Psychology*, *11*, 285. https://doi.org/10.3389/fpsyg.2020.00285

Kozlowski, L. J., Kost-Byerly, S., Colantuoni, E., Thompson, C. B., Vasquenza, K. J., Rothman, S. K., Billett, C., White, E. D., Yaster, M., & Monitto, C. L. (2014). Pain prevalence, intensity, assessment and management in a hospitalized pediatric population. *Pain Management Nursing*, *15*(1), 22–35. https://doi.org/10.1016/j.pmn.2012.04.003

Kraemer, F. W. (2010). Treatment of acute pediatric pain. *Seminars in Pediatric Neurology*, *17*(4), 268–274. https://doi.org/10.1016/j.spen.2010.10.010

Kruk, M. E., Gage, A. D., Arsenault, C., Jordan, K., Leslie, H. H., Roder-DeWan, S., Adeyi, O., Barker, P., Daelmans, B., Doubova, S. V, English, M., Elorrio, E. G., Guanais, F., Gureje, O., Hirschhorn, L. R., Jiang, L., Kelley, E., Lemango, E. T., Liljestrand, J., … Pate, M. (2018). High-quality health systems in the sustainable development goals era: Time for a revolution. *The Lancet Global Health*, *6*(11), e1196–e1252. https://doi.org/10.1016/S2214-109X(18)30386-3

Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia - Social and Behavioral Sciences*, *31*, 486–490. https://www.sciencedirect.com/science/article/pii/S1877042811030205

Langley, P., Pérez Hernández, C., Margarit Ferri, C., Ruiz Hidalgo, D., & Lubián López, M. (2011). Pain, health related quality of life and healthcare resource utilization in Spain. *Journal of Medical Economics*, *14*(5), 628–638. https://doi.org/10.3111/13696998.2011.604369

Larjow, E., Papavasiliou, E., Payne, S., Scholten, W., & Radbruch, L. (2016). A systematic content analysis of policy barriers impeding access to opioid medication in central and eastern Europe: Results of ATOME. *Journal of Pain and Symptom Management*, *51*(1), 99–107. https://www.jpsmjournal.com/article/S0885-3924(15)00460-1/pdf

Lauzon Clabo, L. M. (2008). An ethnography of pain assessment and the role of social context on two postoperative units. *Journal of Advanced Nursing*, *61*(5), 531–539. https://doi.org/10.1111/j.1365-2648.2007.04550.x

Lawrence, D. W. (2008). What is lost when searching only one literature database for articles relevant to injury prevention and safety promotion? *Injury Prevention*, *14*(6), 401–404. https://doi.org/10.1136/IP.2008.019430

Le May, S., Johnston, C. C., Choinière, M., Fortin, C., Kudirka, D., Murray, L., & Chalut, D. (2009). Pain Management Practices in a Pediatric Emergency Room (PAMPER) Study: Interventions with nurses. *Pediatric Emergency Care*, *25*(8), 498–503. https://doi.org/10.1097/PEC.0b013e3181b0a0af

Leininger, M. M. (2006). Ethnonursing: A research method with enablers to study the theory of culture care. In M. M. Leininger & M. R. McFarland (Eds.), *Culture care diversity and universality: A worldwide theory of nursing* (2nd ed., pp. 43–82). Jones and Bartlett Publishers.

Lemeshow, A. R., Blum, R. E., Berlin, J. A., Stoto, M. A., & Colditz, G. A. (2005). Searching one or two databases was insufficient for meta-analysis of observational studies. *Journal of Clinical Epidemiology*, *58*(9), 867–873. https://doi.org/10.1016/j.jclinepi.2005.03.004

Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, *7*(1), 24–25. https://pubmed.ncbi.nlm.nih.gov/16557257/

Lewis, C., Darnell, D., Kerns, S., Monroe-DeVita, M., Landes, S. J., Lyon, A. R., Stanick, C., Dorsey, S., Locke, J., Marriott, B., Puspitasari, A., Dorsey, C., Hendricks, K., Pierson, A., Fizur, P., Comtois, K. A., Palinkas, L. A., Chamberlain, P., Aarons, G. A., … Dorsey, C. (2016). Proceedings of the 3rd biennial conference of the society for implementation research collaboration (SIRC) 2015: Advancing efficient methodologies through community partnerships and team science. *Implementation Science*, *11*(S1), 85. https://doi.org/10.1186/s13012-016-0428-0

Lipsitz, L. A. (2012). Understanding health care as a complex system: the foundation for unintended consequences. *JAMA*, *308*(3), 243–244. https://doi.org/10.1001/jama.2012.7551

Lloyd, H. (2017). Theory without practice is empty; practice without theory is blind: The inherent inseparability of doctrine and skills. In L. H. Edwards (Ed.), *The Doctrine Skills Divide: Legal education's Self-Inflicted Wound* (pp. 77–90). Carolina Academic Press.

Logan, D. E., Simons, L. E., & Carpino, E. A. (2012). Too sick for school? Parent influences on school functioning among children with chronic pain. *Pain*, *153*(2), 437–443. https://doi.org/10.1016/j.pain.2011.11.004

Lorenz, E., Köpke, S., Pfaff, H., & Blettner, M. (2018). Cluster-randomized studies. *Deutsches Arzteblatt International*, *115*(10), 163–168. https://doi.org/10.3238/arztebl.2018.0163

Lunsford, L. (2015). Knowledge and attitudes regarding pediatric pain in Mongolian nurses. *Pain Management Nursing*, *16*(3), 346–353. https://doi.org/10.1016/j.pmn.2014.08.007

Mackintosh-Franklin, C. (2017). Pain: A content review of undergraduate pre-registration nurse education in the United Kingdom. *Nurse Education Today*, *48*, 84–89. https://doi.org/10.1016/j.nedt.2016.08.035

Málek, J., Ševčík, P., Bejšovec, D., Gabrhelík, T., Hnilicová, M., Křikava, I., Kubricht, V., Lejčko, J., Mach, D., & Mixa, V. (2017). *Postoperative pain management* (3rd ed.). Mladá fronta.

Manges, K., Scott-Cawiezell, J., & Ward, M. M. (2017). Maximizing team performance: The critical role of the nurse leader. *Nursing Forum*, *52*(1), 21–29. https://doi.org/10.1111/nuf.12161

Manworren, R. C. (2000). Pediatric nurses' knowledge and attitudes survey regarding pain. *Pediatric Nursing*, *26*(6), 610–614. http://www.ncbi.nlm.nih.gov/pubmed/12026363

Manworren, R. C. (2001). Development and testing of the pediatric nurses' knowledge and attitudes survey regarding pain. *Pediatric Nursing*, *27*(2), 151–158.

Manworren, R. C. B., & Stinson, J. (2016). Pediatric pain measurement, assessment, and evaluation. *Seminars in Pediatric Neurology*, *23*(3), 189–200. https://doi.org/10.1016/j.spen.2016.10.001

Manworren, R., LaFond, C., Wittmayer, K., Cordaro, L., Seewald, N., Hoeman, E., Fanelli, J., Park, S., Duggan, S., & Porfyris, S. (2018). Interdisciplinary education to improve pediatric healthcare providers' knowledge and attitudes regarding pain. *The Journal of Pain*, *19*(3), S97. https://doi.org/10.1016/j.jpain.2017.12.211

Marun, G. N., Morriss, W. W., Lim, J. S., Morriss, J. L., & Goucke, C. R. (2020). Addressing the challenge of pain education in low-resource countries. *Anesthesia & Analgesia*, *130*(6), 1. https://doi.org/10.1213/ane.0000000000004742

Mathew, P. J., Mathew, J. L., & Singhi, S. (2011). Knowledge, attitude and practice of pediatric critical care nurses towards pain: survey in a developing country setting. *Journal of Postgraduate Medicine*, *57*(3), 196–200. https://doi.org/10.4103/0022-3859.85203 [doi]

Mattick, K., Barnes, R., & Dieppe, P. (2013). Medical education: a particularly complex intervention to research. *Advances in Health Sciences Education*, *18*(4), 769–778. https://doi.org/10.1007/s10459-012-9415-7

Matula, S. T., Polomano, R. C., & Irving, S. Y. (2018). The state of the science in paediatric pain management practices in low-middle income countries: An integrative review. *International Journal of Nursing Practice*, *24*(6), e12695. https://doi.org/10.1111/ijn.12695

Mayer, R. E. (2010). Applying the science of learning to medical education. *Medical Education*, *44*(6), 543–549. https://doi.org/10.1111/j.1365-2923.2010.03624.x

Mayne, J. (2001). La revue Canadienne d'evaluation de programme addressing attribution through contribution analysis: Using performance measures sensibly. *The Canadian Journal of Program Evaluation*, *16*(1), 1–24.

Mazhin, S. A., Kiarsi, M., Moosavi, A., Maniey, M., Zakeri, O., & Moghaddam, A. S. (2018). Investigating the frequency, prevalence and management of pain in children. *Journal of Advanced Pharmacy Education and Research*, *8*(4), 109–115.

Menheere, A., & Hooge, E. H. (2010). Parental involvement in children's education: A review study about the effect of parental involvement on children's school education with a focus on the position of illiterate parents. *Journal of the European Teacher Education Network* , *6*, 144–157. https://pdfs.semanticscholar.org/60a7/ce2e4a45dfc0489b3d0151055a0d76b5a566.pdf

Miaskowski, C., Nichols, R., Brody, R., & Synold, T. (1994). Assessment of patient satisfaction utilizing the American Pain Society's quality assurance standards on acute and cancer-related pain. *Journal of Pain and Symptom Management*, *9*(1), 5–11. https://doi.org/10.1016/0885-3924(94)90140-6

Ministry of Health. (2011). *Ghana human resources for health country profile*. Ministry of Health. https://www.moh.gov.gh/wp-content/uploads/2016/02/Ghana-hrh-country-profile.pdf

Ministry of Health. (2020). *Ministry of Health: Republic of Ghana*. https://www.moh.gov.gh/the-ministry/

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., Atkins, D., Barbour, V., Barrowman, N., Berlin, J. A., Clark, J., Clarke, M., Cook, D., D'Amico, R., Deeks, J. J., Devereaux, P. J., Dickersin, K., Egger, M., Ernst, E., … Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Möhler, R., Köpke, S., & Meyer, G. (2015). Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: Revised guideline (CReDECI 2). *Trials*, *16*(1). https://doi.org/10.1186/s13063-015-0709-y

Mulvaney, S., Lambert, E. W., Garber, J., & Walker, L. S. (2006). Trajectories of symptoms and impairment for pediatric patients with functional abdominal pain: A 5-year longitudinal study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *45*(6), 737–744. https://doi.org/10.1097/10.chi.0000214192.57993.06

Namnabati, M., Abazari, P., & Talakoub, S. (2012). Identification of perceived barriers of pain management in Iranian children: A qualitative study. *International Journal of Nursing Practice*, *18*(3), 221–225. https://doi.org/10.1111/j.1440-172X.2011.01981.x

National Heart Lung and Blood. (n.d.). *Study quality assessment tools*. National Heart, Blood and Lung Institute. Retrieved May 24, 2018, from https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools

Noel, M., Rabbitts, J. A., Tai, G. G., & Palermo, T. M. (2015). Remembering pain after surgery: A longitudinal examination of the role of pain catastrophizing in children's and parents' recall. *Pain*, *156*(5), 800–808. https://doi.org/10.1097/j.pain.0000000000000102

Noh, J.-W., Park, B. S., Kim, E. J., & Kim, M. H. (2018). The investigation of the educational needs on the job competence for physicaltherapist assistant in the students of Quang Tri medical college inVietnam. *Journal of Physical Therapy Science*, *30*(12), 1428–1433. https://doi.org/10.1589/JPTS.30.1428

Notejane, M., & Bernadá, M. (2019). Knowledge of nursing staff at a pediatric referral hospital regarding the assessment and management of pain in children. *Boletin Medico Del Hospital Infantil de Mexico*, *76*(1), 27–34. https://doi.org/https://doi.org/10.24875/BMHIM.18000076

Nugraha, S. T., Suwandi, S., Nurkamto, J., & Saddhono, K. (2018). The importance of needs assessment for the implementation of e-learning in a language program. *KnE Social Sciences*, *3*(9), 254. https://doi.org/10.18502/kss.v3i9.2686

O'Cathain, A., Croot, L., Duncan, E., Rousseau, N., Sworn, K., Turner, K. M., Yardley, L., & Hoddinott, P. (2019). Guidance on how to develop complex interventions to improve health and healthcare. *BMJ Open*, *9*, e029954. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6701588/pdf/bmjopen-2019-029954.pdf

O'Cathain, A., Croot, L., Sworn, K., Duncan, E., Rousseau, N., Turner, K., Yardley, L., & Hoddinott, P. (2019). Taxonomy of approaches to developing interventions to improve health: A systematic methods overview. *Pilot and Feasibility Studies*, *5*(1), 41. https://doi.org/10.1186/s40814-019-0425-6

O'Mathúna, D. P. (2000). Evidence-based practice and reviews of therapeutic touch. *Journal of Nursing Scholarship*, *32*(3), 279–285. https://doi.org/10.1111/J.1547-5069.2000.00279.X

Odell, S., & Logan, D. E. (2013). Pediatric pain management: The multidisciplinary approach. *Journal of Pain Research*, *6*, 785–790. https://doi.org/10.2147/JPR.S37434

Oliveira, N. C. A. C., & Linhares, M. B. M. (2015). Nonpharmacological interventions for pain relief in children: A systematic review. *Psychology & Neuroscience*, *8*(1), 28–38. https://doi.org/10.1037/h0101030

Ortiz, M. I., Ponce-Monter, H. A., Rangel-Flores, E., Castro-Gamez, B., Romero-Quezada, L. C., O'Brien, J. P., Romo-Hernández, G., & Escamilla-Acosta, M. A. (2015a). Nurses' and nursing students' knowledge and attitudes regarding pediatric pain. *Nursing Research and Practice*, *2015*, 210860. https://doi.org/10.1155/2015/210860

Ortiz, M. I., Ponce-Monter, H. A., Rangel-Flores, E., Castro-Gamez, B., Romero-Quezada, L. C., O'Brien, J. P., Romo-Hernández, G., & Escamilla-Acosta, M. A. (2015b). Nurses' and nursing students' knowledge and attitudes regarding pediatric pain. *Nursing Research and Practice*, *2015*, 1–8. https://doi.org/10.1155/2015/210860

Overmeer, T., Boersma, K., Denison, E., & Linton, S. J. J. (2011). Does teaching physical therapists to deliver a biopsychosocial treatment program result in better patient outcomes? A randomized controlled trial. *Physical Therapy*, *91*(5), 804–819. https://doi.org/10.2522/ptj.20100079

Palermo, T. M., Valrie, C. R., & Karlson, C. W. (2014). Family and parent influences on pediatric chronic pain: A developmental perspective. *American Psychologist*, *69*(2), 142–152. https://doi.org/10.1037/a0035216

Pannucci, C. J., & Wilkins, E. G. (2010). Identifying and avoiding bias in research. *Plastic and Reconstructive Surgery*, *126*(2), 619–625. https://doi.org/10.1097/PRS.0b013e3181de24bc

Peirce, D., Corkish, V., Lane, M., & Wilson, S. (2018). Nurses' knowledge and attitudes regarding pediatric pain management in western Australia. *Pain Management Nursing*, *19*(6), 707–717.

Petrović, J., & Pale, P. (2015). Students' perception of live lectures' inherent disadvantages. *Teaching in Higher Education*, *20*(2), 143–157. https://doi.org/10.1080/13562517.2014.962505

Pfund, R., & Fowler-Kerry, S. (2010). *Perspectives on palliative care for children and young people : A global discourse* (R. Pfund & S. Fowler-Kerry (Eds.); 1st ed.). https://doi.org/https://doi.org/10.1201/9781315383637

Pluye, P., Robert, E., Cargo, M., & Bartlett, G. (2011). Mixed Method Appraisal Tool (MMAT). *Montréal: McGill University*, *Part I*, 1–8.

Polit, D. F., & Beck, C. T. (2012). *Nursing research: Generating and assessing evidence for nursing practice.* (9th ed.). Lippincott, Williams & Wilkins.

Predebon, C. M., Cruz, D. de A. L. M. da, Matos, F. G. de O. A., Ferreira, A. M., Pasin, S., & Rabelo, E. R. (2015). Evaluation of pain and accuracy diagnostic in hospitalized children. *International Journal of Nursing Knowledge*, *23*(2), 106–113. https://doi.org/10.1111/2047-3095.12105

Racine, M., Hudson, M., Baron, M., Nielson, W. R., Pope, J., Markland, J., Robinson, D., Jones, N., Khalidi, N., Docherty, P., Kaminska, E., Masseto, A., Sutton, E., Mathieu, J.-P., Ligier, S., Grodzicky, T., Thorne, C., Gyger, G., Smith, D., … Larché, M. (2016). The impact of pain and itch on functioning and health-related quality of life in systemic sclerosis: An exploratory study. *Journal of Pain and Symptom Management*, *52*(1), 43–53. https://doi.org/10.1016/j.jpainsymman.2015.12.314

Rajasagaram, U., Taylor, D. M., Braitberg, G., Pearsell, J. P., & Capp, B. A. (2009). Paediatric pain assessment: Differences between triage nurse, child and parent. *Journal of Paediatrics and Child Health*, *45*(4), 199–203. https://doi.org/10.1111/j.1440-1754.2008.01454.x

Ramira, M. L., Instone, S., & Clark, M. J. (2016). Pediatric pain management: An evidence-based approach. *Pediatric Nursing*, *42*(1), 39–49.

Ranger, M., Johnston, C. C., & Anand, K. J. S. (2007). Current controversies regarding pain assessment in neonates. *Seminars in Perinatology*, *31*(5), 283–288. https://doi.org/10.1053/j.semperi.2007.07.003

Ranson, M. K., Chopra, M., Munro, S., Dal Poz, M., & Bennett, S. (2008). Establishing human resources for health research priorities in developing countries using a participatory methodology. World Health Organisation.

Risjord, M. (2019). Middle-range theories as models: New criteria for analysis and evaluation. *Nursing Philosophy*, *20*(1), e12225. https://doi.org/10.1111/nup.12225

Rosenberg, R. E., Klejmont, L., Gallen, M., Fuller, J., Dugan, C., Budin, W., & Olsen-Gallagher, I. (2016). Making comfort count: Using quality improvement to promote pediatric procedural pain management. *Hospital Pediatrics*, *6*(6), 359–368. https://doi.org/10.1542/hpeds.2015-0240 [doi]

Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social withdrawal in childhood. *Annual Review of Psychology*, *60*(1), 141–171. https://doi.org/10.1146/annurev.psych.60.110707.163642

Samarkandi, O. (2018). Knowledge and attitudes of nurses toward pain management. *Saudi Journal of Anaesthesia*, *12*(2), 220. https://doi.org/10.4103/sja.sja_587_17

Schwappach, D. L. B., Pfeiffer, Y., & Taxis, K. (2016). Medication double-checking procedures in clinical practice: A cross-sectional survey of oncology nurses' experiences. *BMJ Open*, *6*(6), e011394. https://doi.org/10.1136/BMJOPEN-2016-011394

Scott, L. E., Crilly, J., Chaboyer, W., & Jessup, M. (2013). Paediatric pain assessment and management in the emergency setting: The impact of a paediatric pain bundle. *International Emergency Nursing*, *21*(3), 173–179. https://doi.org/10.1016/j.ienj.2012.08.004

Serdenciuc, N. L. (2013). Competency-based education – implications on teachers' training. *Procedia Social and Behavioral Sciences*, *76*, 754–758. https://doi.org/10.1016/j.sbspro.2013.04.200

Sessle, B. (2011). Unrelieved pain: A crisis. *Pain Research & Management*, *16*(6), 416–420. https://doi.org/10.1155/2011/513423

Setia, M. S. (2016). Methodology series module 5: Sampling strategies. *Indian Journal of Dermatology*, *61*(5), 505. https://doi.org/10.4103/0019-5154.190118

Severino, S., & Messina, R. (2011). Group dynamics in on-line and face-to-face interactions: An experimental study on learning methods. *Sociology Mind*, *01*(02), 65–73. https://doi.org/10.4236/sm.2011.12008

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015: Elaboration and explanation. *BMJ*, *349:g7647*. https://doi.org/10.1136/BMJ.G7647

Simera, I., Moher, D., Hirst, A., Hoey, J., Schulz, K. F., & Altman, D. G. (2010). Transparent and accurate reporting increases reliability, utility, and impact of your research: Reporting guidelines and the EQUATOR Network. *BMC Medicine*, *8*, 24. https://doi.org/10.1186/1741-7015-8-24

Simons, J., Franck, L., & Roberson, E. (2001). Parent involvement in children's pain care: Views of parents and nurses. *Journal of Advanced Nursing*, *36*(4), 591–599. https://doi.org/10.1046/j.1365-2648.2001.02012.x

Simons, J., & MacDonald, L. M. (2006). Changing practice: Implementing validated paediatric pain assessment tools. *Journal of Child Health Care*, *10*(2), 160–176. https://doi.org/10.1177/1367493506062555

Sinatra, R. (2010). Causes and consequences of inadequate management of acute pain. *Pain Medicine*, *11*(12), 1859–1871. https://doi.org/10.1111/j.1526-4637.2010.00983.x

Size, M., Soyannwo, O. A., & Justins, D. M. (2007). Pain management in developing countries. *Anaesthesia*, *62*(SUPPL. 1), 38–43. https://doi.org/10.1111/j.1365-2044.2007.05296.x

Smeland, A. H., Twycross, A., Lundeberg, S., & Rustøen, T. (2018). Nurses' knowledge, attitudes and clinical practice in pediatric postoperative pain management. *Pain Management Nursing*, *19*(6), 585–598. https://doi.org/10.1016/j.pmn.2018.04.006

Snilstveit, B., Oliver, S., & Vojtkova, M. (2012). Narrative approaches to systematic review and synthesis of evidence for international development policy and practice. *Journal of Development Effectiveness*, *4*(3), 409–429. https://doi.org/10.1080/19439342.2012.710641

Solé, E., Tomé-Pires, C., De La Vega, R., Racine, M., Castarlenas, E., Jensen, M. P., & Miró, J. (2016). Cognitive fusion and pain experience in young people. *Clinical Journal of Pain*, *32*(7), 602–608. https://doi.org/10.1097/AJP.0000000000000227

Srouji, R., Ratnapalan, S., & Schneeweiss, S. (2010a). Pain in children: Assessment and nonpharmacological management. *International Journal of Pediatrics*, *2010*, 474838. https://doi.org/10.1155/2010/474838

Srouji, R., Ratnapalan, S., & Schneeweiss, S. (2010b). Pain in children: Assessment and nonpharmacological management. *International Journal of Pediatrics*, *2010*, 474838. https://doi.org/10.1155/2010/474838

Stanley, M., & Pollard, D. (2013). Relationship between knowledge, attitudes, and self-efficacy of nurses in the management of pediatric pain. *Pediatric Nursing*, *39*(4), 165–171. http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=104206987&site=ehost-live

Stevens, B., Donkor, E. S., Goka, B. Q., Odame, I., Langins, M., Riahi, S., De Young, S., Walters, D., Eliason, C., Fleming-Carroll, B., Barnes, G., Ekey, F. V., Hubley, P., Nyanteh, F., Mensah, E., & Sackey, I. (2014). Impact and sustainability of an accredited paediatric nursing training programme in Ghana. *Journal of Nursing Education and Practice*, *4*(12), 142–154. https://doi.org/10.5430/jnep.v4n12p142

Stevens, B. J., Harrison, D., Rashotte, J., Yamada, J., Abbott, L. K., Coburn, G., Stinson, J., Le May, S., & CIHR Team in Children's Pain. (2012). Pain assessment and intensity in hospitalized children in Canada. *The Journal of Pain*, *13*(9), 857–865. https://doi.org/10.1016/j.jpain.2012.05.010

Stocki, D., McDonnell, C., Wong, G., Kotzer, G., Shackell, K., & Campbell, F. (2018). Knowledge translation and process improvement interventions increased pain assessment documentation in a large quaternary paediatric post-anaesthesia care unit. *BMJ Open Quality*, *7*(3), e000319. https://doi.org/10.1136/bmjoq-2018-000319

Subramaniam, S. D., Doss, B., Chanderasekar, L. D., Madhavan, A., & Rosary, A. M. (2018). Scope of physiological and behavioural pain assessment techniques in children - a review. *Healthcare Technology Letters*, *5*(4), 124–129. https://doi.org/10.1049/htl.2017.0108

Sudheesh, K., Duggappa, D. R., & Nethra, S. S. (2016). How to write a research proposal? *Indian Journal of Anaesthesia*, *60*(9), 631–634. https://doi.org/10.4103/0019-5049.190617

Tacconelli, E. (2010). Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases*, *10*(4), 226. https://doi.org/10.1016/S1473-3099(10)70065-7

Taddio, A. (2015). Setting the stage for improved practices during vaccine injections: A knowledge synthesis of interventions for the management of pain and fear. *Clinical Journal of Pain*, *31*(10), S1–S2. https://doi.org/10.1097/AJP.0000000000000274

Taddio, A., Shah, V., Wang, J., Parikh, C., Smart, S., Ipp, M., Pillai Riddell, R., & Franck, L. S. (2015). Usability and knowledge testing of educational tools about infant vaccination pain management directed to postnatal nurses. *BMC Medical Education*, *15*(1), 45. https://doi.org/10.1186/s12909-015-0305-6

Tarquinio, C., Kivits, J., Minary, L., Coste, J., & Alla, F. (2015). Evaluating complex interventions: Perspectives and issues for health behaviour change interventions. *Psychology & Health*, *30*(1), 35–51. https://hal.univ-lorraine.fr/hal-01573571/document

Taylor, E. M., Boyer, K., & Campbell, F. A. (2008). Pain in hospitalized children: A prospective cross-sectional survey of pain prevalence, intensity, assessment and management in a Canadian pediatric teaching hospital. *Pain Research and Management*, *13*(1), 25–32. https://doi.org/10.1155/2008/478102

Ternullo, S., & DiAntonio, A. (2015). Assessment and treatment of pain in children. *US Pharm*, *5*, 15.

Thibodeau, M. A., Fetzner, M. G., Carleton, R. N., Kachur, S. S., & Asmundson, G. J. G. (2013). Fear of injury predicts self-reported and behavioral impairment in patients with chronic low back pain. *Journal of Pain*, *14*(2), 172–181. https://doi.org/10.1016/j.jpain.2012.10.014

Thomas, D., Kircher, J., Plint, A. C., Fitzpatrick, E., Newton, A. S., Rosychuk, R. J., Grewal, S., & Ali, S. (2015). Pediatric pain management in the emergency department: The triage nurses' perspective. *Journal of Emergency Nursing*, *41*(5), 407–413. https://doi.org/10.1016/j.jen.2015.02.012

Thomas, M. J. W. (2002). Learning within incoherent structures: the space of online discussion forums. *Journal of Computer Assisted Learning*, *18*(3), 351–366. https://doi.org/10.1046/j.0266-4909.2002.03800.x

Timans, R., Wouters, P., & Heilbron, J. (2019). Mixed methods research: What it is and what it could be. *Theory and Society*, *48*(2), 193–216. https://doi.org/10.1007/s11186-019-09345-5

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, *19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

Training evaluation form for participants in Iowa ESL regional trainings. (2020). https://www.opinionstage.com/rastgarsurvey/training-evaluation-form-for-participants-in-iowa-esl-regional-trainings

Tricco, A. C., Ashoor, H. M., Cardoso, R., MacDonald, H., Cogo, E., Kastner, M., Perrier, L., McKibbon, A., Grimshaw, J. M., & Straus, S. E. (2016). Sustainability of knowledge translation interventions in healthcare decision-making: A scoping review. *Implementation Science*, *11*, 55. https://doi.org/10.1186/s13012-016-0421-7

Twycross, A., Forgeron, P., & Williams, A. (2015). Paediatric nurses' postoperative pain management practices in hospital based non-critical care settings: A narrative review. *International Journal of Nursing Studies*, *52*(4), 836–863. https://doi.org/10.1016/j.ijnurstu.2015.01.009

Twycross, A., & Roderique, L. (2013). Review of pain content in three-year preregistration pediatric nursing courses in the united kingdom. *Pain Management Nursing*, *14*(4), 247–258. https://doi.org/10.1016/j.pmn.2011.05.002

Ung, A., Salamonson, Y., Hu, W., & Gallego, G. (2016). Assessing knowledge, perceptions and attitudes to pain management among medical and nursing students: A review of the literature. *British Journal of Pain*, *10*(1), 8–21.

United Nations. (2020). *World Economic Situation and Prospects 2020*. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2020_Annex.pdf

United Nations Committee for Development Policy. (2018). *Leaving no one behind*. https://sustainabledevelopment.un.org/content/documents/2754713_July_PM_2._Leaving_no_one_behind_Summary_from_UN_Committee_for_Development_Policy.pdf

United Nations International Children's Emergency Fund, World Health Organization, World Bank, & Division, U. N.-D. of E. and S. A. P. (2019). *Levels and trends in child mortality report 2019: Estimates developed by the UN inter-agency Group for Child Mortality Estimation*. World Health Organization. https://www.who.int/maternal_child_adolescent/documents/levels_trends_child_mortality_2019/en/

Upadhyay, S., Stephenson, A. L., & Smith, D. G. (2019). Readmission rates and their impact on hospital financial performance: A study of Washington hospitals. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, *56*, 004695801986038. https://doi.org/10.1177/0046958019860386

Vael, A., & Whitted, K. (2014). An educational intervention to improve pain assessment in preverbal children. *Pediatric Nursing*, *40*(6), 301–302. http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=103926585&site=ehost-live

Valeri, B. O., Holsti, L., & Linhares, M. B. M. (2015). Neonatal pain and developmental outcomes in children born preterm: A systematic review. *Clinical Journal of Pain*, *31*(4), 355–362. https://doi.org/10.1097/AJP.0000000000000114

van den Berg, T., Heymans, M. W., Leone, S. S., Vergouw, D., Hayden, J. A., Verhagen, A. P., & De Vet, H. C. (2013). Overview of data-synthesis in systematic reviews of studies on outcome prediction models. *BMC Medical Research Methodology*, *13*, 42. https://doi.org/10.1186/1471-2288-13-42

van der Heijden, M. J. E., de Jong, A., Rode, H., Martinez, R., & van Dijk, M. (2018). Assessing and addressing the problem of pain and distress during wound care procedures in paediatric patients with burns. *Burns*, *44*(1), 175–182. https://doi.org/10.1016/J.BURNS.2017.07.004

Van Hulle Vincent, C., Wilkie, D. J., & Wang, E. (2011). Pediatric nurses' beliefs and pain management practices. *Western Journal of Nursing Research*, *33*(6), 825–845. https://doi.org/10.1177/0193945910391681

Vega-Avelaira, D., McKelvey, R., Hathway, G., & Fitzgerald, M. (2012). The emergence of adolescent onset pain hypersensitivity following neonatal nerve injury. *Molecular Pain*, *8*, 30. https://doi.org/10.1186/1744-8069-8-30

Vejzovic, V., Bozic, J., Panova, G., Babajic, M., & Bramhagen, A. C. (2020). Children still experience pain during hospital stay: A cross-sectional study from four countries in Europe. *BMC Pediatrics*, *20*(1), 1–6. https://doi.org/10.1186/s12887-020-1937-1

Vickers, N. (2011). Knowledge and attitudes regarding pain among surgical nurses in three teaching hospitals in Ireland [Dublin City University, Ireland]. http://doras.dcu.ie/16608/

Von Baeyer, C. L., Uman, L. S., Chambers, C. T., & Gouthro, A. (2011). Can we screen young children for their ability to provide accurate self-reports of pain? *Pain*, *152*(6), 1327–1333. https://doi.org/10.1016/j.pain.2011.02.013

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *PLoS Medicine*, *4*(10), e29. https://doi.org/10.1371/journal.pmed.0040296

Waltz, K. N. (1997). Evaluating Theories. *American Political Science Review*, *91*(4), 913–917. https://doi.org/10.2307/2952173

White, P. F. (2008). Multimodal analgesia: Its role in preventing postoperative pain. *Current Opinion in Investigational Drugs* , *9*(1), 76–82. http://www.ncbi.nlm.nih.gov/pubmed/18183534

Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, *52*(5), 546–553. https://doi.org/10.1111/j.1365-2648.2005.03621.x

Williams, A. C. de C., & Craig, K. D. (2016). Updating the definition of pain. *Pain*, *157*(11), 2420–2423. https://doi.org/10.1097/j.pain.0000000000000613

Williams, R. F., Blakely, M. L., Fischer, P. E., Streck, C. J., Dassinger, M. S., Gupta, H., Renaud, E. J., Eubanks, J. W., Huang, E. Y., Hixson, S. D., & Langham, M. R. (2009). Diagnosing ruptured appendicitis preoperatively in pediatric patients. *Journal of the American College of Surgeons*, *208*(5), 819–825. https://doi.org/10.1016/j.jamcollsurg.2009.01.029

Williams, T. N. (2016). Sickle cell disease in sub-Saharan Africa. *Hematology Oncology Clinics of North America*, *30*(2), 343–358. https://doi.org/10.1016/j.hoc.2015.11.005

Wilmore, D. W., & Kehlet, H. (2001). Management of patients in fast track surgery. *British Medical Journal*, *322*(7284), 473–476. https://doi.org/10.1136/bmj.322.7284.473

Wludyka, P. (2012). Study designs and their outcomes. In K. Macha & J. P. McDonough (Eds.), *Epidemiology for Advanced Nursing Practice* (pp. 81–114). Jones & Barlett Learning. http://samples.jbpub.com/9780763789961/89961_CH03_Macha.pdf

World Bank. (2019). *Literacy rate, adult total (% of people ages 15 and above) - Ghana | Data*. https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=GH

Wren, A., Ross, A., D'Souza, G., Almgren, C., Feinstein, A., Marshall, A., & Golianu, B. (2019). Multidisciplinary pain management for pediatric patients with acute and chronic pain: A foundational treatment approach when prescribing opioids. *Children*, *6*(2), 33. https://doi.org/10.3390/children6020033

Yamane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). Harper and Row.

Zhou, H., Roberts, P., & Horgan, L. (2008). Association between self-report pain ratings of child and parent, child and nurse and parent and nurse dyads: Meta-analysis. *Journal of Advanced Nursing*, *63*(4), 334–342. https://doi.org/10.1111/j.1365-2648.2008.04694.x

Appendix

Appendix 1. Search strategies conducted on the databases.

Database	Search query	Search results	Included studies
Pediatric pain educational programs in developing countries			
CENTRAL	S1: ("child"):ti,ab,kw OR ("adolescent"):ti,ab,kw OR ("pediatric discipline"):ti,ab,kw S2: ("pain"):ti,ab,kw OR ("discomforting"):ti,ab,kw S3: ("education"):ti,ab,kw OR ("training"):ti,ab,kw OR ("instruction"):ti,ab,kw OR ("learning"):ti,ab,kw S4: ("program evaluation"):ti,ab,kw OR ("intervention study"):ti,ab,kw OR ("intervention research"):ti,ab,kw OR ("initiativeness"):ti,ab,kw S5: ("African"):ti,ab,kw S6: S1 AND S2 AND S3 AND S4 AND S5	7	5
CINAHL	S1: child* OR adolescent* OR P?ediatric* S2: discomfort or pain or distress S3: education or school or learning or teaching or classroom or education system S4: program or intervention or training or treatment or education S5: developing countries or developing nations or third world or low income countries or middle income countries S6: (nurse or nurses or nursing) OR (midwife or midwives or midwifery) S7: S1 AND S2 AND S3 AND S4 AND S5 AND S6	15	
PubMed/ Medline	S1: **((adolescent*) OR (child*)) OR (p?ediatric*)** S2: **(pain*) OR (discomfort*)** S3: ((((education*) OR (train*)) OR (instruct*)) OR (teach*)) OR (learn*) S4: **((program*) OR (intervention*)) OR (initiative*)** S5: **((developing countr*) OR (low income countr*)) OR (middle income countr*)** S6: **(nurs*) OR (midwi*)** S7: S1 AND S2 AND S3 AND S4 AND S5 AND S6	71	

Database	Search query	Search results	Included studies
Scopus	S1: child* OR adolescent* OR P?ediatric* S2: pain* OR discomfort* S3: education* OR train* OR instruct* OR teach* OR learn* S4: program* OR intervention* OR initiative* S5:developing AND countr* OR low AND income AND countr* OR middle AND income AND countr* S6: nurs* OR midwi* S7: S1 AND S2 AND S3 AND S4 AND S5 AND S6	4,844,940	
Behaviour change theories			
Embase	S1: behavio?r* OR character* OR competenc* OR abilit* OR knowledge OR attitude* OR skill* S2: chang* OR amend* OR modif* S3: theor* OR model* OR framework* S4: healthcare OR hospital* OR health* S5: S1 AND S2 AND S3 AND S4	169310	598,656
PubMed/ Medline	S1: ((((((Behavio?r*) OR character*) OR competenc*) OR abilit*) OR knowledge) OR attitude*) OR skill* S2: ((chang*) OR modif*) OR amend* S3: ((theor*) OR model*) OR framework* S4: ((healthcare) OR hospital*) OR health S5: S1 AND S2 AND S3 AND S4	7920	
Psychology database (ProQuest)	S1: Behavio?r* OR character* OR competenc* OR abilit* OR knowledge OR attitude* OR skill* S2: Chang* OR amend* OR modif* S3: Theor* OR model* OR framework* S4: Healthcare OR hospital* OR health* S5: S1 AND S2 AND S3 AND S4	425658	

Note: CENTRAL – Cochrane Central Register of Controlled Trials, CINAHL – Cumulative Index to Nursing and Allied Health Literature, S – Search query

UNIVERSITY OF TURKU

Painosalama Oy, Turku, Finland 2020

ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
ISBN 978-951-29-8218-9 (Print)
ISBN 978-951-29-8219-6 (PDF)