

Elina Koota

THE DEVELOPMENT OF AN
EVIDENCE-BASED PRACTICE
EDUCATIONAL
INTERVENTION AND ITS
EFFECTIVENESS ON
EMERGENCY NURSES'
ATTITUDES, KNOWLEDGE,
SKILLS, SELF-EFFICACY AND
BEHAVIOR

UNIVERSITY OF OULU GRADUATE SCHOOL;
UNIVERSITY OF OULU,
FACULTY OF MEDICINE;
MEDICAL RESEARCH CENTER OF OULU



ACTA UNIVERSITATIS OULUENSIS
D Medica 1582

ELINA KOOTA

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Academic dissertation to be presented with the assent of the Doctoral Training Committee of Health and Biosciences of the University of Oulu for public defence in Surgical Hospital, Faltin sali (Helsinki) on 16 October 2020, at 12 noon.

UNIVERSITY OF OULU, OULU 2020

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Acta Univ. Oul. D 1582, 2020

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ISBN 978-952-62-2716-0 (Paperback)
ISBN 978-952-62-2717-7 (PDF)

ISSN 0355-3221 (Printed)
ISSN 1796-2234 (Online)

Cover Design
Raimo Ahonen

PUNAMUSTA
TAMPERE 2020

Koota, Elina, The development of an evidence-based practice educational intervention and its effectiveness on emergency nurses' attitudes, knowledge, skills, self-efficacy and behavior.

University of Oulu Graduate School; University of Oulu, Faculty of Medicine; Medical Research Center of Oulu

Acta Univ. Oul. D 1582, 2020

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Abstract

The aim of this study was to develop an evidence-based practice (EBP) educational intervention and to evaluate its effectiveness on EBP attitudes, knowledge, skills, self-efficacy and behavior among emergency nurses.

The study consisted of two phases. In the development phase (I), a systematic review of educational interventions promoting EBP and their outcomes among emergency nurses was conducted. Based on the review, an educational intervention was developed, and it was piloted. In the evaluation phase (II), the effectiveness of educational intervention on emergency nurses' EBP attitudes, knowledge, skills, self-efficacy and behavior, and their satisfaction with education was evaluated. A randomized controlled trial (RCT) with parallel group design, with evaluations before the education, immediately after it, and 6 and 12 months after the education, was used. An experimental group (n = 40) received a multifaceted EBP education and a control group (n = 40) a self-directed EBP education. The data was collected using five questionnaires and was analyzed statistically.

The systematic review showed that the EBP educational interventions had improved emergency nurses' EBP knowledge, skills and behavior and produced benefits to their patients. In the evaluation phase, the emergency nurses' EBP attitudes, knowledge, skills and self-efficacy were better than average level at the baseline. There was statistically a significant difference between the experimental and control groups in EBP knowledge both immediately after the education and 6 and 12 months after the education. There were differences between the groups in EBP attitudes, skills, self-efficacy and behavior at 6 months measurement point and in EBP attitudes at 12 months measurement point. The experimental group was more satisfied with the education.

The results of the EBP education were not permanent. Thus, EBP education should be continuously available for the emergency nurses. Educational interventions using multifaceted learning strategies are recommended to promote EBP in emergency nursing.

Keywords: attitude, behavior, educational intervention, emergency nurse, emergency nursing, evidence-based nursing, evidence-based practice, knowledge, learners' satisfaction, randomized controlled trial, self-efficacy, skills

Koota, Elina, Näyttöön perustuvaa toimintaa edistävän koulutusinterventio kehittäminen ja vaikuttavuus päivystyspoliklinikalla työskentelevien sairaan- hoitajien asenteisiin, tietoihin, taitoihin, minäpystyvyyteen ja käytänteisiin.

Oulun yliopiston tutkijakoulu; Oulun yliopisto, Lääketieteellinen tiedekunta; Medical Research Center of Oulu

Acta Univ. Oul. D 1582, 2020

Oulun yliopisto, PL 8000, 90014 Oulun yliopisto

Tiivistelmä

Tutkimuksen tarkoituksena oli kehittää näyttöön perustuvaa toimintaa (NPT) edistävä koulutusinterventio ja arvioida sen vaikuttavuutta päivystyspoliklinikalla työskentelevien sairaanhoitajien asenteisiin, tietoihin, taitoihin, minäpystyvyyteen ja käytänteisiin.

Tutkimus oli kaksivaiheinen. Kehittämävaiheessa (I) toteutettiin järjestelmällinen kirjallisuuskatsaus päivystyshoitajien NPT:aa edistävästä koulutusinterventioista ja niiden tuloksellisuudesta. Kirjallisuuskatsauksen pohjalta kehitettiin koulutusinterventio, ja se pilotoitiin. Arviointivaiheessa (II) arvioitiin koulutusinterventio vaikuttavuus päivystyspoliklinikalla työskentelevien sairaanhoitajien asenteisiin, tietoihin, taitoihin, minäpystyvyyteen ja käytänteisiin sekä arvioitiin heidän koulutustyytyväisyytensä. Tutkimusasetelmana oli satunnaistettu kontrolloitu koe rinnakkaisryhmillä. Arviointi toteutettiin ennen koulutusta, heti koulutuksen jälkeen, sekä 6 kuukautta ja 12 kuukautta koulutuksen päättymisestä. Koeryhmä (n = 40) suoritti monimuoto-opetuksena toteutetun NPT:n koulutuksen ja kontrolliryhmä (n = 40) suoritti itseohjautuvan NPT:n koulutuksen. Aineisto kerättiin viidellä mittarilla ja analysoitiin tilastollisten menetelmien avulla.

Järjestelmällinen kirjallisuuskatsaus osoitti, että NPT:n koulutusinterventiot olivat parantaneet päivystyshoitajien NPT:n asenteita, tietoja, taitoja ja todellista NPT:aa käytännössä sekä hyödyttäneet potilaita. Arviointivaiheen alkumittauksessa päivystyshoitajien NPT:n asenteet, minäpystyvyys, tiedot ja taidot olivat keskimääräistä parempia. Koe- ja kontrolliryhmän välillä oli tilastollisesti merkitseviä eroja NPT:n tiedoissa heti koulutuksen jälkeen sekä 6 ja 12 kuukautta koulutuksen päättymisestä. Eroja ryhmien välillä esiintyi NPT:n asenteissa, taidoissa, minäpystyvyydessä ja käytänteissä 6 kuukautta koulutuksen jälkeen ja asenteissa 12 kuukautta koulutuksen jälkeen. Koeryhmä oli tyytyväisempi NPT koulutukseen kuin kontrolliryhmä.

Koska NPT-koulutuksen tulokset eivät olleet pysyviä, tulisi sitä olla päivystyspoliklinikalla työskenteleville sairaanhoitajille jatkuvasti saatavilla. Monimuoto-opetuksena toteutettavia koulutusinterventioita on suositeltavaa käyttää päivystyspoliklinikalla työskentelevien sairaanhoitajien NPT:n edistämiseksi.

Asiasanat: asenne, koulutusinterventio, koulutustyytyväisyys, minäpystyvyys, näyttöön perustuva hoitotyö, näyttöön perustuva käytäntö, näyttöön perustuva toiminta, päivystyshoitaja, päivystyshoitotyö, satunnaistettu kontrolloitu koe, taidot, tiedot

To the emergency nurses participating in this study.

Acknowledgements

This study was carried out at the Research unit of Nursing Science and Health Management, University of Oulu, with co-operation from the Department of Emergency Medicine and Services, Helsinki University Hospital during 2017–2020. This research process would not been possible without important people involved who I would like to warmly thank.

I wish to express my sincere gratitude to my excellent supervisors, Adj. Prof. Hanna-Leena Melender and Prof. Maria Kääriäinen for their excellent guidance, continuous support and great patience over these years. Hanna-Leena, your faith, support and encouragement have been essential in starting, carrying out and finishing this study. You have helped me so many ways to improve my scientific thinking. Maria, your intensity, energy and creativity have facilitated my work, thinking and goals.

I would like to express my gratitude to my follow-up group members Adj. Prof. Satu Elo, Dr. Marja Renholm and Dr. Johanna Kaartinen. Thank you Satu, Marja and Johanna for all your support throughout these years.

I respectfully thank to Prof. Helvi Kyngäs, head of Nursing Science and Health Management research unit. Helvi, thank you for your insightful comments and continuous support through this study.

I sincerely thank the official reviewers, Prof. Tarja Suominen and Prof. Tarja Kvist. Their careful review helped me to correct all the inconsistencies and to improve the final version of the dissertation. Discussions with them opened new insights to this work and inspired my thoughts further.

This work would not been the same without my statistical expert Mitja Lääperi MSc. I thank you for all your help and great patience in explaining statistical tests repeatedly in an understandable way and drawn dozens of figures to illustrate the analyses performed. I could have not survived without your expertise.

My sincerest thanks go to the “down-under” to Prof. Julie Considine and Prof. Judy Currey. Thank you for your mentoring and support! Your words of wisdom in the field of emergency nursing has made an impact on this study.

My warmest thanks to Prof. Anne Pitkäranta and Dr. Anitta Karioja. Anne, your unbelievable strive and love for research and education has taken me even further. Anitta, thank you for your support during this process.

My deepest thanks go to “Kammarin jengi” = Hilikka Kivelä, Carita Löfqvist and Virpi Valkama. You have always been interested in my research, encouraged

me to think further and often asking questions more difficult than those I was working with.

My humble thanks goes to my dear colleagues; Susanna Ruuskanen, Paula Kukko, Netta Pohjamies, Timo Laaksonen, Margit Eckardt, Sara Palander, Leena Timonen, Toni Haapa, Minna Tavi-Jussila and Pia Kukkonen. It is everyday co-operation and support which makes bigger things possible.

I also express my gratitude to Taina Kärsämänoja and Sari Bergström for their valuable support and practical help during the data collection. I express my warm thanks to all the emergency nurses working at the EDs at Helsinki University Hospital and Oulu University Hospital who participated in this study. Without you, the research would never have been completed.

I'm blessed with extremely good friends. I could never have kept my sanity in these years without the support, 'reality check' and joy you have brought into my life. Anu and Tommi, Anu and Tommi, Elise and Petri, Johanna and Mika, Leena and Mika, Milla and Toni, Raisa and Seppo, Suvi, Taija and Ari, Terhi and Tero, without MBs' WhatsApp discussions and our traditional Boxing day gatherings I would not have made this journey! You are all so dear! A heartfelt thank you for Leena and Kaisu for a daily walks and long talks. A warm thank you for Leena and Risto, who have offered our family a great company all the way from Shanghai. I would like to give my dearest thanks to my soul mate Nina. During these years, our friendship has provided me the positive energy needed. Thank you for your encouragement and always believing in me.

My family has been the most loving and most important supporter. I would like to express my deepest respect and love to my mum and dad, who have always encouraged me to study and always been there for me and for us no matter what. My deepest gratitude goes to my own precious family Pasi, Luukas and Hertta. Your love, support and faith in me have been unwavering, and for that I will be eternally grateful. Thank you Pasi for patience and support during these years when I have been studying. Luukas, for constantly challenging me in so many ways. Hertta, for taking care of my daily walks outside. I love you so much!

I want to thank HUS emergency medicine and services for providing me the research months. This study was financially supported by the Finnish Foundation of Nursing Education and The Finnish Association of Nursing Research, which are all gratefully acknowledged.

Torpassa 1.9.2020

Elina

Abbreviations

ARCC	Advancing Research and Clinical practice through close Collaboration
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CREATE	The Classification Rubric for EBP Assessment Tools in Education
EBP	Evidence-based practice
EBP Basics EmNurs	Evidence-based practice basics for emergency nurses
ECTS	European Credit Transfer System
ED	Emergency department
EDNA	Emergency Department Nurses Association
ENA	Emergency Nurses Association
GREET	The Guideline for Reporting Evidence-based practice Educational interventions and Teaching
HIRAID	History, Identify Red flags, Assessment, Interventions, Diagnostics, communication and reassessment
JEN	Journal of Emergency Nursing
MeSH	Medical Subject Headings
PICO(T)	Population, Intervention, Comparison and Outcome (Time)
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomized controlled trial
RN	Registered nurse
Self-Dir EBP Basics EmNurs	Self-Directed Learning module: Evidence-Based Practice Basics for Emergency Nurses
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
SWOT	Strengths, weaknesses, opportunities, threats
TNCC	Trauma Nursing Core Course

List of original publications

This thesis is based on the following original publications, which are referred to in the text with Roman numerals I–III:

- I Koota, E., Kääriäinen, M. & Melender, H.-L. (2018). Educational interventions promoting evidence-based practice among emergency nurses: A systematic review. *International Emergency Nursing*, 41, 51–58. <https://doi.org/10.1016/j.ienj.2018.06.004>
- II Koota, E., Kääriäinen, M., Lääperi, M. & Melender, H.-L. (2019). Emergency nurses' evidence-based practice attitudes, self-efficacy, knowledge, skills and behaviors before an educational intervention – Baseline of a randomized controlled trial. *Collegian*, 27, 361–369. <https://doi.org/10.1016/j.colegn.2019.11.002>
- III Koota, E., Kääriäinen, M., Kyngäs, H., Lääperi, M. & Melender, H.-L. (2020). Effectiveness of Evidence-based Practice (EBP) education on emergency nurses' EBP attitudes, knowledge, self-efficacy, skills and behavior – a randomized controlled trial. *Worldviews on Evidence-Based Nursing*, accepted for publication.

The summary also contains unpublished material.

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1 Introduction

Emergency departments (ED) are busy and unpredictable environments that play a vital role in providing access to the health care system. The ED is a place where emergency practitioners care for a wide range of unpredictable incidents, often dealing with life and death situations (Duffield, Conlon, Kelly, Catling-Paull, & Stasa, 2010). The patients entering ED expect that the care they receive is of the highest quality, based on the latest evidence (Lateef, 2011; Morley, Unwin, Peterson, Stankovich, & Kinsman, 2018).

In Finland, emergency care has undergone structural changes following the health care reform and recent changes in legislation. Both have affected the service structure, division of tasks and roles, as well as activities in specialized medical care. The main changes relate to the organization of emergency care (MSAH, 2017a) and the centralization of service provision at larger hospitals (MSAH, 2017b). The emergency care system has been divided into primary healthcare services, which are provided by health centers, and specialized medical care services, which are provided by hospital-district hospitals. On-call services have undergone a shift towards EDs that provide primary and specialist care and are located mostly in hospitals. The number of these joint primary and specialized care EDs has increased.

There has been an annual rise of ED presentations of approximately 2.5% during 2016–2018 in specialized medical care, with close to 211 visits/1000 inhabitants in specialized ED medical care during 2018 (THL, 2005–2020). Similar increases have been documented globally. Combined with a patient acuity, diminishing resources and reduction in bed capacity, this development has led to overcrowding in EDs. EDs are also facing a shortage of staff, especially qualified staff. Competent staff is one of the most important factors affecting the performance of EDs (Considine, Curtis, Shaban, & Fry, 2018; Considine, Shaban, Curtis, & Fry, 2019; Kirk & Nielsen, 2016; Morley et al., 2018).

Emergency nursing is a comparatively young professional specialty which has evolved over the past 40 years and is an internationally recognized profession. Emergency nursing has the closest collaboration with emergency medicine (Lecky et al., 2014; Munroe et al., 2016). Emergency nurses and emergency physicians are key partners in the delivery of emergency care and together they form the largest emergency care workforce. The work of emergency nurses requires breadth of basic and advanced clinical expertise and in-depth knowledge of the patient lifespan to meet the challenging situations that arise in ED (Considine et al., 2019).

Due to its short history, there are no specific graduate qualifications in emergency nursing. Many countries (e.g. the UK, Australia, and the USA) have a national postgraduate emergency nursing program of their own and additionally, there are many well regarded postgraduate courses around the world that nurses can complete to improve their delivery of emergency care, such as the Trauma Nursing Core Course (TNCC). In Finland, nursing education consists of three and half years of study (210 ECTS (European Credit Transfer System)) in universities of applied sciences that lead to a bachelor's degree in nursing and enables graduates to work as general registered nurses. No formal postgraduate specialization for emergency nurses exists in Finland, it is possible to work in ED without specialization (Act on Health Care Professionals 1994/559). However, future health care policies will be influenced by demographical changes, globalization, the transformation of work, and technological advancements (STM, 2020). This will create demands and opportunities for continuous education among different specialities of care (Haapiainen, Kaila, & Salomaa, 2019).

Due to the short history of emergency nursing, the history of EBP in emergency nursing is unclear. In 1970, development of the profession was accelerated by the founding of the Emergency Department Nurses Association (EDNA), later renamed the Emergency Nurses Association (ENA). ENDA published the first core curriculum standards for emergency nursing practice and the Journal of Emergency Nursing (JEN) was established in 1975. JEN was a peer-reviewed bimonthly journal and an official publication which offered original clinical articles on the work of the ED staff. These formed the beginning of the evidence-oriented practice in emergency nursing since patient safety, practice standards and guidelines, and research in the context of emergency nursing were first mentioned in the curriculum by ENA (Alpi, 2006; ICNa; ICNb). However, it was stated later that the process of EBP is unsuitable for many of the clinical problems of patients in ED because it is too simplistic and time consuming and because the available evidence is weak (Kelly & Horsley, 2000). Subsequently, it was noticed that EBP would offer two advantages to emergency nursing practice in ED. First, EBP, when applied, will reduce variations in practice but also allows minor variations based on patient preferences. Second, practices that are based on evidence and implemented consistently should yield predictable results (Shapiro, 2007). Later, the statement on the importance of EBP in emergency nursing has been substantiated and a need for research in this area has been emphasized (Considine et al., 2019).

Implementation of EBP improves health care, including the enhancement of the quality and reliability of health care, improvement of health outcomes, and

reduction of variations in care and costs (Melnik, Gallagher-Ford, & Fineout-Overholt, 2017). The challenges for the implementation of EBP in emergency nursing (Chan et al., 2011; Person, Spiva, & Hart, 2013; Sadeghi-Bazargani, Tabrizi, & Azami-Aghdash, 2014) are many, and they are in line with the challenges of EBP in nursing in general (Saunders & Vehviläinen-Julkunen, 2016), including time limitations, the challenges of an overcrowding and busy unit, inadequate EBP knowledge or education, organizational resistance, heavy workloads, resistance from nursing colleagues, uncertainty about where to look for information and how to critically appraise evidence, limited access to resources that facilitate EBP. These all hamper ambitions to achieve an EBP.

There are many ways to introduce evidence into emergency nursing practice. One way is an educational intervention on EBP. The effectiveness of EBP educational interventions have been studied among nurses in general (e.g. Melender et al., in press; Bagnasco et al., 2019; Häggman-Laitila, Mattila, & Melender, 2017; Saunders & Vehviläinen-Julkunen, 2016; Stokke, Olsen, Espehaug, & Nortvedt, 2014) and among emergency nurses (e.g. Moore, Vermuelen, Taylor, Kihara, & Wahome, 2019; Munroe et al., 2016; Skaggs, Daniels, Hodge, & DeCamp, 2018). However, such EBP educational interventions, which would have included the steps of EBP (Melnik et al., 2017), have not been studied in the field of emergency nursing. This thesis is intended to fill in this gap in knowledge.

2 Review of the literature

The literature review focuses on the main concepts relating to the study and consists of three parts. First, EBP is looked at from the perspective of emergency nursing. Second, educational interventions to promote emergency nurses' EBP and their outcomes as well as the used teaching/learning methods in EBP education among the emergency nurses are described. Finally, the main gaps in the previous literature are summarized.

2.1 Evidence-based practice in emergency nursing

Due to the dynamic nature of the clinical environment, emergency nurses are expected to keep pace with advances in research and ensure that their practice is evidence-based (Considine et al., 2018). The use of research in clinical practice has become an essential component of providing evidence-based care for ED patients. It is through EBP that nurses use research findings to guide their decisions, actions, interventions, and policies (Chan et al., 2011). The research concerning how EBP is integrated within emergency nursing is still shallow. To understand and describe the current status of EBP in emergency nursing, a literature search was conducted for the first time in October 2016, relating to the years 2006–2016 (Table 1) with the expert assistance of a university librarian. An exploration of the literature was conducted in four databases, which were CINAHL, Cochrane, PubMed/MEDLINE (Ovid), and Scopus. The search was updated in September 2019, again with the expert assistance of a university librarian (Table 1).

In Finland, neither the concept 'emergency nursing' nor the concept 'emergency nurse' have been officially defined. It is stated in the health care act that the care given in EDs is urgent medical care, which involves the immediate assessment and treatment required by a sudden illness or injury or the deterioration of a chronic illness and where immediate intervention or treatment cannot be postponed without risking the worsening of the condition or further injury (Health Care Act 2010/1326). The Emergency Nurses Association (ENA, 2012) has defined emergency nursing as follows: 'a specialty within the field of professional nursing focusing on the care of patients in the emergency or critical phase of their illness or injury'. Based on this, the ENA definition of emergency nursing was selected to define emergency nursing in this study.

Table 1. Database searches on EBP educational interventions among emergency nurses.

Database	Search terms	Original search 2016 Titles/ Abstracts/ Accepted	Updated search 2019 New Titles/ Accepted
CINAHL	<p><i>Headings:</i> (Boolean phrase): ((MH "Emergency Nursing") OR (MH "Emergency Nurse Practitioners")) AND ((MH "Nursing Practice, Evidence-Based") OR (MH "Professional Practice, Evidence-Based") OR (MH "Nursing Practice, Theory-Based") OR (MH "Nursing Practice, Research-Based") OR (MH "Education, Nursing, Theory-Based") OR (MH "Education, Nursing, Research-Based")) AND ((MH "Quality of Health Care") OR (MH "Quality Management, Organizational") OR (MH "Quality Improvement") OR (MH "Quality Assessment") OR (MH "Quality of Nursing Care") OR "knowledge translation" OR (MH "Professional Development"))</p> <p><i>Keywords:</i> (((("evidence based practice" OR "evidence based nursing" OR "knowledge translat*") AND ("emergency nurs*") OR ("emergency department*" AND nurs*)))) AND ((educ* OR train* OR "quality improvement"))).</p>	184/16/4	118/0
Cochrane Library	<p><i>Headings and keywords:</i> ("Evidence based practice" OR "Evidence based nursing" OR "Knowledge translat*") AND "Emergency department" AND "Nurs*" AND ("Educ*" OR "Train*" OR "Quality improvement*")</p>	7/0/0	0/0
PubMed	<p><i>Headings:</i> "Professional Competence"[MeSh] OR "Outcome Assessment (Health Care)"[MeSh] OR "Evidence-Based Emergency Medicine"[MeSh] OR "Evidence-Based Nursing"[MeSh] OR "Evidence-Based Practice"[MeSh] OR "Quality Improvement"[MeSh] AND "Emergency Nursing"[MeSh].</p> <p><i>Keywords:</i> (((("evidence based practice" OR "evidence based nursing" OR "knowledge translation")) AND ("emergency nursing") OR ("emergency department" AND (nursing or nurse)))) AND ((education OR training OR "quality improvement"))</p>	449/45/6	38/0
Scopus	<p><i>Keywords:</i> "Evidence based practice" OR "Evidence based nursing" OR "Knowledge translat*" AND ("Emergency department" AND "Nurs*") OR "Emergency nurs*" AND Educ* OR Train* OR "Quality improvement*"</p>	71/5/0	2/0

In Finland, the most commonly used and appropriate title for a registered nurse working in the ED is ‘nurse’. ‘Acute nurse’ (‘akuuttihoitaja’ in Finnish) or

‘emergency nurse’ (‘päivystysohittaja’ in Finnish) are also used, but no formal definitions for these titles exist in Finland. Due to this, the concept ‘emergency nurse’ in this study is defined as a registered nurse (RN) who works at the ED (Lankinen, 2013; Paakkonen, 2008).

The history of evidence-based practice (later EBP) in nursing can be considered to have begun in the 1800s in the time of Florence Nightingale. In her work in military hospitals during the Crimean War, she started to critically examine how the environment influenced patient health and outcomes (Aravind & Chung, 2010; Mackey & Bassendowski, 2017; Nightingale, 1970). At the beginning of the 1970s in the field of modern medicine, a British epidemiologist, Archie Cochrane, contended that randomized controlled trials provided the most reliable form of evidence. His collection and analysis of systematic reviews led to the development of the Cochrane Library database of systematic reviews, which opened in 1992 (Barker, 2010). In the same year, the term ‘evidence-based medicine’ was clearly defined by Sackett, Rosenberg, Muir, Haynes, and Richardson (Aravind & Chung, 2010; Beyea & Slattery, 2013). Since the widespread adoption of EBP in medicine, the use of evidence-based practices has rapidly spread to other fields of health care (Mackey & Bassendowski, 2017). In 1998 the Centre for Evidence-Based Nursing was founded at the University of York. The aim of it was to promote evidence-based nursing through education, research and development (Barker, 2010). Almost at the same time, experts emphasized that learning EBP as part of the education of health professionals was important. This led to curriculum revisions, efforts for clinical education reform and professional development programs (Stevens, 2013). In 2003, a statement on EBP was prepared, known as the Sicily Statement. In the statement, conceived by the delegates of the Second International Conference of Evidence-Based Health Care Teachers and Developers, it was stated that EBP requires that decisions about health care are based on the best available, current, valid and relevant evidence (Dawes et al., 2005).

Sackett, Rosenberg, Gray, Haynes, and Richardson (1996) classic definition of EBP in healthcare defines EBP as: ‘the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research’ (Sackett et al., 1996, p.71). Based on Sackett et al’s definition, Melnyk, Fineout-Overholt, Stetler, and Allan have defined EBP in the years 2005 (Melnyk et al., 2005), 2012 (Melnyk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012) and 2017. The most recent definition is as follows: ‘EBP is a life-long problem-solving approach to how healthcare is

delivered that integrates the best evidence from high-quality studies with clinician's expertise and patient's preferences and values' (Melnyk et al., 2017, p. 8). This definition by Melnyk et al. (2017) was selected to define EBP in this study. A systematic implementation of EBP is essential to improve the effectiveness and cost-effectiveness of care (Melnyk et al., 2012).

The seven steps of EBP presented by Melnyk, Gallagher-Ford, Long, and Fineout-Overholt (2014) provide a base for facilitating the best clinical decisions and ensuring the best patient outcomes. The EBP steps start with step 0: cultivating a spirit of inquiry within an environment that is open to EBP. The subsequent steps are as follows: asking questions in the PICO(T) format (step 1); searching for the best evidence (step 2); critically appraising the evidence (step 3); integrating the evidence with clinical expertise and patient preferences to make the best clinical decision (step 4); evaluating the outcome(s) of the EBP practice change (step 5); and disseminating the outcome(s) (step 6) (Melnyk et al., 2014).

Step 0 of the seven steps of EBP is to cultivate a spirit of inquiry within an environment that is open to EBP. It means being curious and continuously questioning the current practices. This requires support from the organization, its leaders, peers and colleagues in order to create an EBP friendly culture and environment. This means that the organization is prone and supports its clinicians in a continual and consistent questioning of current clinical practices. After a clinician asks a clinical question from day-to-day practice, it will be put into a PICOT format (P for patient/population, I for intervention/interest area, C for comparison intervention or group, O for outcomes or/and T for time) to facilitate an effective evidence search. After the question is formulated into the PICOT format, the keywords will arrive through the PICOT process. These keywords will be used when searching in the databases. The critical appraisal will begin after the relevant evidence has been found. The critical appraisal checklists can be used to assist in evaluating validity, reliability and applicability of a study. After the evidence found in the search has been critically appraised, evaluated and synthesized, it needs to be integrated with a clinician's expertise and a patient's preferences and values. After the change has been done it is important to evaluate the outcomes to determinate the impact of the EBP change. Finally, it is important to disseminate the outcomes to increase the adoption of research findings into practice to improve the patient outcomes. The dissemination can take place among the colleagues, organization stakeholders and at local, national or international conferences (Melnyk et al., 2017).

Implementing EBP in everyday practice at the ED is key when caring for patients of a wide range (Jennings, Clifford, Fox, O'Connell, & Gardner, 2015). Emergency nurses, like other clinicians, are expected to keep up with the most recent research and ensure that their practice is evidence-based (Considine et al., 2018; Person et al., 2013; Sampson, Goodacre, & O' Cathain, 2014). EBP implementation research in emergency nursing has focused on implementing an evidence-based nursing guideline for the management of patients with stroke (Considine & McGillivray, 2010), implementing an evidence-based care bundle for patients with severe traumatic brain injury (Damkliang, Considine, Kent, & Street, 2015) or implementing the evidence-informed patient-assessment framework HIRAID (History, Identify Red flags, Assessment, Interventions, Diagnostics, communication and reassessment) (Munroe, Curtis, Buckley, Lewis, & Atkins, 2018). The results of these studies have been ambivalent. It has been indicated that the implementation of EBP guidelines has been successful and improved the patients' care (e.g. Considine & McGillivray, 2010; Damkliang et al., 2015; Munroe et al., 2016). In contrast, it has been indicated that ED nurses do not implement the guidelines and screening routines and thus their current practice is not fully evidence-based (Kirk & Nielsen, 2016).

Although EBP is essential in effective improvement of patient outcomes and value of care, the adoption and implementation of EBP by nurses in general have been described as inadequate (Saunders & Vehviläinen-Julkunen, 2016). Specifically, regarding emergency nurses, integrating the best evidence into daily clinical practice and decision-making among them has turned out to be more challenging than initially thought (Bigham et al., 2012; Person et al., 2013).

The barriers for EBP implementation in emergency nursing do not differ from the barriers of EBP among nurses in general. Among emergency nurses, the lack of time (Chan et al., 2011; Kirk & Nilsen, 2016; Shapiro, 2007) and resources (Bigham et al., 2012; Shapiro, 2007), an overcrowded and busy ED (Bigham et al., 2012; Chan et al., 2011; Person et al., 2013; Sampson et al., 2014), resistance from nursing colleagues (Bigham et al., 2012; Chan et al., 2011) as well as inadequate EBP knowledge or education (Chan et al., 2011; Person et al., 2013) have been identified as the main barriers for the consistent implementation of EBP. The same barriers have found to be common also among community nurses (Mathieson, Grande, & Luker, 2019), primary care nurses (McKenna, Ashton, & Keeney, 2004), intensive care nurses (Jansson, Ala-Kokko, Ylipalosaari, Syrjälä, & Kyngäs, 2013) and palliative care nurses (Antunes, Harding, & Higginson, 2014). The barriers have also been discovered to be global. Similar barriers have been found, for

example, in Iran (Khammarnia, Haj Mohammadi, Amani, Rezaeian, & Setoodehzadeh, 2015), the USA (Melnik et al., 2012), England (Gerrish et al., 2011), Canada (Black, Balneaves, Garossino, Puyat, & Qian, 2015), as well as in Finland (Holopainen, Siltanen, Hahtela, & Korhonen, 2018).

EBP is an essential part of professional education for all health professionals (Tilson et al., 2011). Research on EBP educational interventions in emergency nursing has almost only concentrated on EBP in certain clinical substance areas. The most recent research studies in the area of EBP educational interventions in emergency nursing have been focused on evidence-based care bundles, for example, on sepsis (Moore et al., 2019), care bundles of nursing service (Skaggs et al., 2018), EBP quality in a certain specific area, for example, alarm systems (Fujita & Choi, 2020), a difficult venous access team (Whalen, Maliszewski, Sheinfeld, Gardner, & Baptiste, 2018), or benefits of a multiprofessional team on triage at the ED (Spencer, Stephens, Swanson-Biearman, & Whiteman, 2019). However, the steps of EBP (Melnik et al., 2014) have not been included in the EBP education as a learning content among emergency nurses.

2.2 Educational interventions to promote emergency nurses' EBP and their outcomes

A systematic literature search of educational interventions promoting emergency nurses' EBP and their outcomes was conducted in four databases, which were CINAHL, Cochrane, PubMed/MEDLINE (Ovid), and Scopus. The first search was conducted in October 2016 with the expert assistance of a university librarian. The search process and its outcomes are presented in publication I. The search was updated in September 2019, again with the expert assistance of a university librarian. The updated search is presented in Table 1. The updated search did not gain new information. An overview of the original studies and the results found in them, which were found through the first search, are presented in publication I (Koota et al., 2018).

The basic purpose of educational interventions is to increase learners' competence and skills in a specific content area and to promote lifelong learning (Ilic & Maloney, 2014). In this study report, an expression 'EBP education' is also used as the meaning of 'EBP educational intervention'.

Definitions of learning vary widely, due to the broad and abstract nature of it. There is no one definition of learning that would be universally accepted by theorists, researchers, and practitioners. Learning is a major focus of research in

psychology, neuroscience, behavioral ecology, evolutionary theory, and computer science, as well as in many other disciplines. While the specific definitions of learning can vary among and even within disciplines, in the 20th century many theoretical considerations of learning viewed it as a structured updating of system properties based on processing of new information. Despite the consensus of definitions of learning, new definitions continue to be proposed (De Houwer, Barnes-Holmes, & Moors, 2013). Learning is commonly defined as behavioral change, and experience is strongly linked to the learning concept because it is assumed to be one source of the information that is learned (De Houwer, 2011; Schunk, 2012).

In this study, learning is defined according to Mezirow (1996) as it 'is understood as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action' (Mezirow, 1996, p. 162). Mezirow's transformative learning theory is focused on adult learning, particularly in the context of post-secondary education (King, 2002; Taylor, 2007) and it has been used as a learning theory in this study.

2.2.1 Elements of educational interventions to promote emergency nurses' EBP

The most effective teaching strategies for promoting the effective use of EBP in health care practice are uncertain (Ilic & Maloney, 2014). Inconsistent reporting of interventions used in EBP educational research is a significant barrier to identifying the most effective teaching strategies (Ilic & Maloney, 2014; Young, Rohwer, & Volmink, & Clarke, 2014). To report EBP educational interventions consistently and transparently, the Guideline for Reporting EBP Educational interventions and Teaching (GREET) checklist was developed by Phillips et al. (2016) (Table 2). The GREET checklist is based on the framework used for the Template for Intervention Description and Replication (TIDieR) checklist and guide, which is a generic checklist for reporting interventions (Hoffman et al., 2014). The GREET checklist is a specific reporting guideline designed to provide a framework for consistent and transparent reporting of educational interventions for EBP. It is a valid and reliable intervention reporting instrument with a criterion validity (ICC 0,73) and inter-reliability (ICC 0,96). It comprises 17 items that are recommended for reporting EBP educational interventions. Each checklist item is independent. The items have been developed to ensure that each can be understood without having to read the others (Phillips et al., 2016). The 17 items which are recommended for reporting

EBP educational interventions are as follows: intervention, theory, learning objectives, EBP content (steps of EBP), materials, educational strategies, incentives, instructors, delivery, environment, schedule, face-to-face time, adaptations, modifications, attendance, realization of the planned delivery, and actual schedule (Phillips et al., 2016). In this study, the GREET checklist was used to guide and help in the development phase for an educational intervention, as well as reporting the educational intervention for EBP. The GREET checklist and explanations for each checklist item are provided in Table 2. The detailed GREET checklist containing descriptions of its use in this study are presented in the supplementary Table 1 of publication III.

Table 2. The GREET 2015 checklist (Published with the permission of the authors (Phillips et al., 2016) and BMC Medical Education).

Group	Item	
	No	Description
BRIEF NAME	1.	INTERVENTION: Provide a brief description of the educational intervention for <i>all</i> groups involved [e.g. control and comparator(s)].
WHY - this educational process	2.	THEORY: Describe the educational theory(ies), concept or approach used in the intervention.
	3.	LEARNING OBJECTIVES: Describe the learning objectives for <i>all</i> groups involved in the educational intervention.
	4.	EBP CONTENT: List the foundation steps of EBP (ask, acquire, appraise, apply, assess) included in the educational intervention.
WHAT	5.	MATERIALS: Describe the specific educational materials used in the educational intervention. Include materials provided to the learners and those used in the training of educational intervention providers.
	6.	EDUCATIONAL STRATEGIES: Describe the teaching/learning strategies (e.g. tutorials, lectures, online modules) used in the educational intervention.
	7.	INCENTIVES: Describe any incentives or reimbursements provided to the learners.
WHO PROVIDED	8.	INSTRUCTORS: For each instructor(s) involved in the educational intervention describe their professional discipline, teaching experience/expertise. Include any specific training related to the educational intervention provided for the instructor(s).
HOW	9.	DELIVERY: Describe the modes of delivery (e.g. face-to-face, internet or independent study package) of the educational intervention. Include whether the intervention was provided individually or in a group and the ratio of learners to instructors.
WHERE	10.	ENVIRONMENT: Describe the relevant physical learning spaces (e.g. conference, university lecture theatre, hospital ward, community) where the teaching/learning occurred.

Group	Item
	No Description
WHEN and HOW MUCH	11. SCHEDULE: Describe the scheduling of the educational intervention including the number of sessions, their frequency, timing and duration.
	12. Describe the amount of time learners spent in face to face contact with instructors and any designated time spent in self-directed learning activities.
PLANNED CHANGES	13. Did the educational intervention require specific adaptation for the learners? If yes, please describe the adaptations made for the learner(s) or group(s).
UNPLANNED CHANGES	14. Was the educational intervention modified during the course of the study? If yes, describe the changes (what, why, when, and how).
HOW WELL	15. ATTENDANCE: Describe the learner attendance, including how this was assessed and by whom. Describe any strategies that were used to facilitate attendance.
	16. Describe any processes used to determine whether the materials (item 5) and the educational strategies (item 6) used in the educational intervention were delivered as originally planned.
	17. Describe the extent to which the number of sessions, their frequency, timing and duration for the educational intervention was delivered as scheduled (item 11).

Since little is known about EBP education in the context of emergency nursing, research findings regarding nurses in general are presented in this literature review. EBP education among emergency nurses has been inconsistently reported (Koota et al., 2018). For example, in some studies, EBP education for emergency nurses has not been described (e.g. Scott, Crilly, Chaboyer, & Jessup, 2013; Wentz & Kleiber, 2013) or they have been described briefly (e.g. Damkliang et al., 2015; Rautava et al., 2013). Similarly, the EBP content of the educational interventions for emergency nurses have rarely been described (Delaney, Friedman, Dolansky, & Fitzpatrick, 2015; Evans, Thaker, Gill, & Downer, 2008; Muntlin, Carlsson, Säfwenberg, & Gunningberg, 2011; Rankin, Then, & Atack, 2013; Rautava et al. 2013).

The role of the educational strategy is essential when teaching EBP in a clinical environment (Horntvedt, Nordsteien, Fermann, & Severinsson, 2018). The conventional face-to-face theoretical lecture has been an often-used learning strategy in the EBP education of emergency nurses (Considine & McGillivray, 2010; Considine & Brennan, 2007a, 2007b; Habich & Letizia, 2015; Solomon & Jurica, 2016). Self-directed learning (Considine & McGillivray 2010), a workshop (Munroe et al., 2016), or a combination of multifaceted education (Damkliang et al., 2015; Yeoh, Taylor, & Taylor, 2009) have seldom been used as an educational strategy for emergency nurses.

In all EBP educational interventions for emergency nurses, the content of the theoretical lectures have focused on a specific clinical area (Considine & McGillivray, 2010; Considine & Brennan, 2007a, 2007b; Damkliang et al., 2015; Habich & Letizia, 2015; Jordan & Moore-Nadler, 2014; Solomon & Jurica, 2016). None of the above-mentioned studies have focused on teaching the steps of EBP as a learning content among emergency nurses.

The educational interventions found on EBP among emergency nurses working at the children's ED have been alike. They have been delivered through conventional face-to-face lectures and focused on a specific substance area: children's maltreatment (Jordan & Moore-Nadler, 2014); fever (Considine & Brennan, 2007a, 2007b) or pain management at the pediatric ED (Habich & Letizia, 2015; Ramira, Instone, & Clark, 2016). However, the inconsistent reporting of these EBP educational interventions was evident.

EBP educational interventions implemented for nurses in general have shown promising results. A combination of multifaceted educational strategies has been suggested to be used when teaching EBP for nurses in clinical practice. The content of EBP education should combine both EBP steps and the clinical context (Häggman-Laitila et al., 2017; Häggman-Laitila, Mattila, & Melender, 2016). The same suggestions have also been presented in the context of medical education (Patelarou et al., 2017; Phillips et al., 2014; Young et al., 2014). In the context of health care multiprofessional EBP education, few studies have concentrated on EBP improvement in a certain clinical area. The multiprofessional EBP education have seldom included the EBP steps as a learning content. Even though there have been multiprofessional EBP education, more such interventions are needed (Häggman-Laitila et al., 2017; Lehane et al., 2019; Patelarou et al., 2017).

2.2.2 Outcomes of educational interventions to promote emergency nurses' EBP

The goal of EBP is to improve patient care outcomes within the context of complex healthcare systems (Melnik et al., 2017). The consistent use of the EBP in daily practice at EDs is still lacking (Kirk & Nielsen, 2016). To assess the outcomes of EBP education, Tilson et al. (2011) specifically developed the Classification Rubric for EBP Assessment Tools in Education (CREATE) framework. CREATE includes the following seven assessment categories related to EBP learning: attitudes about EBP, knowledge about EBP principles, skills for performing EBP, self-efficacy for conducting EBP, behavior congruent with EBP as part of patient care, reaction to

the EBP educational experience, and EBP-related benefits to patients (Tilson et al., 2011).

Attitudes encompass learners' perceptions of the importance and usefulness of EBP in informing clinical decision-making. Knowledge describes learners' awareness and understanding of EBP concepts. Skills relates to the application of knowledge and describes an individual's ability to perform the EBP steps in a practical setting. Self-efficacy refers to learners' judgments of their ability to perform a given activity, while behavior describes learners' real-life actions, i.e., their commitment to following the EBP steps in everyday practice. It includes all the processes used in the application of EBP. Reaction to the EBP educational experience, from herein referred to as learners' satisfaction, describes learners' opinions regarding the learning experience and the intervention's efficacy. Benefits to patients covers how the EBP educational intervention will impact the health of patients and communities. This category is difficult to measure as the EBP learning process is affected by numerous variables. Effective EBP education clearly addresses all these learning outcomes (Tilson et al., 2011). In this study, attitudes, knowledge, skills, self-efficacy, behavior and learners' satisfaction have been used as outcomes based on their definitions by Tilson et al. (2011). Due to the nature of the EBP education and the context it will be implemented in, patient outcomes were not evaluated.

The measurement of the outcomes of EBP education among emergency nurses has mainly concentrated on improvement of one or two EBP areas only. More typically, educational interventions have concentrated on the improvement of emergency nurses' EBP on a particular substance area. No previous research was found that would have explicitly studied emergency nurses' EBP attitude, knowledge, skills, self-efficacy, behavior and learners' satisfaction specifically as outcomes described by Tilson et al. (2011).

EBP attitude has rarely been studied among emergency nurses. Earlier studies have found that according to emergency nurses, identifying, critically assessing and applying relevant research in clinical practice is a time-consuming process, and that they do not have enough time to implement the large number of EBP guidelines (Kirk & Nilsen, 2016; Shapiro, 2007).

No previous research reports specifically on the knowledge of emergency nurses regarding the EBP steps (Melnyk et al., 2014) was found. A study among nurses in general, which also included emergency nurses, reported that nurses self-assessed their EBP knowledge as average (Mollon et al., 2012). A Finnish study, which also included emergency nurses, found that the nurses self-rated their actual

EBP knowledge as low (Saunders, Vehviläinen-Julkunen, & Stevens, 2016). Outcomes regarding knowledge on a certain clinical areas after education have been studied in EBP educational interventions concerning pediatric fever management (Considine & Brennan, 2007a, 2007b), oxygen administration (Considine, Botti, & Thomas, 2007), management of patients with severe traumatic brain injury (Damkliang et al., 2015), pediatric pain assessment (Habich & Letizia, 2015), and children's maltreatment (Jordan & Moore-Nadler, 2014). All of these studies have reported results showing that EBP education has increased the emergency nurses' EBP knowledge on that certain clinical area.

EBP skills have mainly been studied along with EBP knowledge. In a Finnish study, also including emergency nurses, nurses reported inadequate EBP skills and admitted that they did not use the best evidence in clinical practice (Saunders et al., 2016). The improvement of the skills of emergency nurses has also been studied in the context of a certain clinical area. After the EBP education, improvement has been found in emergency nurses' skills in assessing pediatric pain (Habich & Letizia, 2015), assessing the children's risk of maltreatment (Jordan & Moore-Nadler, 2014) and assessing patients at the ED (Munroe et al., 2016). However, these last mentioned did not describe the individual's ability to perform all the EBP steps in a practical setting in a sense of how Tilson et al. (2011) described EBP skills.

EBP self-efficacy has rarely been studied in the context of emergency nursing. In a Finnish study, also including emergency nurses, nurses' EBP self-efficacy levels were found to range from low to moderate (Saunders et al., 2016). In the context of emergency nursing, after the EBP education, emergency nurses have felt more confident in the assessment of pain in children (Habich & Letizia, 2015) or assessing the children risk of maltreatment (Jordan & Moore-Nadler, 2014).

As for emergency nurses' EBP behavior, it has been found that ED nurses did not always implement guidelines and screening routines and thus, their practice was not fully evidence-based (Kirk & Nilsen, 2016). Moreover, studies by Person et al. (2013) and Sampson et al. (2014) have also shown that emergency nurses do not always implement EBP into their practice.

Research on EBP-related benefits to patients after an EBP education for emergency nurses has focused on certain substance or medical specialty areas. Patients have received better discharge advice from emergency nurses concerning fever management at home (Considine & Brennan, 2007a), patients have been better assessed after a new evidence-informed nursing assessment framework HIRAIID has been implemented (Munroe et al., 2016), children's pain has been

better assessed during triage after the EBP pain assessment scale has been taken into use (Yeoh et al., 2009), and patients' discomfort has been better understood in nasal-gastric tube insertion procedures and thus, patients have been better medicated during the procedure (Solomon & Jurica, 2016). Moreover, children at the risk of maltreatment have been better screened after emergency nurses' EBP education and thus, they have received better care (Jordan & Moore-Nadler, 2014).

Learners' satisfaction with EBP education has rarely been studied in a context of emergency nursing or nursing in general. Two studies were found in the context of emergency nursing (Habich & Letizia, 2015; Jordan & Moore-Nadler, 2014). Both studies reported that emergency nurses were satisfied with the EBP education they received.

In the field of emergency nursing, the outcomes of the EBP educational interventions for emergency nurses are still largely unknown due to a lack of published studies and robust evidence. None of the published educational interventions have included steps of EBP (Melnik et al., 2014) as learning contents. Moreover, they have all measured only short-term effects of the educational interventions.

2.3 Summary of the literature

The elements and outcomes of EBP among emergency nurses are presented in Figure 1. The research on EBP educational interventions including steps of EBP among emergency nurses and their outcomes is scant. The gaps that this study aims to address are presented as follows.

First, most of the previous studies have described the content of the EBP educational intervention focusing on the planned change in practice on a certain clinical nursing area. Research concerning emergency nurses' learning of the steps of EBP is lacking.

Second, the EBP educational interventions for emergency nurses have been implemented by using only one teaching/learning method, mainly by using theoretical face-to-face lectures. However, not all of them have been effective. Research concerning the use of multiple teaching/learning methods to teach EBP among emergency nurses is lacking.

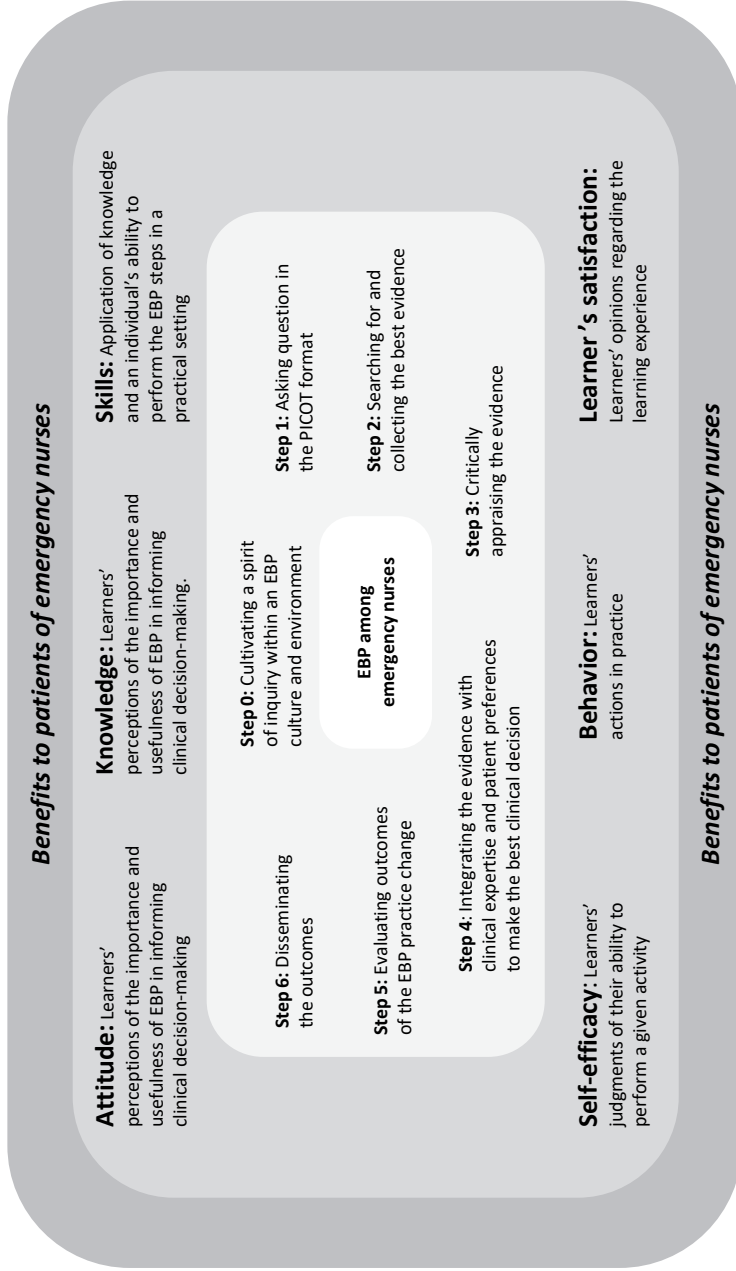


Fig. 1. Steps of evidence-based practice (EBP) and outcomes of an EBP educational intervention among emergency nurses (adaptation to Melnyk et al., 2014; Tilson et al., 2011).

Third, the data collection intervals in earlier EBP educational interventions studies for emergency nurses have been short. The studies have included only one follow-up, which has been conducted soon after the intervention. Research concerning the long-term effectiveness of an EBP education among emergency nurses is lacking. Long-term follow-ups are needed to evaluate the persistence of observed outcomes of the EBP educational interventions.

Fourth, almost all the study designs used in earlier studies on EBP educational interventions for emergency nurses have been pre-test post-test designs. Randomized controlled trials (RCTs) have been lacking. RCTs are needed to assess the effects of the educational interventions.

Fifth, no previous research was found that would have explicitly studied emergency nurses' EBP attitude, knowledge, self-efficacy, behavior and learners' satisfaction as outcomes described in the CREATE taxonomy.

3 Aim, research questions and hypothesis of the study

The aim of this study was to develop an evidence-based practice (EBP) educational intervention and to evaluate its effectiveness on attitudes, knowledge, skills, self-efficacy and behavior. The learners' satisfaction with educational experience was also assessed after the EBP education. The phases, detailed research questions and the hypotheses of the study are listed here.

Phase 1 (development phase)

The research questions were as follows:

1. What kind of educational interventions have been used to promote EBP in emergency nursing? (publication I)
2. What outcomes have been achieved by using these educational interventions in emergency nursing? (publication I)

Phase 2 (evaluation phase)

The research questions were as follows:

3. What are EBP attitudes, knowledge, skills, self-efficacy and behaviors of emergency nurses in experimental and control groups at baseline? (publication II)
4. What is the effectiveness of the educational intervention on attitudes, knowledge, skills, self-efficacy and behavior among emergency nurses compared with experimental and control groups after a 6-month and 12-month follow-up? (publication III)
5. How satisfied are the emergency nurses in the experimental group compared with the emergency nurses in the control group after the education? (publication III)

Hypothesis 1. The attitudes, knowledge, skills, self-efficacy, and behavior are better in the experimental group compared with the control group immediately after the education and 6 and 12 months after the education.

4 Materials and methods

The study was conducted in two phases: development and evaluation. The phases were based on the Medical Research Council (MRC) Framework for the Development and Evaluation of RCTs for Complex Interventions to Improve Health (Craig et al., 2008, 2019). The MRC guidance recommends a careful process of development of intervention, modelling of process and outcomes, followed by assessment of feasibility and eventual dissemination. The development and evaluation process consist of following elements: development phase, piloting phase, evaluation phase and implementation phase. In this study, development and piloting phases are reported as development phase and evaluation phase as own. (Craig et al., 2008, 2019) (Table 3).

Table 3. Study phases.

Phase	Study design	Participants	Data collection	Data analysis	Publ. ¹
I	Systematic review	Emergency nurses (n = 416) in original studies (2006–2016)	4 databases: PubMed/Medline (Ovid), CINAHL, Scopus and Cochrane	Deductive content analysis	I
II	RCT	Emergency nurses working at EDs (n = 80)	Four different instruments: EBPQ-FI EBPB EBPI The knowledge test at the baseline	Descriptive statistics Mann-Whitney U-test Kruskal-Wallis H-test Pearson correlation test	II
II	RCT	Emergency nurses in experimental group (n = 40) and control group (n = 40)	Five different instruments: EBPQ-FI EBPB EBPI The knowledge test after, 6 and 12 months follow-up The course assessment form after education	Descriptive statistics Fisher's test Chi-square test Mann-Whitney U-test Kruskal-Wallis H-test Wilcoxon test Pearson correlation test	III

¹publications

4.1 Development phase

The development phase included a systematic review and development and piloting of an educational intervention. The systematic review was performed at the end of 2016. The development process of the EBP education occurred during 2017 and it was piloted on January 2018.

4.1.1 The systematic review

A systematic review (publication I) was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines for reporting study methods and results (Moher, Liberati, Tetzlaff, & Altman, 2009). A systematic literature search was carried out using the databases PubMed/Medline (Ovid), CINAHL, Scopus and Cochrane. The search was done using appropriate subject headings and/or keywords. The search terms used are presented in publication I. All of the search term variations were used purposefully focusing on educational interventions promoting EPB in emergency nursing. The search for studies was limited to publications in English, published between January 1, 2006 and October 20, 2016. The search was done with the expert assistance of a university librarian. The total number of titles, abstracts and full texts found through the search and selection processes are presented in publication I.

The inclusion criteria for the studies to be included in the review were as follows: (1) participants were emergency nurses working in ED, (2) described an educational intervention to promote EBP, (3) included an evaluation of the patient-and/or staff-related outcomes of the educational intervention, (4) published in a scientific peer-reviewed journal, and (5) a randomized controlled study, a quasi-experimental study with a comparison group, or an uncontrolled quasi-experimental study. Exclusion criteria for the studies were as follows: (1) did not describe an educational intervention to promote EBP, (2) was not an empirical study, and (3) participants held jobs other than emergency nurses (medical staff or paramedic nurses).

The systematic selection process was performed in three phases to ensure that all relevant studies were included. After rejecting the duplicates ($n = 11$), two reviewers independently screened the eligibility of potentially relevant titles ($n = 711$), abstracts ($n = 82$) and full texts ($n = 20$) based on the pre-defined inclusion and exclusion criteria. Ten original studies were selected. The quality of

the studies was evaluated according to the criteria presented by Gifford, Davies, Edwards, Griffin, and Lybanon (2007), which provided design-specific quality assessment criteria for quasi-experimental studies. The quality of the studies was classified as ‘excellent’ (16–12 points), ‘some limitations’ (11–7 points) or ‘many limitations’ (6–0 points). Excellent quality was assigned when no major confounders or flaws were found in the quality assessment. Out of 10 studies, five were excellent, four had some limitations, and one had many limitations from the point of view of their quality. All of the studies were included in the analysis in order to achieve a broad view of the current research and in order to avoid bias.

The data was analyzed using deductive content analysis. The contents of the interventions, evaluation methods and essential results of the outcome evaluations were written into a matrix based on two frameworks: the Guideline for Reporting Evidence-based practice Educational interventions and Teaching (GREET) (Phillips et al., 2016) and the taxonomy of the Classification Rubric for EBP Assessment Tools in Education (CREATE) (Tilson et al., 2011). The GREET checklist is a reliable reporting guideline which enabled consistent analysis of the EBP educational interventions (Phillips et al., 2016). The CREATE taxonomy is a framework that includes all outcome areas that should be evaluated when implementing EBP educational interventions (Tilson et al., 2011). The data in the matrix was coded according to the research questions. The codes were meaningful expressions that gave answers to the research questions. The codes were organized according to the items of the frameworks to present the results (Elo & Kyngäs, 2008). The results were quantified by documenting the extent to which meaningful expressions belonging in some item of the framework were present (Polit & Beck, 2016) (publication I, supplementary Table S1).

4.1.2 Development of the educational intervention

In the development of the educational intervention, the GREET checklist (Phillips et al., 2016) was used as a guide when designing an educational intervention for EBP (Table 2). The description of the educational intervention is presented in publication III, supplementary Table 1. The curriculums of the interventions are presented in Appendices 1 and 2. The first 12 items of the GREET checklist are reported here, whereas the last five items are reported after the pilot study. The student workload was estimated as the time needed for contact and independent study, the quantity and level of difficulty of the work and the type and timing of assessments of learning (Karjalainen, Alha, & Jutila, 2007). The number of hours

was then converted to credits (ECTS). The main developer of the educational intervention was the researcher.

Phillips et al. (2016) suggested a *brief name* for the educational intervention. The name of the educational intervention for the experimental group was Evidence-Based Practice Basics for Emergency Nurses (EBP Basics EmNurs). For the control group, a prefix ‘the Self-Directed Learning Module’ was used to highlight the nature of learning strategy of the intervention (Self-Dir EBP Basics EmNurs).

As *theories* (Phillips et al., 2016), a learning theory and a model for implementation of EBP were used. Transformative learning theory was chosen to be the learning theory used in the interventions. In transformative learning theory, learning through critical reflection is used as a strategy to promote reflective professional practice whereby learners develop a new way of interpreting the meaning of one’s experience in order to guide their future actions (Mezirow, 1996, 2000). The participants of this study had past experiences of EBP. During the EBP education they were supposed to bring their personal experiences to bear and critically reflect their earlier experiences of EBP either alone or in dialogue with the group and with the teacher. The participants were encouraged to create, elaborate and transform their assumptions and expectations through reflection.

The Advancing Research and Clinical practice through close Collaboration (ARCC) (Melnik & Fineout-Overholt, 2010) was chosen to be used as a model of implementation of EBP in the intervention. It is a system-wide model to advance and sustain EBP in healthcare systems (Melnik et al., 2017; Melnyk & Fineout-Overholt, 2002). EBP mentors are in a key role in the ARCC Model, through intentional strategic initiatives regarding EBP as well as assisting nurses to foster their knowledge, beliefs, skills and the value of EBP and their confidence in implementing it (Melnik et al., 2017).

The first step in implementing the ARCC Model is an organizational assessment of the current culture for EBP in order to identify strengths and limitations about EBP in the healthcare system, so that strategies can be implemented to overcome those barriers (Melnik et al., 2005, 2017).

The next step of the application of the ARCC model is to educate EBP mentors. Mentors are nurses who are proficient in EBP and mentor their peers in the direct care settings to deliver clinical care based on best evidence (Melnik et al., 2005, 2017). EBP mentors in this study were assistant head nurses of the unit in teaching position or administrative assistant head nurses in ED. Their role was to help to ensure that nurses use best evidence in their daily clinical practice. Mentors had learned about EBP either during their master’s level education (in the Universities

Applied Sciences or Universities) or they had taken a continuing education course in EBP. Mentors themselves were supported in their mentoring work by the Clinical Nurse Specialist of the department and the researcher.

The *learning objectives* (Phillips et al., 2016) were based on a description of EBP competencies for practicing registered professional nurses (Melnyk et al., 2014). The 13 EBP competencies were combined into one main objective for the interventions and five specific learning objectives for the participants in both groups. The main objective was to provide emergency nurses with basic competencies of EBP. The learning objectives are presented in publication III, supplementary Table 1 and Appendices 1 and 2.

The core *evidence-based practice content* (Phillips et al., 2016) of the educational interventions was based on the seven steps of EBP presented by Melnyk et al. (2014). The seven steps of EBP provide a platform for facilitating the best clinical decisions and ensuring the best patient outcomes. The EBP steps start with step 0 as cultivating a spirit of inquiry along with an EBP culture and environment. The steps continue with asking the PICO(T) question (step 1), searching the best evidence (step 2), critically appraising of the evidence (step 3), integrating the evidence with clinical expertise and patient preferences to make the best clinical decision (step 4), evaluating the outcome(s) of the EBP practice change (step 5), and disseminating the outcome(s) (step 6) (Melnyk et al., 2014).

The learning *materials* consisted of journal articles, internet pages, PowerPoint handouts, video clips and scientific databases Medic, CINAHL and PubMed. The pre-material consisted of journal articles, books, videos and internet pages. Moreover, the participants shared their final given assignments with each other. The learning materials are listed in Appendices 1 and 2.

The *educational strategies* (Phillips et al., 2016) of the interventions were built upon on the literature on the topic (Table 1). The specific use of different educational strategies during the EBP education are presented in publication III, supplementary Table 1.

Previous studies have shown that organization have offered *incentives or reimbursements* (Phillips et al., 2016) to create a culture that sustains the use of EBP (Patterson et al., 2017). In this study, organizational and administrative support was in a key role to enable the implementation of the educational intervention. For the experimental group, additional support was needed to implement the EBP education. The nursing leadership provided the education as a part of professional development program for the participants. In addition, budgeted working hours and flexible scheduling for the participants to attend group

tutorials were provided. For the EBP mentors, flexible scheduling to work in their own unit to be able to do the mentoring was provided. For the control group, the self-directed learning module was not considered as a continuing clinical education/professional development program. The units named their mentors and allowed them flexible scheduling to do the mentoring during their working days as well. Support from the researcher, the clinical nursing specialist, and a librarian was available for all equally. One of the existing computers in the unit was named to be available in all units for all participants to use.

Generally, reporting about *the instructors* (Phillips et al., 2016) has been the least commonly reported information in the reports of educational interventions on EBP, though the professional discipline and teaching experience or expertise of the instructors may potentially influence learning outcomes (Phillips et al., 2014). In a systematic review on EBP educational interventions among emergency nurses it was found that instructors were briefly mentioned in original studies. The instructors had been a researcher, ED nurse educators or a team of experienced ED nurses (Koota et al., 2018). In this study, the educational team for the experimental group intervention consisted of the researcher, the ED units' clinical nursing specialist and the EBP mentors. The mentors were assistant head nurses of the ED units in teaching position or administrative assistants head nurses of the ED units.

An orientation about EBP education was provided for the instructors and the EBP mentors prior to the education. The instructors and mentors had an opportunity to discuss the whole course in general and all arising questions concerning the course with the researcher and the clinical specialist in nursing.

The main instructors were the researcher and the clinical nursing specialist. The EBP mentors participated in the education; thus, they had a clear understanding about the content of the learning and based on that they could support the participants when they were making their course assignment. The mentors were named from the units by head nurse.

In previous studies on EBP education among emergency nurses, the most common *modes of delivery* (Phillips et al., 2016) of an educational intervention have been theoretical lectures or tutorials, which have been delivered in the form of face-to-face lectures. Also, a self-directed learning package, an e-learning module, in-service training, reminder techniques, and staff feedback have been used as delivery modes. Interventions involving face-to-face contact have been associated with significant or highly significant effects on patient benefits and emergency nurses' EBP knowledge, skills and behavior. Interventions using written self-directed learning material have been associated with significant improvements

in emergency nurses' knowledge of EBP (Koota et al., 2018). For the experimental group in this study, one contact learning day (8 hours) was planned which contained face-to-face didactic lectures (4 hours) and a team-based small group work (2 hours). One-hour small group tutorials, database search workshops and individual face-to-face support were planned to be available throughout the educational intervention. A more precise description is presented in publication III, supplementary Table 1.

Environment (Phillips et al., 2016) or physical learning space may be relevant to the delivery, feasibility and generalizability of the intervention (Hoffman et al., 2014). For the experimental group, the contact learning day was planned to be delivered in the hospital lecture room. The group tutorials were planned to be delivered in the ED units. The database search workshops were planned to be delivered either in the units or in the hospital IT classrooms. One database workshop was arranged in a library nearby the hospital; this workshop was a voluntary one.

For the control group, self-directed learning activities (reading, database searching, given assignment) took place either at hospital or at learners' home. In previous studies (Koota et al., 2018) on EBP educational interventions among emergency nurses, it was not reported where the learners were physically situated during self-directed learning.

The schedule (Phillips et al., 2016) is an essential requirement to enable replication of an educational intervention (Phillips et al., 2014). However, in the original studies of two systematic reviews, the duration of the learning sessions of the educational intervention was not always reported (Koota et al., 2018; Phillips et al., 2014). As for the schedule for the experimental group, the pre-material was sent to the participants two weeks before the course started. A contact learning day was organized two weeks after the pre-material was sent. At the end of the contact learning day the instruction for the assignment was given to the participants. The participants were given eight weeks' time to complete the given assignment and finish the course. During that period the participants had the opportunity to participate in group tutorials, which were held every other week at the unit. A voluntary supplementary database workshop was organized for those who needed supplementary support.

The control group received an introduction email to the Self-Dir EBP Basics EmNurs two weeks prior to its start. The first learning task email was sent to the participants two weeks after the introduction email was sent. The participants had two weeks' time to complete the learning task, before the second learning task email

was sent to them. Then, they had three weeks' time to complete the learning task before the third learning task email was sent to them. The last email included instructions of the given assignment. From that, they had three weeks' time to complete the given assignment and finish the course. The total study time for the self-directed learning module was eight weeks.

The amount of time learners spent in face-to-face contact (Phillips et al., 2016) may impact on their learning outcomes (Phillips et al., 2014). However, this has rarely been reported in original studies of systematic reviews (Koota et al., 2018; Phillips et al., 2014). In this study, the experimental group learners had a total of 18 hours face-to-face time with the instructors, including 12 hours didactic lectures and six hours group tutorials. Based on the learner's needs, she/he could get face-to-face support in one-on-one sessions max 6 hours during the course. The time designated for self-directed learning activities was 30 hours in total. The control group participants had no face-to-face time with the instructors. For them, 54 hours were designated for self-directed learning activities.

4.1.3 Pilot study

The EBP education for the experimental group was piloted prior to the evaluation phase. Piloting includes feasibility and testing procedures for their acceptability (Craig et al., 2008, 2019). As for feasibility, the pilot study aimed to test all procedures, materials and instruments for their suitability for use in the intervention. It provided an opportunity to identify possible challenges and prepare for them before conducting the intervention. A pilot study was conducted on a smaller scale. Moreover, as for acceptability, within the pilot it was possible to estimate the likely rate of recruitment and retention of participants and calculate appropriate sample sizes (Arain, Campbell, Cooper, & Lancaster, 2010; Feeley et al., 2009; Thabane et al., 2010).

The pilot study was assessed in two phases: 'a paper model' and 'a real-life pilot' of the educational intervention. All possible potential barriers and enablers were dealt with by using the SWOT analysis method. A SWOT analysis is a well - known and frequently used business tool for assessing major factors impacting on business performance. A SWOT analysis uses standardized, open - ended questions to identify favorable and unfavorable issues in four quadrants of a SWOT template. Strengths (S) and weaknesses (W) are internal factors; whereas opportunities (O) and threats (T) are external factors (Helms & Nixon, 2010; Hoff, 2009). The strengths of a SWOT analysis are its ability to identify important

management and strategic information on influencing factors, resources and capabilities, simply, quickly and economically (DeSilets, 2008; Helms & Nixon, 2010; Hoff, 2009).

‘A paper model of the EBP education’ was planned to identify the key relations among components, possible potential weak points and bottlenecks of the intervention (Craig et al., 2008). An 8-member team of specialists from the ED (a clinical nurse specialist, two assistant head nurses of the units in teaching position, administrative assistant head nurse, head nurse, director of nursing, two RNs) assessed the paper model of the EBP education concentrating on process (e.g. participants’ recruitment and length of time to carry out the education) and personnel management issues by using the SWOT analysis (Figure 2).

		Strengths	Weaknesses
Internal		<ul style="list-style-type: none"> • One whole contact learning day is easier to carry out from the management/ administrative point of view than two half contact learning days (another option suggested). • The contact learning day constitutes part of the professional development program for the participants. • Mentor support can be easily arranged in advance with flexible scheduling of working hours. • Participants’ access to databases at home can be arranged with the help of the IT-department. • Organizations’ positive attitude towards EBP. EBP is one of the main goals in the RCTs target organizations’ strategy. 	<ul style="list-style-type: none"> • Existing computers may not always be available for the participants in the units, because, patient care is prioritized in their use.
		Opportunities	Threats
External		<ul style="list-style-type: none"> • An opportunity to do the given assignment during the working day can possibly be arranged for the participants, depending on the daily working load at ED. • Using different learning/teaching methods in the education may make it more interesting to the participants. • Services from the librarian may help the participants in acquiring database searching skills. • An excellent possibility to improve implementation of EBP in the unit 	<ul style="list-style-type: none"> • Unpredictable events in the unit during the educational intervention in the form of sick leaves or absence of staff for other reason, which may hinder the participants to participate in the tutorials. • Participant retention from the workplace during the educational intervention. • The participants’ motivation and commitment to education might be an issue. Some participants may be active and some passive. • Finding time for the self-directed learning in participants’ personal life might be challenging.

Fig. 2. A team of specialists’ SWOT analysis of the paper model of the EBP education.

An effort to improve the weakness was made by placing one extra computer into the units’ coffee rooms. In order to prevent the threats, the timing of one-hour small group tutorials was properly planned, and the participants were motivated by

informing them about the importance of EBP throughout the educational intervention.

A real-life pilot was performed in January 2018 prior to the implementation of the actual EBP education. The pilot was carried out in January 2018. By piloting the EBP education, the researcher and the clinical nurse specialist examined again the possible key uncertainties (barriers and enablers) of the intervention implementation and thus strived to increase the feasibility of it (Craig et al., 2008, 2019).

Nine RNs participated in the pilot study. Inclusion criteria for the participants were the same as in the actual study, which were as follows: (1) being a practicing RN at the designated university hospital ED; (2) working full- or part-time as an RN; and (3) able to fluently read and understand Finnish. The EBP education was implemented in the same way as it would then be implemented in the actual EBP education to be able to assess for feasibility. One detail of the pilot intervention was not the same: the pre-material was not sent to the participants two weeks in advance. In the pilot EBP education, they received it one day prior to the EBP education.

After piloting, the researcher and the clinical nurse specialist discussed with the pilot participants freely and again used the SWOT analysis (Figure 3) as a framework in the discussion to help overcome the barriers and promote the enablers by identifying them at first.

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> • EBP education was a very clear and informative education of EBP. • The objectives were achievable, and the education met the expectations well. • On the contact learning day, the use of different learning/teaching methods motivated the learners to learn more. The PICO game in particular was well received. • The schedule, timing and duration of the contact learning day were well planned. 	<ul style="list-style-type: none"> • The participants did not anticipate any weaknesses.
	Opportunities	Threats
External	<ul style="list-style-type: none"> • The participants reported that after the EBP education they were better prepared for using EBP than before. 	<ul style="list-style-type: none"> • Possible problems in finding time for the self-studies in personal lives were seen as a threat by the participants.

Fig. 3. The SWOT analysis based on the views of the participants of the pilot EBP education.

The pilot participants were asked if they would like to suggest any changes for the EBP education. No one wanted to do that. The pilot study did not reveal any limitations nor potential barriers to the subsequent implementation of the intervention. After the pilot study the last five items of GREET checklist (Phillips et al., 2016) were reported.

Educational interventions on EBP in health care may require modification to ensure they meet the needs of the learners, due to the complex nature of health care (Phillips et al., 2014). The piloting stage is rarely reported in the intervention studies and thus the planned changes are rarely reported (Moore et al., 2015). In a systematic review (Koota et al., 2018), none of the original studies included in the review reported *planned or unplanned changes* (i.e. adaptations or modifications) (Phillips et al., 2016) or their influence on outcomes. In this study, there were no adaptations nor modifications done to the EBP education after piloting the intervention.

The *attendance* of the learners (Phillips et al., 2016) may have an impact on the learning outcomes (Phillips et al., 2014). In a systematic review on EBP educational interventions among emergency nurses, the learner attendance was reported in all original studies (Koota et al., 2018). In this study, the experimental groups learner attendance was recorded in every contact learning session by gathering a name list. The control group learner attendance was not be recorded, since the mode of delivery was self-directed learning and the participants were able to conduct the given assignment when the time was appropriate for them.

The materials and the educational strategies were used and delivered in the educational intervention *as originally planned* (Phillips et al., 2016). For the experimental group, the materials were delivered to learners by email as originally planned. The educators had extra copies of the materials with them, in case a participant had not noticed the emails. The researcher will keep a diary during the implementation of the educational strategies to make sure the intervention will be delivered as originally planned. For the control group, the materials and educational strategies will be delivered as originally planned, but no formal record will be kept during the educational intervention, since the mode of delivery is self-directed learning and the participants conducted the given assignment when the time is appropriate.

Whether the educational intervention is delivered as planned can impact on the success of the educational intervention Nelson, Cordray, Hulleman, Darrow, and Sommer (2012). The researcher kept a formal record of the delivery schedule for the educational interventions of each group. *The number of sessions, their*

frequency, timing and duration were delivered as originally scheduled (Phillips et al., 2016) for both groups of this educational intervention.

4.2 Evaluation phase

In the evaluation phase, the effectiveness of the EBP education was evaluated by using an RCT with parallel group design with follow up after 6 and 12 months (publications II and III) (Table 4). The RCT was conducted in four EDs at two university hospitals in Finland. The units were randomized into two experimental groups and two control groups by an impartial secretary using a simple coin toss. After the EDs were randomized, the participating emergency nurses were recruited. The units' emergency nurses were given information about the EBP education, its objectives, content and what it will demand from the participant. After that they were asked whether they were interested in participating in the EBP education.

Table 4. The EBP educational intervention implementation and outcomes measurement protocol.

Evaluation phase	Experimental group	Control group
T ₀ Baseline measurement	5/2018	5/2018
Implementation of the EBP educational intervention	5/2018	6/2018 or 8/2018
T ₁ Measurement immediately after the EBP education		
T ₂ Measurement 6 months after	11/2018	12/2018 or 2/2019
T ₃ Measurement 12 months after	5/2019	6/2019 or 8/2019

The population consisted of 300 emergency nurses employed in the two university hospitals' emergency departments. Inclusion criteria for the potential participants were as follows: (1) working as an RN at a university hospital emergency department; (2) working full- or part-time as an RN at emergency department of the university hospital; and (3) being able to understand and read Finnish. In order to recruit the relevant number of participants, a statistician was consulted for sample size determination. The sample size (n = 80, 40/group) for this RCT was estimated using a simulation approach. Each sample size and increase of the response combination was bootstrapped 1 000 times and the power was approximated by the number of significant Mann-Whitney U tests when comparing increases in groups and Wilcoxon signed-rank tests when comparing increases on individual level. As repeated measures were utilized, drop-out attrition was expected. To account for an estimated 20% attrition rate, based on previous studies

conducted on the phenomenon of interest and studies utilizing a similar study design, a total sample of +20% RN participants was recruited for this study (Julious, 2010). At the beginning of the study, 40 participants for the experimental and 40 participants for the control group were recruited. Finally, 35 participants of the experimental and 29 participants of the control group completed the study. The CONSORT diagram of the study is presented in original publication III, Figure 1.

Data was collected from participating emergency nurses with repeated measures through an electronic or manual survey, which was administered at four different time points (T_0 – T_3) during the period May 2018 to August 2019 from participating two university hospitals. The participants had an opportunity to choose whether they wished to fill in the electronic survey or the manual (paper) survey. T_0 was the pre-intervention/baseline survey (instruments 1, 2, 3, 4), which was administered in May 2018. T_1 was administered immediately after the educational intervention (instrument 5 included). T_2 was administered 6 months after T_1 and T_3 within 12 months after T_1 .

At T_0 , participants from both groups answered the manual survey. At T_1 , all participants from the experimental group answered the manual survey, whereas 32 control group participants answered the manual and eight control group participants answered the electronic survey. At T_2 , all participants from the experimental group answered the manual survey, whereas 20 control group participants answered the manual and 17 control groups participants answered the electronic survey. At T_3 , 23 participants from the experimental group answered the manual and 12 participants the electronic survey, whereas 18 of control group participants answered the manual and 11 participants the electronic survey.

The participants' learning of EBP was measured according to the CREATE framework (Tilson et al., 2011). The data was collected using five different instruments which were: the Evidence-Based Practice Questionnaire-FI (EBPQ-FI) (Upton & Upton, 2006), the Evidence-Based Practice Beliefs Scale© (EBPB) (Melnyk, Fineout-Overholt, & Mays, 2008), the Evidence-Based Practice Implementation Scale© (EBPI) (Melnyk et al., 2008), the EBP Basic EmNurs knowledge test and The EBP education course assessment form (Table 5). The research instrument as a whole is presented in Appendix 3. The instruments are published with a permission of their owners.

Table 5. Instruments used in the study.

Measure	Subscales	Categories of the CREATE-taxonomy (outcome areas)
Evidence-Based Practice Questionnaire-FI (EBPQ-FI) ¹	3 subscales (24 items): <ul style="list-style-type: none"> • practice (use of EBP) • attitude (attitude toward EBP) • knowledge (knowledge and skills in EBP) 	behaviors attitudes knowledge skills
Evidence-Based Practice Beliefs Scale© (EBPB) ²	• beliefs about the value of EBP and the ability to implement it (16 items)	attitudes self-efficacy
Evidence-Based Practice Implementation Scale© (EBPI) ²	• extent of EBP implementation (18 items)	behaviors
The EBP Basic EmNurs knowledge test	• knowledge about EBP (13 items)	knowledge
The EBP education course assessment form	• learners' satisfaction (5 items)	learners' reactions to the educational experience

¹ Upton & Upton (2006), ² Melnyk et al. (2008)

Evidence-Based Practice Questionnaire-FI (EBPQ-FI). The EBPQ was developed by Upton and Upton (2006) in the UK to measure factors influencing EBP uptake and implementation, initially within nursing practice. It is a 24-item self-report measure, comprising three subscales: practice (use of EBP), attitude (attitude toward EBP), and knowledge (knowledge and skill in EBP). The EBPQ scale has response categories ranging from 1–7, with a higher score indicating a more positive attitude towards clinical effectiveness or use and knowledge of clinical effectiveness and EBP. The EBPQ has been found to be quick and easy to administer, and to have good internal reliability as measured by Cronbach's alpha; the alpha for the overall questionnaire is 0.87 and the three subscales have alphas of 0.85 (practice), 0.79 (attitude), and 0.91 (knowledge) (Upton, Upton, & Scurlock-Evans, 2014). EBPQ-FI is a Finnish version of the instrument. It has been translated into Finnish language by the Finnish Nursing Research Foundation. Permission to use the EBPQ-FI in this study was obtained from Upton and Upton in November 2016. Out of the components of the CREATE taxonomy, attitudes, knowledge, skills and behavior can be measured by using the EBPQ-FI.

Evidence-Based Practice Beliefs Scale© (EBPB). The EBPB was developed in the USA by Melnyk and Fineout-Overholt (The Centre for the Advancement of Evidence-Based Practice in Arizona State University). The 16-item EBP Beliefs

Scale allows measurement of person's beliefs about the value of EBP and the ability to implement it. The EBP Beliefs Scale has response categories ranging from 1 = strongly disagree to 5 = strongly agree with higher scores indicating higher value of EBP. Cronbach's alpha has found to be > 0.90 for the whole instrument (Melnik et al., 2008). Permission to translate and use EBPB in this study was obtained from Melnyk and Fineout-Overholt in May 2017. The translation was done using the symmetrical category as an approach (Sousa & Rojjanasrirat, 2011). Out of the components of the CREATE taxonomy, attitudes and self-efficacy related to EBP of the study participants (beliefs about the value of EBP and beliefs of one's own ability to implement it) can be measured by using the EBPB.

Evidence-Based Practice Implementation Scale© (EBPI). The EBPI was developed in the USA by Melnyk and Fineout-Overholt (The Centre for the Advancement of Evidence-Based Practice in Arizona State University). The 18-item EBP Implementation Scale allows measurement of the extent to which EBP is implemented. The EBP Implementation scale's response categories range from 0 = 0 times to 4 = > 8 times with higher scores indicating increased frequency in implementing EBP within the past eight weeks. Cronbach's alpha has found to be > 0.90 for the whole instrument (Melnik et al., 2008). Permission to translate and use EBPI in this study was obtained from Melnyk and Fineout-Overholt in May 2017. The translation was done using the symmetrical category as an approach (Sousa & Rojjanasrirat, 2011). Out of the components of the CREATE taxonomy, behavior of the study participants (measurement of the extent to which EBP is implemented) can be measured by using the EBPI.

The EBP Basic EmNurs knowledge test. The EBP Basic EmNurs knowledge test was developed for this study because no suitable test was found. The EBP Basic EmNurs knowledge test was used to objectively test knowledge of EBP of the participants. The questions were based on the EBP competencies presented by Melnyk et al. (2014) so that there was one question regarding each competency. The EBP Basic EmNurs knowledge test consisted of 13 questions. Each question has 4 answering options with only one correct answer. The EBP Basic EmNurs knowledge test was piloted when piloting the EBP education and the results of the piloting were analyzed statistically to examine the measurement properties of the instruments. Kuder-Richardson formula (KR-20) was calculated for the EBP Basic EmNurs knowledge test. KR-20 is a special case of the Cronbach alpha for dichotomous variables and similarly to the Cronbach alpha it measures the reliability of the test. The EBP Basic EmNurs knowledge test achieved a KR-20 of 0.57.

The EBP education course assessment form was developed for this study and used to assess the learners' satisfaction i.e. reactions to the educational experience. The questions of the instrument are based on the items proposed by Tilson et al. (2011). The 5-item assessment form allows measurement of the learners' satisfaction with the educational experience. The response categories range from 1 = lowest grade to 5 = highest grade of learners' satisfaction with the educational experience. The permission to translate and use the items in this study was obtained from Tilson in March 2020. The course assessment form was piloted when piloting the educational intervention. No amendments were done after the piloting. Cronbach's alpha was calculated, and it was found to be 0.85 for the whole instrument.

Four instruments were also piloted during autumn 2017 among master's students of nursing science (n = 11) and master's students of development and management in health care and social services in University of Applied Sciences (n = 5). The data was collected with the instruments 1, 2, 3 and 4 and analyzed statistically to examine the measurement properties of the instruments. Some small amendments regarding the linguistic clarity of the questions were made after piloting the instruments. The details of Cronbach's alpha results of the instruments are presented in publication II, Table 1.

The data was analyzed by using the R (version 3.4.4) and R (version 3.6.1) in collaboration with a biostatistician. The background data was analyzed with descriptive statistics. The results were then reported as percentages, means, medians and standard deviations. In both studies, the baseline and longitudinal, the sum variables were formed based on the CREATE framework (Tilson et al., 2011). All other sum variables, except the EBP Basic EmNurs knowledge test, were formed by calculating the means within a category. Scores for the questions 'I believe that EBP takes too much time' and 'I believe EBP is difficult' were reversed to match the scale (negative-to-positive) of other questions included in the Attitude EBPB sum variable. As for the EBP Basic EmNurs Knowledge test sum variable, the number of right answers of the EBP Basic EmNurs knowledge test questions were counted. Summary statistics were then calculated for this sum variable.

Continuous variables were presented as means and medians while categorical data was presented as numbers of observations and percentages. The continuous variables were compared using Mann-Whitney U test or Wilcoxon signed rank test depending on if the comparison was done for a timepoint or for change from baseline. The categorical variables were compared with Chi-squared test and the Fisher test depending on the number of observations in each subgroup. The change

in the number of all correct answers in the EBP Basic EmNurs knowledge test was tested using Fishers test. The continuous variables in different categories were compared using Kruskal-Wallis H test while correlation between two continuous variables were investigated using Pearson correlation coefficients. In both studies, the baseline and longitudinal, two-tailed p-values < 0.05 were considered statistically significant (Burns & Grove, 2009). The plots were done using the ggplot2 package. Boxplots were used to visualize the scores and the differences between the groups. The line at the centre of the box marks the median while the box itself contains 50% of the observations, the top of the box marks the 75th percentile and the bottom the 25th percentile (i.e. the interquartile range, IQR). Sticking out of the top and bottom are two whiskers which extend to maximum of 1.5 times the IQR range and beyond this the observations are plotted individually as points. The bar plot shows the mean of the variable and the whiskers show the mean plus/minus the standard deviation (Wickham, 2016).

4.3 Ethical considerations

The ethical considerations consist of three parts. First, the ethics of the study design are described. Second, the approvals obtained are described. Then third, informed consents are described.

The study was conducted in accordance with the guidelines for the Responsible Conduct of Research (Finnish Advisory Board on Research Integrity 2019). The guidelines were carefully followed throughout the study process. The study aims, research questions and hypotheses were justifiable because they were based on the main gaps in the existing literature (Polit & Beck, 2016). Power analysis was used to estimate the sample size needed. The permissions to translate (EBPB, EBPI) and use (EBPQ, EBPB, EBPI) the exiting validated questionnaires were obtained from the original developers of the instruments by email (Kelleher & Andrews, 2008; McKillop, 2004). The reporting of the study complied with the PRISMA (Moher et al., 2009), CONSORT (Boutron et al., 2008), and STROBE (STROBE 2007) standards.

Study permits for this study were obtained from one University Hospital (Mar 14, 2018) and the other University Hospital (Apr 24, 2018) where the educational interventions were implemented, and the data was collected. The pilot study was conducted with the oral approval from the head of department since the ethical approval was obtained from the University Hospital ethical committee

(7.3.2018/455/2018). The data was projected with the register description in accordance with section 10 and 14 of the Finnish Personal Data Act (523/99).

In accordance with the Finnish Medical Research Act (488/1999), each participant received written and oral information about the study's aim, procedure and requirements and signed a written consent before participating. Participants were assured of the confidential and voluntary participation. Participants were guaranteed that all data collected in this study was pseudonymized. Each participant got an ID-code and only the research assistant, not the investigator, knew whose ID-code was in question. The data (paper and electronic) was stored in safe storage and will be destroyed according to regulations and ethical guidelines after the study has been reported (Personal Data Act 523/1999, Finnish Advisory Board on Research Integrity 2009). The participants had a right to withdraw from the study at any time for any reason. In addition, participants were informed that they could withdraw from the study without giving any justification (Medical Research Act 488/1999).

5 Results

The detailed descriptions of the results are explained in publications I–III. In this section, the main results are presented in two phases. In developmental phase the educational interventions promoting EBP and their outcomes among emergency nurses found in a systematic review are described. In evaluation phase, first the emergency nurses' EBP attitudes, self-efficacy, knowledge, skills and behavior at baseline are described; second, the effectiveness of the EBP education is described; finally, the main results are summarized.

5.1 The development phase

The aim of the systematic review of the literature, (publication I) was to describe educational interventions promoting EBP and their outcomes among emergency nurses, compared with no education. Ten original studies were included in the review. One study was conducted in five different hospital EDs and another was conducted in four EDs. Seven studies were conducted in a single hospital ED, the tenth study's setting was not disclosed. Six of the studies were conducted in Australia, three in USA, and one was conducted in Thailand.

In terms of methodology, the majority ($n = 9$) of the original studies were uncontrolled quasi-experimental studies using a pre-test post-test design, one study was a quasi-experimental study with a comparison group. The data collection intervals were short. The pre-test data was collected before the educational intervention and the post-test data was collected immediately after the education in all except in one study, which collected the data 1 month and 3 months after the educational intervention, and only this one study had a second follow-up. There was great variation in the total sample sizes of the original studies included in the review; the sample size ranged from 14 to 88. There was also great variation in the response rates; they varied from 30% to 92.9%. Additionally, six of the studies did not publish a response rate.

The educational interventions promoting EBP in emergency nursing were described using the GREET checklist (Phillips et al., 2016) as a framework. The details of the educational interventions reported varied considerably between the studies, with most failing to provide details of the educational intervention. Nine different interventions were reported in ten different studies, and they were all self-developed educational interventions.

The GREET checklist items that were reported in all the studies were a brief description of the intervention, educational strategies, and the modes of delivery of the intervention. The items that were reported in one study or more, but not in all the studies were educational theory (n = 1), educational materials (n = 7), instructors (n = 4), environment (n = 6), schedule (n = 6), the amount of time learners spent in face-to-face contact (n = 6), and learner attendance (n = 7). The items that were not reported in any of the studies were learning objectives, EBP content, incentives, possible adaptation or modifications done, the adherence or fidelity, and if the intervention was delivered as scheduled.

The educational interventions were provided with face-to-face group sessions (n = 7) or through the internet (n = 2) with a self-learning package. Face-to-face lectures/tutorials (n = 6) and a face-to-face workshop (n = 1) were the most used methods of an educational strategy and mode of delivery. Interventions using face-to-face contact gained good results regarding emergency nurses' knowledge, benefits to the patient, skills, and behavior. Self-directed learning material gained good results regarding EBP knowledge. However, it was not possible to determine whether the educational strategies and modes of delivery caused the effects, because the interventions included many elements, and all studies but one were uncontrolled.

The outcomes of the educational interventions were described using the CREATE taxonomy (Tilson et al., 2011) as a framework. Nine studies had not addressed EBP attitudes as an outcome of an educational intervention. One study reported on data collection regarding attitudes but did not report the results. EBP knowledge had been self-evaluated in seven studies. The evaluation of knowledge had been tied to a specific clinical substance and it had been measured as a factual knowledge. Four of these studies had gained statistically significant improvements. ED nurses' knowledge of child fever management, care for patients with severe traumatic brain injuries, assessment of pediatric pain and medication for nasogastric tube insertion improved. EBP skills had been evaluated as performance in two studies by using self-administered tools, and neither one had gained statistically significant improvements. Eight of the studies had not assessed EBP self-efficacy as an outcome. In two studies, the self-efficacy was reported, however, the outcomes had not been statistically significant. EBP behavior was reported in four studies. Although improvements had been gained, none of them were statistically significant. Six studies had not assessed learners' satisfaction. Two studies had gathered the data but did not report the results, and two studies mentioned shortly, in which the learners had reported that the education had been

beneficial for them. Benefits to the patient were reported in six studies. The benefits had been evaluated by auditing clinical documentation (n = 4) or by an interview (n = 2). Out of the six studies, two had gained statistically significant results. Patients received better discharge advice from ED nurses concerning fever management at home and nurses' patient assessments improved after the educational intervention.

In summary, the results of the systematic review showed that there have been few educational interventions intending to promote EBP among emergency nurses. They have been similar to one another with regards to educational strategies used and focusing on clinical issues as the learning content and leaving the EBP steps out from the learning content. Educational interventions involving face-to-face contact have had statistically significant effects on emergency nurses' EBP regarding knowledge, benefits to the patient, skills, and behavior. Additionally, the use of self-directed learning material has significantly improved emergency nurses' EBP knowledge. Face-to-face tutorials and/or self-directed learning packages have proved to be effective educational strategies for teaching EBP for emergency nurses. The outcomes of the interventions have been promising. The level of evidence in the studies was modest with regard of the evaluation focusing mostly on EBP knowledge.

5.2 Evaluation phase

5.2.1 The baseline of emergency nurses' EBP attitudes, self-efficacy, knowledge, skills and behavior

The aim of the baseline measurement was to describe emergency nurses' EBP attitudes, self-efficacy, knowledge, skills, and behavior before an educational intervention (publication II).

The majority of the participating emergency nurses were women (n = 66) and registered nurses (n = 68), often with a bachelor's degree (n = 67) as their educational qualification. The median work experience in emergency nursing among the participants was 6.5 years (IQR 7.1). More than half of them (63%, n = 50) had learned about EBP during their nursing education, and three of the participants reported learning more about EBP on their own time in a self-directed continuous education course (publication II, Table 1).

At the baseline measurement, the participants' EBP attitudes, knowledge, skills and self-efficacy, were at a better than average level. They had positive attitudes towards EBP measured with both instruments (EBPB and EBPQ). EBP knowledge was measured with two sum variables, EBPQ knowledge and the EBP Basic EmNurs knowledge test, and both scores demonstrated better than average knowledge of EBP. Furthermore, self-evaluated skills, measured with one sum variable (EBPQ), were better than average. EBP self-efficacy, measured with one sum variable (EBPB), was also better than average. Findings on EBP behavior were contradictory: when measured with the sum variable behavior EBPI, it was below average level, yet the behavior EBPQ sum variable demonstrated better than average level behavior (Figure 4). As for knowledge, the range of the correct answers and number of participants receiving maximum points in the EBP Basic EmNurs knowledge test at different measurement points are presented in table 6.

At the baseline measurement, there were no statistically significant ($p < 0.05$) between-group differences in the values for the EBP attitudes, self-efficacy, skills and behavior. When measured with the EBP Basic EmNurs knowledge test, EBP knowledge scores were statistically significantly ($p < 0.01$) better in the control group compared with the experimental group (Figure 4).

The correlations between the sum variables and age, years since graduation and both years of work experience in health care and in emergency nursing are presented in publication II, Table 4. A significant negative correlation was found between age, years since graduation, the length of the working experience in health care and EBP attitudes, behavior, knowledge and self-efficacy. This indicates that increasing age and years since graduation were predictors of lower EBP related attitude, self-efficacy, knowledge, skills and behavior. The table also shows associations between gender, educational background and prior exposure to EBP and the main outcomes though no significant association were found (publication II, Table 4).

5.2.2 The effectiveness of the educational intervention

The aim was to evaluate the effectiveness of an EPB educational intervention on emergency nurses' EBP attitudes, knowledge, skills, self-efficacy and behavior immediately after, and 6 months and 12 months after the EBP education. Moreover, the learners' satisfaction with the EBP education was assessed after the EBP education (publication III).

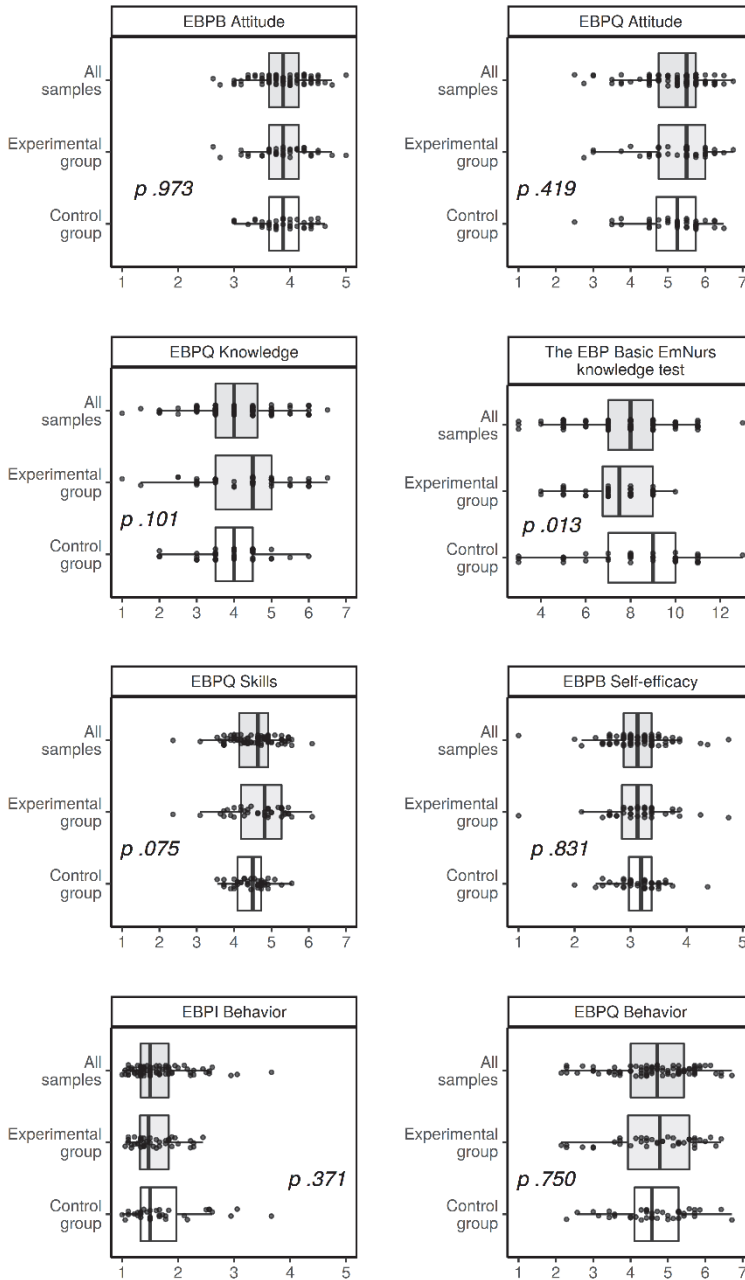


Fig. 4. The baseline of EBP attitudes, knowledge, skills, self-efficacy and behavior among emergency nurses – along with differences between groups.

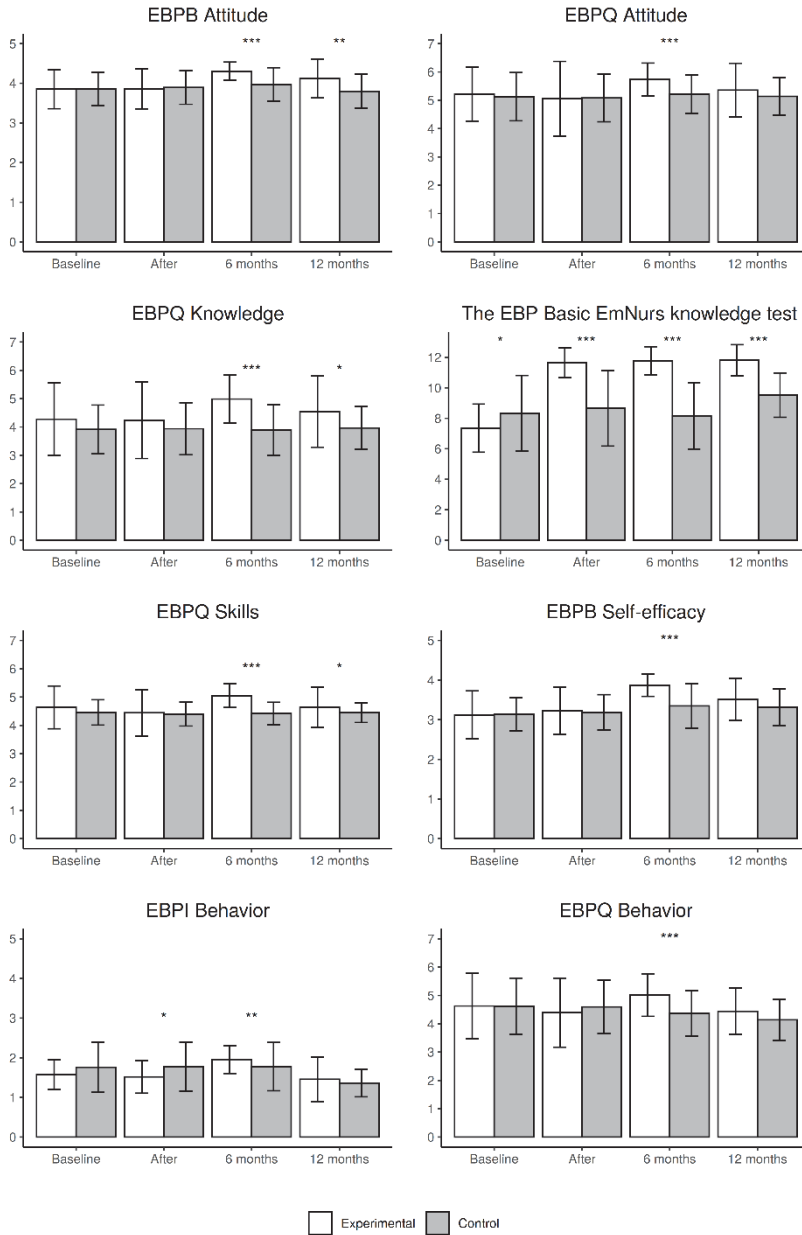
Altogether, 35 participants of experimental and 29 participants of control group completed the study. The findings concerning the sum variable level are outlined in Figure 5. The item level full data is presented in Appendix 4 and 5.

Immediately after the EBP education there were not statistically significant ($p < 0.05$) improvements and differences between groups in EBP attitudes, self-efficacy or behavior. This result does not support hypothesis 1. EBP knowledge measured with the EBP Basic EmNurs knowledge test increased statistically significantly ($p < 0.001$) with the experimental group, while EBP skills decreased from the baseline measurement. At the 6-month measurement point, there were statistically significant ($p < 0.01$) differences between the groups within every sum variable. This result supports hypothesis 1. At the 12-month measurement point there were differences between the groups in all outcomes (attitudes, knowledge, skills, self-efficacy, behavior) except the EBP attitudes measured with EBPQ and EBP behavior measured with both instruments.

In the experimental group, EBP attitudes, knowledge, self-efficacy and behavior did not improve immediately after education, but it did at 6 months. At 12 months EBP attitudes (measured with EBPB) and self-efficacy slightly decreased. EBP knowledge measured with both instruments (the EBPQ knowledge and the EBP Basic EmNurs knowledge test) stayed at a higher level compared with the baseline measurement throughout the follow-up period in the experimental group. This result supports hypothesis 1.

In the control group, EBP self-efficacy improved immediately after the EBP education, otherwise there were no statistically significant changes immediately after the EBP education. At 6 months, EBP attitude measured with EBPB and self-efficacy increased statistically significantly. At the same time, behavior measured with the EBPQ decreased. At 12 months, EBP knowledge measured with the EBP Basic EmNurs knowledge test and EBP self-efficacy increased from the baseline, while EBP behavior measured with both instruments decreased from the baseline.

In the EBP Basic EmNurs knowledge test, the number of participants in the experimental group receiving 13 points, which was the maximum, increased statistically significantly after the intervention. In the control group it stayed the same all measurement points. The range of the correct answers and number of participants receiving maximum points in the EBP Basic EmNurs knowledge test at different measurement points are presented in table 6.



* = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001

Fig. 5. Emergency nurses' EBP attitude, knowledge, skills, self-efficacy and behavior in a 12-month follow-up.

Table 6. The range of the correct answers and number of participants receiving maximum points in the EBP Basic EmNurs knowledge test.

Measurement point	The range of the correct answers in the experimental group	Received 13 points (maximum) in the experimental group (%)	The range of the correct answers in the control group	Received 13 points (maximum) in the control group (%)
Baseline	4–10	0 (0.0%)	3–13	1 (2.5%)
After	10–13	8 (20.0%)	3–13	1 (2.5%)
6 mo	10–13	9 (22.5%)	3–13	1 (2.7%)
12 mo	9–13	10 (28.6%)	8–13	1 (3.4%)
p-value		< 0.001		1

The results showed that the correlations between sum variables in experimental and control group did not differ from the baseline measurement (Koota et al., accepted for publication, Table 1). The full data correlations between sum variables are presented in publication III (supplementary Table 2). The correlations stayed constant throughout the study (Koota et al., accepted for publication, supplementary Table 2).

5.2.3 The learners' satisfaction with the EBP education

The learners' satisfaction with the EBP education was measured once, immediately after the education had finished, with five questions based on the items proposed by Tilson et al. (2011). In both groups, the learners' satisfaction score medians were most often 3, which indicates average level satisfaction. There was a statistically significant ($p = 0.01$) difference between the groups regarding satisfaction with the teachers' teaching style with encouragement to ask clinical questions and the usefulness of considering how to use of research evidence in nursing practice. The participants in the experimental group were more satisfied in the teachers' teaching style with encouragement to ask clinical questions and the usefulness of considering how to use research evidence in nursing practice than the control group participants (publication III, Table 2).

5.3 Summary of the main results

The main results of the study are:

1. The systematic review showed that EBP educational intervention studies among emergency nurses have shown a promising improvement on emergency nurses' EBP knowledge, skills and behavior, and benefits to the patient. The educational interventions have mainly used face-to-face didactic lectures and/or self-directed learning packages as an educational strategy. These strategies have been effective when teaching EBP in EDs.
2. At the baseline the emergency nurses' EBP attitudes, self-efficacy, knowledge and skills were better than average level. The results regarding EBP behavior was conflicting since it was below the average level when measured with the behavior EBPI but the behavior EBPQ sum variable showed better than the average behavior.
3. Immediately after the EBP education had finished, neither one of the groups showed statistically significant improvements in EBP attitudes, behavior or knowledge measured with EBPQ.
4. In the experimental group, EBP attitudes, behavior, knowledge, self-efficacy, and skills were improved. Improvement did not happen immediately after the education, but the increase was evident at 6 months. At 12 months, in the experimental group, EBP attitudes (measured with EBPB) and self-efficacy slightly decreased from the 6-month measurement, still staying at a higher level than the baseline measurement. EBP knowledge measured with both instruments (the EBPQ knowledge and the EBP Basic EmNurs knowledge test) stayed at a higher level compared with the baseline measurement throughout the follow-up period in the experimental group.
5. In the control group, the EBP self-efficacy improved immediately after the EBP education, otherwise there were no statistically significant changes immediately after the EBP education. There were changes at 6 and 12 months. At 6 months EBP attitudes measured with EBPB and self-efficacy increased statistically significantly, but behavior (measured with EBPQ) decreased. At the 12 months measurement point, EBP knowledge (measured with The EBP Basic EmNurs knowledge test) and EBP self-efficacy increased from the baseline, while EBP behavior measured with both instruments decreased from the baseline.
6. Age, year since graduation, work experience in healthcare and in emergency nursing showed a statistically significant correlation with the participants' EBP attitudes, self-efficacy, knowledge, skills and behavior. Gender and educational background were not associated with EBP attitudes, self-efficacy, knowledge, skills and behavior measured at every measurement point.

7. As for learners' satisfaction, the participants' in the experimental group rated the teachers' teaching style in inspiring them to ask clinical questions and the usefulness of considering how to use research evidence in nursing practice better compared with the control group. In both groups, the measurement showed average levels of satisfaction with the education.

6 Discussion

The aim of this study was to develop an EBP educational intervention and to evaluate its effectiveness on EBP attitudes, knowledge, skills, self-efficacy and behavior among emergency nurses. The learners' satisfaction with educational experience was also assessed after the EBP education. In this discussion section, the main results will be first discussed. Then the validity and reliability of the study will be discussed. Finally, implications for practice and suggestions for future research are presented.

6.1 Discussion of the results

6.1.1 The development phase

Based on the systematic literature review, the EBP educational interventions among emergency nurses have been incompletely described and the details reported have varied considerably (Koota et al., 2018). The result is quite identical with previous systematic reviews concerning EBP educational interventions in the field of health care in general, where the reporting of the EBP educational interventions has also varied from well reported to modestly reported interventions (Häggman-Laitila et al., 2016, 2017; Melender et al., 2016; Phillips et al., 2014). This was the first study in the field of emergency nursing, where an EBP educational intervention has been described and reported by using the GREET checklist presented by Phillips et al. (2016).

The earlier conducted EBP educational interventions for emergency nurses have not described any educational theories used in the interventions (Koota et al., 2018). In this study, the transformative learning theory was used (Mezirow, 2000). It suited well as it promoted the reflection of one's experience in a social process. The emergency nurses reflected with their past experiences of EBP in the group and created new knowledge and skills about EBP, for instance, how to search the research evidence. Use of the ARCC model helped them then to implement the best evidence in their daily clinical practice. They could get affirmation regarding what they were doing, since there were EBP mentors whom they could ask about unsure issues.

The previous EBP educational interventions have mainly been implemented as a face-to-face tutorial and/or as a self-directed learning package. The content of the

EBP education has focused on the improvement of a certain clinical area and the education has been implemented as an in-service hospital education. The combination of face-to-face teaching and self-directed learning (Damkliang et al., 2015; Yeoh et al., 2009) and entirely self-directed learning (Considine et al., 2010) have been found to be effective for teaching EBP in ED. In this study, the trial was implemented to test the effects of both strategies, the combination for the experimental group and entirely self-directed learning for the control group.

The main objective of the EBP education for both groups was to provide emergency nurses with basic competencies of EBP. The content of the EBP education consisted of the EBP steps (inquiry, ask, search, appraise, integrate, evaluate, disseminate), because in the context of emergency nursing, it is vital for emergency nurses to learn more about the EBP steps and be empowered to employ it in their work i.e. cultivate a spirit of inquiry, learn to generate PICOT questions from clinical practice, gather the best information, critically appraise it, integrate it into daily practice and evaluate the outcomes, and finally, share the information with colleagues (Considine, Shaban, Fry, & Curtis, 2017). This did not differ from the situation of nurses in general, since it has been found that to support nurses' learning of EBP, educational interventions should be modified to include not only clinical content relating to EBP but also the explicit discussions of the steps in the EBP process to ensure that participating nurses are adequately informed about integrating and evaluating EBP in clinical practice (Aglen, 2016; Häggman-Laitila et al., 2016; Phillips et al., 2014; Tilson et al., 2011; Young et al., 2014).

Previous nursing studies concerning the outcomes of educational interventions on EBP attitudes, knowledge, skills, self-efficacy and behavior have almost entirely focused on nurses in general. Emergency nurses might have been included in these studies, but this has not been specifically mentioned. In the context of emergency nursing, the studies have often focused on one or two EBP areas, most commonly, attitudes, knowledge and/or skills in relation to EBP (Saqe-Rockoff, Schubert, Ciardiello, & Douglas, 2018; Sampson et al., 2014; Stokke et al., 2014). This study widened the number of the outcomes measured by focusing on measurement of emergency nurses' EBP attitudes, knowledge, skills, self-efficacy and behavior and learner's satisfaction and thus, produced new knowledge on the topic.

EBP Basics for EmNurs for the experimental group used a multifaceted learning strategy, including didactic lectures and discussions, small group tutorials, database search workshops and self-directed learning in the form of assignments and reading in order to reach the learning objectives. The teacher spent 18 hours with the participants face-to-face. The experimental group's EBP attitudes,

knowledge, skills, self-efficacy and behavior improved statistically significantly and were still evident at the 6-month follow-up measurement. It can be estimated, with care, that using evidence-based multifaceted learning strategies when teaching EBP caused the positive learning results. However, it is worth noticing, that since a combination of many teaching/learning methods were used for the experimental group, it cannot be distinguished as to whether they all as a combination were effective or if, for example, only one of them caused the positive effects. The results of this study support the previous studies which recommend that EBP education should be implemented using at least two teaching/learning methods (Häggman-Laitila et al., 2016; Phillips et al., 2014; Tilson et al., 2011; Young et al., 2014). However, more research concerning an effective learning/teaching strategy promoting EBP among emergency nurses is needed.

The control group received the same learning objectives and content as the experimental group. However, the whole intervention was delivered as self-directed learning, without any teacher being present face-to-face. The self-directed learning module did not improve the control group's EBP attitudes, knowledge, skills, self-efficacy and behavior. There was only a slight improvement in EBP knowledge in the control group measured with the knowledge test at the 12-months measurement point. This result supports the conclusion based on the studies among nurses in general, that if using only online EBP education, more modest improvements may be expected (Mollon et al., 2012; Moore, 2017). Based on the result which does not support the null hypothesis, the null hypothesis can be rejected.

6.1.2 The evaluation phase

The participating emergency nurses in this study had a positive *EBP attitude* prior to the EBP education and in the experimental group it stayed above the average level throughout the study. No earlier study was found concerning emergency nurses' EBP attitudes or effect of an EBP education on emergency nurses' attitudes. These results are in line with previous study results concerning the status of EBP attitudes among nurses in general (Duffy et al., 2015; Melnyk et al., 2012; Stokke et al., 2014), and concerning nurses' positive EBP attitudes immediately after an EBP educational intervention (Friesen, Brady, Milligan, & Christensen, 2017; Moore, 2017; Moore et al., 2019; Ramos-Morcillo, Fernández-Salazar, Ruzafa-Martínez, & Del-Pino-Casado, 2015; Snibsøer, Espehaug, Ciliska, & Wammen Nortvedt, 2017). However, most of these studies measured the effect of an EBP

education only immediately after the EBP education. One reason for a positive EBP attitude might be that almost all of the participating emergency nurses in this study had a bachelor's degree from a university of applied sciences where they had learned about EBP. In 2003 in Finland, the Ministry of Social Affairs and Health gave recommendations to strengthen the student nurses' EBP competencies during the nursing education and to strengthen implementation of EBP in clinical nursing practice (STM 2003). Based on this, when the newly graduated nurses are entering working life, it is important to offer them a possibility to use their EBP competences.

Prior to the EBP education, the emergency nurses subjectively self-evaluated their *EBP knowledge* being on average level (measured with the EBPQ) and when it was objectively measured with the EBP Basic EmNurs knowledge test, EBP knowledge was slightly higher than average level. This result is in line with a result of an earlier study, whose sample has also included emergency nurses, where nurses self-assessed their EBP knowledge as average (Mollon et al., 2012). Finnish nurses' (including emergency nurses and other nurses) EBP knowledge has recently been assessed twice in two different studies. In the first study, both actual EBP knowledge measured with a test and self-rated EBP knowledge were on a low level (Saunders et al., 2016), whereas in the second study, self-rated EBP knowledge was rated above average level (Holopainen et al., 2018).

After the EBP education, the emergency nurses' self-assessed (measured with the EBPQ) and objectively measured EBP knowledge (measured with The EBP Basic EmNurs knowledge test) improved in both groups and the increase was still evident at the 12-month measurement point. In the field of emergency nursing, improvements have also been found in EBP educational interventions for ED nurses regarding EBP knowledge on a certain clinical area. However, the effects of the education were measured immediately after the education. No longer follow-ups concerning EBP knowledge of emergency nurses were found. Research findings regarding EBP knowledge of nurses in general have been twofold: the EBP education has improved nurses' EBP knowledge (Ramos-Morcillo et al., 2015) and/or it has had no effect on EBP knowledge (Moore, 2017; Saunders et al., 2016). In these studies, the measurements have been done only once, immediately after the education. In almost all the above-mentioned studies, the measurement of the level of EBP knowledge has been based on nurses' self-evaluation.

EBP skills have rarely been reported or they have been reported in combination with knowledge in the earlier studies. In this study, the emergency nurses self-evaluated their baseline EBP skills as being above an average level. After the EBP education, in the experimental group, the EBP skills decreased after the EBP

education and increased at the 6-month follow-up. In earlier research, EBP skills have improved immediately after an online education for nurses in general including the combination of face-to-face learning and online learning as a learning strategy (Ramos-Morcillo et al., 2015). In the control group, EBP skills decreased at the 6-month follow-up. Similar results was found in Moore's (2017) study which included an online EBP education for nurses in general, after which EBP skills decreased immediately after the education. No studies in the context of emergency nursing were found concerning the assessment of EBP skills. More research in emergency nursing is needed on how to develop an effective learning/teaching method to support learning of EBP skills. Most of the tools assessing EBP skills have been based on nurses' self-assessment. There is a need for more objective ways to assess EBP skills. This could be, for example, the use of simulation technology for assessing EBP skills or observational peer-assessment in clinical practice.

Emergency nurses participating in this study showed better than average levels of *EBP self-efficacy* prior to the EBP education. This differs from an earlier study concerning Finnish nurses (the sample of this study did include also emergency nurses) who assessed their EBP self-efficacy being on a low to moderate level (Saunders et al., 2016). After the EBP education, EBP self-efficacy in the experimental group increased by the 6-month point, whereas after 12 months it had decreased, staying higher than the baseline level. In the control group, self-efficacy increased immediately after the EBP education and stayed higher than baseline level throughout the study. In the context of emergency nursing, no earlier research on the effect of an EBP education on EBP self-efficacy was found. However, in earlier studies in the context of nursing in general, EBP self-efficacy first increased and then decreased (Friesen et al., 2017; Moore et al., 2019; Royer, Crary, Fayram, & Heidrich, 2018; Snibsøer et al., 2017). Self-efficacy has a key role in implementing EBP in clinical practice since it refers to one's ability and confidence to perform a specific skill (Tilson et al., 2011). In this study, efforts to support the learners' self-efficacy were made in the form of activating them to self-evaluate their learning (Atjonen, 2007) and it may have somewhat supported their self-efficacy. However, more research is needed on how to intentionally support self-efficacy of the learners during the education. For example, it would be important to investigate the role of the formative evaluation during the EBP education and other methods of ipsative evaluation (Atjonen, 2007) to support the individual's EBP related self-efficacy (Snibsøer et al., 2017).

EBP behavior has an essential role because it converts the knowledge, skills and attitude into benefits for the patient. It refers to what the health care professionals actually do in clinical practice (Tilson et al., 2011). The results concerning EBP behavior in this study were contradictory. Prior to the EBP education, EBP behavior was below the average level when measured with EBPI, but above average level when measured with EBPQ. The reason for the differing findings may be associated with the differences in the original items of the two instruments, since the result was the same throughout the study. After the EBP education, the experimental groups' EBP behavior increased at the 6-month measurement point measured with both instruments. In the control group, EBP behavior decreased by 6 months when measured with EBPQ and by 12 months when measured with both instruments. During the whole follow-up, EBP behavior was below the baseline level. It is possible that the EBP Basics for EmNurs education for the experimental group includes elements that support the use of EBP, whereas the control group's intervention may not include such elements. It is noteworthy that in the control group there was a decrease in EBP attitude and skills. This could be connected to the decrease of EBP behavior.

As was found in this study, previous studies have also reported that emergency nurses do not always implement EBP into their practice (Kirk & Nilsen, 2016; Person et al., 2013; Sampson et al., 2014). The effect of an EBP education on EBP behavior has not been evaluated in the earlier studies in the field of emergency nursing. In earlier studies concerning the effect of an EBP education among nurses in general, the level of EBP behavior has either decreased (Friesen et al., 2017; Moore, 2017; Snibsøer et al., 2017) or increased (Moore et al., 2019) after the education. One possible reason for the decrease of the self-reported EBP behavior might be that the participating emergency nurses in the experimental group may have truly deeply understood the essence of EBP during the education and they may have been more self-critical in their self-assessments after the education. More different methods or combination of different methods could be useful in the assessment of the EBP behavior. Improvement in knowledge and skills does not automatically lead to an improvement of behavior in practice. Such methods could be, for example, interviews, observations or auditing patient records (Rengerink et al., 2013; Tilson et al., 2011).

Learners' satisfaction (i.e. learners' reaction to the educational experience) was evaluated in this study immediately after the EBP education with the EBP education assessment form. The participants in the experimental group provided more positive ratings of the teacher's teaching style in encouraging them to ask clinical

questions and the usefulness of the considerations of how to use research evidence in nursing practice than participants in the control group. This finding is most probably explained by the fact that the control group participants were encouraged to ask clinical questions and consider how to use research evidence in nursing practice only of their own written material. Learners' satisfaction with EBP education has quite rarely been reported. In the context of emergency nursing, two previous studies were found. The EBP education has been found to be beneficial in the study by Jordan and Moore-Nadler (2014). Another study reported that the learners had found the learning objectives and the content relevant and the method effective (Habich & Letizia, 2015). In this study, the scope of the EBP education assessment might have been narrow. More information might have been obtained by collecting qualitative data, for example, with open questions, by inviting the learners to describe their own learning experiences or their opinion, for example, about how the ARCC model used in the education supported their EBP behavior.

Benefits to the patient were not assessed in this study, even though the goal of EBP is to improve care outcomes for patients. In this study, the EBP education focused on basics competences of EBP and the steps of EBP which are difficult to assess from the point of view of benefits to the patients, since they do not include direct measures of patient care. In earlier studies, in the context of emergency nursing, the benefits to the patient have been assessed after educational interventions whose contents have been based on a certain clinical topic. In these studies, the methods of assessing the benefits to the patients has been an audit of clinical documentation (Considine & McGillivray, 2010; Habich & Letizia, 2015; Jordan & Moore-Nadler, 2014; Solomon & Jurica, 2016; Yeoh et al., 2009), or structured telephone interviews (Considine & Brennan, 2007a, 2007b), or use of an observation and documentation checklist (Munroe et al., 2016). However, these studies have not included the learning of the EBP steps.

In this study, EBP attitudes, knowledge, skills, self-efficacy and behavior were significantly correlated with age, years since graduation as well as the length of work experience in healthcare. However, the association with gender, educational background and a prior exposure to EBP was not evident. Throughout the study, younger, recently graduated and with less work experience in health care emergency nurses showed more positive attitudes towards EBP compared to their older, more experienced colleagues. A previous study of Melnyk et al. (2012) supports this, since the longer the work experience was in their study, the less nurses were interested in EBP. Melnyk et al. (2012) also found that more highly educated nurses were clearer about the steps of EBP and were more confident in

implementing them. In this study, however, the educational background was not associated with emergency nurses' EBP attitudes, knowledge, skills, self-efficacy and behavior.

Adoption of effective learning/teaching strategies and context-specific clinical integration of EBP are in the key role when teaching EBP in clinical practice (Lehane et al., 2019). Almost all of the previous studies in the field of emergency nursing, have used traditional educational strategies to teach EBP in clinical practice. Similarly, they have used the pre-post-test design to evaluate the effect of an educational intervention. In this study, an RCT design with repeated measures was used to evaluate the effectiveness of an EBP education. One of the main results of this study was that the effectiveness of the educational intervention was evident at the 6-month follow-up but mostly decreased until the 12-month follow-up. These results suggest that the EBP education should be available for emergency nurses on regular basis to maintain the EBP attitudes, behavior, self-efficacy and skills. A good level of EBP knowledge was still evident after the 12-month follow-up.

Based on the results of this study, using entirely the self-directed learning methods does not improve the learning of EBP nor motivates the learner, since the number of drop-outs from the control group were more than expected. However, online learning is needed as one strategy among other strategies. Developers of educational interventions could, for example, consider including the use of online group discussions and other interactive approaches to provide personalized feedback, and collaborative learning, both of which are known to facilitate adult learning (Mezirow, 2000).

One way to support learning of EBP in clinical practice might be the use of the EBP mentors (Melnyk et al., 2014). Mentors would be experts who enable nurses to integrate EBP in clinical practice. The mentors in this study were assistant head nurses of the units in a teaching position or administrative assistant head nurses in EDs. Since both also had other work obligations in the unit, their time for mentoring work was limited. Another professional group which could take the role of EBP mentor in emergency nursing could be the Emergency Nurse Practitioners (ENPs). The first suggestion for the use of the ENPs was presented in USA in 2007 (Shapiro, 2007) and in Finland the following year (Paakkonen, 2008). Since then, the discussion about the need for ENPs and the role of ENPs has increased (Considine et al., 2018, 2019). A suggestion for the nursing leadership would be to open new vacancies in emergency nursing clinical practice for ENPs to support the implementation of EBP. It would be worthy of further research to investigate the explicit role of ENPs to enhance EBP.

The promotion of EBP requires healthcare organizations' commitment to support the delivery of EBP and an EBP education system, which is efficient in supporting healthcare professionals in acquiring EBP competencies (Melnyk, 2012; Dawes et al., 2005). In this study, the organizational and administrative support to implement the EBP education was endorsed. Previous studies have identified the leaders as being in an important role in the implementation of EBP, since their role is to create a supportive culture and help to overcome the existing barriers (Stetler, Ritchie, Rycroft-Malone, & Charns, 2014). In this study, the nursing leadership (the directors of nursing, head nurses and assistant head nurses) supported the EBP education in many ways. For example, EBP education was endorsed as a part of the professional development program for the experimental group, and the EBP mentors included in the implementation of the ARCC model were provided. The EBP mentors were provided with a flexible scheduling of work in their units to enable the mentoring, and extra computers were installed in the units. However, even with the good organizational and administrative support, the EBP attitudes, skills, knowledge, self-efficacy and behavior as outcomes of this study had decreased at the 12-month measurement point. Therefore, it is important that the stakeholders strive to create an EBP culture, and supportive structures and environment for EBP overall, in the units so that the EBP competences of nurses would be in constant use (Gallagher-Ford, 2017).

In this study, the EBP education was targeted at emergency nurses only, however, emergency nurses and emergency physicians work together in a close collaboration at the ED. There is a growing need for multiprofessional EBP educational interventions (Häggman-Laitila et al., 2017; Lehane et al., 2019; Patelarou et al., 2017; Phillips et al., 2014). During this research process, it became evident that a multiprofessional EBP education approach could have been useful. It has been suggested that healthcare organizations and their leaders should support the development and implementation of an EBP education, which would be focused on multiprofessional teams and aims to encourage them to use EBP in their clinical practice to ensure the high-quality and safe patient care (Lehane et al., 2019; Patelarou et al., 2017). This is also a development and research challenge in the context of emergency care.

6.2 Validity and reliability of the study

The validity and reliability of the research designs, samplings, measurements, and analysis will be discussed in this section. Both the strengths and threats to the validity and/or reliability are discussed.

A systematic review was assumed to be the most reliable and valid approach to summarize previous research findings (Polit & Beck, 2016). The search was made in four databases: CINAHL, Cochrane, PubMed and Scopus. Appropriate subject headings and/or keywords used were determined together with the expert assistance of a university librarian. The search terms are presented in publication I. During the process, the search strategy and the screening phases were documented carefully to ensure their repeatability. These all enhance the validity and reliability of the systematic review.

The systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines for reporting study methods and results. The quality of relevant studies was assessed by two reviewers independently (Polit & Beck, 2016) by using the design-specific study quality assessment criteria by Gifford et al. (2007). All of the evaluated studies were included in the analysis to provide a broad and unbiased overview of current research. Since the study selection process was performed by two reviewers, it enhanced the validity.

The review may be limited by publication bias because grey literature is difficult to obtain and was not searched for, for the reason of difficulty to obtain it. However, there is no consensus on whether systematic reviews should include grey literature (Polit & Beck, 2016). There is also a possibility of language and publication bias, since only papers published in English and published over the last 10 years (2006–2016) were included (CRD 2009). A limitation of the existing evidence was the heterogeneity of interventions that have been used and outcomes measured, which did not allow for a meta-analysis to be conducted.

To enhance the content validity of the measurement, a systematic review on the investigated topic was conducted. The instruments that were appropriate for measuring phenomena were selected to the study objectives. Three of the instruments (EBPQ, EBPB, EBPI) have been validated in numerous studies (Melnik et al., 2012; Stokke et al., 2014; Upton et al., 2014; Upton & Upton, 2006) and have shown good reliability. The translated versions of the EBPB and the EBPI were produced through back-translation to avoid the reporting bias and to ensure equivalence between the source and target languages. Even though back-translation

allows comparison between the original source language version and the back-translated version, there will always be some variation, which can be a risk to reliability, study validity and the credibility of the findings. The translated versions of the EBPB and the EBPI were pre-tested with short-stay unit nurses when piloting the EBP Basics for EmNurs education to increase the face validity prior to piloting them (Burns & Grove, 2009; Maneesriwongul & Dixon, 2004).

As for construct validity, the sum variables of the instruments were theoretically based on the CREATE framework (Tilson et al., 2011). Criterion-related validity was established since EBP attitude, EBP knowledge and EBP behavior were measured with two different instruments. As for attitudes and knowledge, both instruments yielded similar results, which enhances criterion-related validity. However, results regarding behavior were controversial. When considering internal consistency, the Cronbach's alpha values were satisfactory for all of the instruments (publication II, table 2) except for the EBP Basic EmNurs knowledge test, which was calculated with the Kuder-Richardson formula (KR-20). The lower KR-20 for the EBP Basic EmNurs knowledge test may be explained by the fact that scoring was based on the correct or wrong answers. Moreover, the EBP Basic EmNurs knowledge test was self-developed and not validated. All instruments were pilot tested with the short-stay unit nurses which enhances the content validity.

The EBP Basics for EmNurs intervention was piloted among randomly selected nurses who worked at the short-stay unit and were similar in characteristics to the intended participants. This was done in order to determine the feasibility, identify possible problems with study design, determine the correct and representative sample size, and to examine validity and reliability of the instrument and educational intervention (Burns & Grove, 2009).

The fact that this study was conducted in one country threatens the external validity and, furthermore, means that the study findings cannot be generalized largely to other contexts. Similar results could possibly be found, but since no previous studies concerning educational interventions for emergency nurses, including EBP steps as a learning content, were found, it was not possible to compare our findings with what has been reported in entirely similar earlier research. This is a further threat to the external validity of this study. However, study findings from other nursing contexts were found and the results were compared with what has previously been published.

A parallel-group RCT with repeated measurements was selected to assess the effectiveness of an educational intervention. An RCT design is assumed to be

appropriate for establishing causality (Burns & Grove, 2009; Polit & Beck, 2016). Random sampling, random assignment and control group were used, because together they are the most effective approaches for controlling confounding variables to reduce bias and thus enhance the internal and external validity of the study (representativeness and generalizability) (Polit & Beck, 2016). However, controlling the confounding variables in the real life of the participants is impossible. The study participants might, for example, have participated an EBP education in some other organization or studied EBP steps independently. The randomization was done by randomizing the units and using a simple coin toss. This randomization led to a balance of baseline characteristics between the two groups. The results showed that no significant differences were found in most of the baseline demographics between the experimental and control groups.

The attrition bias is a serious challenge in longitudinal studies, limiting the generalizability of the findings (Polit & Beck, 2016). The withdrawal rate between the groups ranged from 12.5% to 27.5%. The sample size was determined by a power analysis but was not totally achieved due to the long follow-up time. However, the results were the same in the original sample size compared with the 12-month sample size after the sensitivity analysis. The long follow up was also a strength, and this study provides unique data regarding Finnish emergency nurses.

6.3 Implications for practice and suggestions for future research

For the use of the results of this study, following practical implications are presented below.

The EBP education for emergency nurses should be well designed and promptly targeted to clinical practice. The content of the education should be developed to comprehensively include the steps of EBP to ensure that emergency nurses gain the EBP competencies that are relevant to their daily work. When implementing EBP education for emergency nurses, it is recommended to use multifaceted learning strategies to improve their EBP attitudes, knowledge, skills, self-efficacy and behavior as well as learners' satisfaction and benefits to the patients.

EBP education in clinical practice should be continuously available for emergency nurses at regular intervals. Once emergency nurses are competent in EBP, they will be more likely to engage in EBP in their clinical practice, and patient care delivery will likely become more evidence based. Multiprofessional educational interventions are recommended for the staff working at the ED.

Emergency nursing administrators, i.e. assistant head nurse, head nurse, director of nursing, are the key persons for promoting EBP in emergency nursing. Their role is important in creating a supportive culture and structures for EBP, and to recognize the barriers and remove them to enable utilization of EBP.

Based on the results of this study, the following suggestions for further research have emerged:

1. Educational interventions on EBP have been studied a great deal, but there is a lack of research concerning the most effective teaching/learning methods promoting EBP in emergency nursing care environment. In general, future studies should focus to investigate the effects of different EBP teaching/learning methods in emergency nursing.
2. No specific multiprofessional EBP education in the field of emergency nursing was identified, despite the need for such education in health care to exist. Further research is needed to develop a multiprofessional EBP education for the emergency care context and to evaluate its effectiveness.
3. This study was the first, multi-center, randomized controlled, follow-up trial to evaluate the effectiveness of an EBP education for emergency nurses including EBP steps as learning content. Six outcomes of the CREATE taxonomy (attitude, knowledge, skills, self-efficacy, behavior and learners' satisfaction) were evaluated, however, the benefits to patient were not evaluated in this study. In the future, it would be important to assess benefits to the emergency patients in studies evaluating the effects of EBP education including the steps of EBP.
4. The EBP Basic EmNurs knowledge test is an objective method to evaluate the factual knowledge of EBP. The EBP Basic EmNurs knowledge test developed in this study was not quite a reliable instrument to measure factual knowledge. There is a need to develop a reliable knowledge test that measures the factual EBP knowledge of the emergency nurses.
5. Research concerning EBP self-efficacy among emergency nurses is scarce, although self-efficacy is key in implementing EBP into clinical practice. More research is needed on how to support emergency nurses' self-efficacy during the EBP education.
6. A structured questionnaire measuring learners' satisfaction with EBP education gives limited information. Also, qualitative information about learners' experiences regarding the EBP education should be collected in future.

7 Conclusions

This study contributed the following new information to the existing knowledge:

1. According to the systematic review, there have been few studies on educational interventions promoting EBP among emergency nurses, and their outcomes are promising. However, the learning contents of earlier educational interventions have focused on certain clinical competence area and not on the EBP steps.
2. Prior to the EBP education, emergency nurses' EBP attitudes, knowledge, skills and self-efficacy, were at a better than average level. EBP behavior had a conflicting result, with one measure (EBPI) demonstrating lower and the other (EBPQ) higher than average level behavior.
3. The multifaceted (EBP Basics EmNurs) education improved emergency nurses' EBP attitudes, knowledge, skills, self-efficacy and behavior. The effects of the education appeared to be the best at six months after the education. After six months, the results started to decrease. By 12 months measurement point, the results were the same as before the education or even lower.
4. Since the results of the EBP education were not lasting, EBP education should be continuously available for the emergency nurses. The focus should also be on how to maintain the achieved EBP competences. The role of stakeholders is important in creating and supporting EBP culture and interesting structures.
5. Using entirely self-directed learning among emergency nurses was not effective in improving EBP attitude, knowledge, skills, self-efficacy and behavior. EBP education for emergency nurses should use of multifaceted strategies including, for example, didactic lectures and discussions, small group tutorials. It should be integrated into clinical practice.
6. The emergency nurses who participated in the multifaceted EBP education were more satisfied with the teacher's teaching style to encourage them to ask clinical questions and the usefulness of consideration on how to use research evidence in nursing practice compared with the participants of the self-directed EBP education.

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Appendix 1. Curriculum for EBP Basics EmNurs [2 ECTS] © Elina Koota

EVIDENCE-BASED PRACTICE FOR EMERGENCY NURSES (EBP Basics EmNurs)

The main objective of the educational intervention is to provide emergency nurses with basic competences of evidence-based practice. Education consists of 10 hours contact learning and 44 hours self-directed learning.

Learner analysis:

- Nurses working in the emergency department, whose working experience is minimum six months.
- Maximum 30 participants in a group.
- No prior exposure to EBP (before the current situation) is needed before education.

Learning objectives:

The learner will be able to:

1. Formulate clinical questions using the PICO format and answer it by using the external evidence.
2. Know the principles of critical appraisal of research studies.
3. Plan and implement evidence-based practice change based on internal and external evidence and to evaluate the outcomes.
4. Disseminate best practices supported by evidence to improve quality of care and patient outcomes.
5. Understand strategies to sustain an evidence-based practice culture.

Learning content and educational strategies are presented in teaching/learning events. The learner has the possibility of individual guidance at different stages of the education.

Learner assessment plan:

- Given assignment (assessed: approved/failed).
- Written self-assessment and written peer review.

Teacher's self-assessment of teaching:

- Reflective diary.

I TEACHING/LEARNING EVENT (Self-Directed learning phase 1)

Topic: Introduction to the EBP (0,6 ECTS)

Time, venue and duration of the educational event: Pre-assignment will be sent to the learners by email two weeks prior the EBP Basics EmNurs education will start.

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
13 hours	Learning objectives 1-5	An overview of the steps of EBP Nursing Research Foundation as a key promoter of EBP in Finnish nursing	Motivation Orientation	The learner reads Melnyk et al's (2010) article dealing with the steps of EBP and makes the necessary notes of them. The learner searches information on EBP using different forums. The learner familiarizes herself/himself with Nursing Research Foundations web pages, especially Näyttö- and Evidence Tips pages.	Article (Melnyk et al., 2010) Nursing Research Foundation www.hotus.fi An optional extra learning material with references to publications.

Resource analysis:

- The article will be sent to the learners by email.
- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).
- The learners will search part of the references herself/himself.
- The following articles will be sent to the learners the articles are available at: <http://journals.lww.com/ajnonline/pages/collectiondetails.aspx?TopicalCollectionID=10>

- Step 0: Melnyk, B.M., Fineout-Overholt, E., Stillwell, S.B. & Williamson, K.M. 2009. Igniting a Spirit of Inquiry: An Essential Foundation for Evidence-Based Practice. How nurses can build the knowledge and skills they need to implement EBP. *The American Journal of Nursing* 109 (11), 49–52.
 - Step 1: Stillwell, S.B., Fineout-Overholt, E., Melnyk, B.M. & Williamson, K.M. 2010. Asking the Clinical Question: A Key Step in Evidence-Based Practice. A successful search strategy starts with a well-formulated question. *The American Journal of Nursing* 110 (3), 58–61.
 - Step 2: Stillwell, S.B., Fineout-Overholt, E., Melnyk, B.M. & Williamson, K.M. 2010. Searching for the Evidence. Strategies to help you conduct a successful search. *The American Journal of Nursing* 110 (5), 41–47.
 - Step 3: Fineout-Overholt, E., Melnyk, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part I. An introduction to gathering, evaluating, and recording the evidence. *The American Journal of Nursing* 110 (7), 47–52.
 - Step 3: Fineout-Overholt, E., Melnyk, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part II. Digging deeper examining the “keeper” studies. *The American Journal of Nursing* 110 (9), 41–48.
 - Step 3: Fineout-Overholt, E., Melnyk, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part III, The process of synthesis: seeing similarities and differences across the body of evidence. *The American Journal of Nursing* 110 (11), 43–51.
 - Step 4: Gallagher-Ford, L., Fineout-Overholt, E., Melnyk, B.M. & Stillwell, S.B. 2011. Implementing an Evidence-Based Practice Change. Beginning the transformation from an idea to reality. *The American Journal of Nursing* 111 (3), 54–60.
 - Step 5: Fineout-Overholt, E., Gallagher-Ford, L., Melnyk, B.M. & Stillwell, S.B. 2011. Evaluating and Disseminating the Impact of an Evidence-Based Intervention: Show and Tell After the data are gathered and analyzed, it’s time to share what you’ve learned. *The American Journal of Nursing* 111 (7), 56–59.
 - Step 6: Melnyk, B.M., Fineout-Overholt, E., Gallagher-Ford, L. & Stillwell, S.B. 2011. Sustaining Evidence-Based Practice Through Organizational Policies and an Innovative Model The team adopts the Advancing Research and Clinical Practice Through Close Collaboration model. *The American Journal of Nursing* 111 (9), 57–60.
- An **optional** extra learning material with references to publications will be sent to the learners.

Assessment plan:

- The criterion for passing the pre-assignment is that the learner has familiarized himself/herself with a pre-sent article and made the necessary notes for himself/herself to be able to participate in the conversation. The method of assessment is the observation by the teacher.

Teacher's Self-Assessment Plan:

- Reflective diary.

II TEACHING/LEARNING EVENT (contact learning 1)

Topic: The idea of EBP, its importance for nursing and steps of EBP (0,3 ECTS)

Time, venue and duration of the educational event: xx.xx.2018 at xx – xx, lecture room, the total duration of 8 x 45 min

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
30 min	Learning objectives 1-5	What is EBP? Why is EBP important?	Motivation Orientation Internalization	Group discussion Pre-assignment review	PowerPoint-presentation
30 min	Learning objectives 1-5	Group discussion: The seven steps of EBP The learners will be divided to seven groups. Each group will get one step to process: Step Zero: What does asking a clinical question mean? What does a research culture mean? Step 1: What is a PICO question? Step 2: What does searching for the best evidence mean? Step 3: What does critically appraising the evidence mean? Step 4: How to integrate the evidence in clinical expertise and patient preferences and values?	Motivation Orientation Internalization	Group work: Instruction phase	PowerPoint-presentation

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
		<p>Step 5: How to evaluate the outcomes of the practice decisions or changes based on evidence?</p> <p>Step 6: How to disseminate EBP results?</p> <p>The group elects from among its members a chairman, secretary and performer.</p> <p>(Teacher-led didactic lectures are another option for some steps, if there are less than 14 learners)</p>			
60 min	Learning objectives 1–5	Implementing the steps of EBP to emergency nursing	Internalization	Group assignment: Working phase	Pre-assignment articles and relevant web pages chosen by learners
7 x 20 min	Learning objectives 1–5	Implementing the steps of EBP to emergency nursing	Internalization Externalization Critique Internalization	Group assignment: completion Group discussion Activating lecture Discussion	Groups can choose their own presentation Article; Alishahin ja Stevensonin (2007): https://www.lib.ncsu.edu/tutorials/scholarly-articles/ Template for presenting a research article (Sarajarvi et al., 2011)
45 min	Learning objectives 2, 4	Anatomy of an article How to read and appraise a research article? Presenting a research article and using a table to assist in reading an article			
35 min	Learning objective 1	Formulating a PICO question clinical practice? Instruction for the assignment	Internalization	PICO game Group discussion	PICO game PICO matrix Written assingment
15 min	Learning objectives 1–5	Reflection of the day and how to proceed?	Control	Group discussion	

Resource analysis:

- Contact learning will take place at the hospital.
- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).
- The article, a research article presentation table, and a PICO observation matrix are sent to the learner by email.

Assessment plan:

- The criterion for passing is that the learner actively participates in classroom discussions and uses a floor at least once during the contact learning day and actively works for the group's joint presentation. The method of assessment is the observation by the teacher.

Teacher's Self-Assessment Plan:

- Reflective diary.

III TEACHING/LEARNING EVENT (Self-Directed learning phase 2)

Topic: Formulation of a PICO question and a section of database search terms (0,3 ECTS)

Time, venue and duration of the educational event:

The learner has an option to do the assignment either individually or with the group (max. 4 persons / group)

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
8 hours	Learning objective 1	The learner formulates a PICO question from clinical practice and develops a literature search strategy	Internalization Externalization Critique	Performing an assignment	PICO matrix Article (Considine et al., 2017)

Resource analysis:

- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).

- The article and the PICO observation matrix are sent to the student by email.

Assessment plan:

- Passed/failed.
- Assessment is done by a written assignment.

Teacher's Self-Assessment Plan:

- Reflective diary.

IV TEACHING/LEARNING EVENT (contact learning 2)

Topic: Basic database search (0,1 ECTS)

Time, venue and duration of the educational event: xx.xx.2018 at xx – xx, IT-room, 3 x 45 minute

The basic database searching module is voluntary, if it has been passed before.

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization:
3 x 45 minutes	Learning objective 1	General principles of database searching Searching for information in the Medic database Searching for information in the CINAHL database Searching for information in the PubMed database	Motivation Orientation Internalization Externalization Critique Control	Workshop: Activating lecture Practicing	PowerPoint-presentation Databases Medic, CINAHL and PubMed

Resource analysis:

- Teaching will take place in the IT-room at the hospital.
- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).

Assessment plan:

- Passed/failed.
- Assessment is done by a written assignment.

Teacher's Self-Assessment Plan:

- Reflective diary.

V TEACHING/LEARNING EVENT (Self-Directed learning phase 3)

Topic: Using a PICO question to formulate a clinical question, performing a literature search in databases and presenting an article (0,7 ECTS)

Time, place and duration of the educational event:

The basic database searching module is voluntary, if it has been passed before (max. 4 persons/group)

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
19 hours	Learning objectives 1-4	The learner or the group presents their PICO question formulated, the database searching terms used, the search results obtained and the article found based on the search. The article is presented by using the Research article presentation table (Sarajärvi et al., 2011).	Internalization Externalization Critique Control	Performing the assignment	Template for presenting a research article (Sarajärvi et al., 2011)

Resource analysis:

- Teaching will take place at the hospital.
- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).
- Sarajärvi et al. (2011) The presentation of the research article is sent to the learner by email.

Assessment plan:

- Passed/failed.

- The criterion for passing the PICO question is properly formulated; the search terms used and search results obtained are recorded; the searches have been correctly conducted; the selected article belongs to the PICO question area; presentation of the research article table is correctly filled.
- The teacher makes the final evaluation of the assignment after the IV educational event and provides the group/individual written feedback on the assignment.

Teacher's Self-Assessment Plan:

- Reflective diary.

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Appendix 2. Curriculum for Self-Directed EBP Basics EmNurs [2 ECTS] © Elina Koota.

SELF-DIRECTED LEARNING MODULE: EVIDENCE-BASED PRACTICE FOR EMERGENCY NURSES (Self-Directed EBP Basics EmNurs) [2 ECTS]

The main objective of the educational intervention is to provide emergency nurses with basic competences of evidence-based practice. Education consists of 54 hours self-directed learning.

Learner analysis:

- Nurses working in the emergency department, whose working experience is minimum six months.
- Maximum 30 participants in a group.
- No prior exposure to EBP (before the current situation) is needed before education.

Learning objectives:

The learner will be able to:

1. Formulate clinical questions using the PICO format and answer it by using the external evidence.

2. Know the principles of critical appraisal of research studies.
3. Plan and implement evidence-based practice change based on internal and external evidence and to evaluate the outcomes.
4. Disseminate best practices supported by evidence to improve quality of care and patient outcomes.
5. Understand strategies to sustain an evidence-based practice culture.

Learning content and educational strategies are presented in teaching/learning events.

Learner assessment plan:

- Given assignment (assessed: approved/failed).
- Written self-assessment.

Teacher's self-assessment of teaching:

- Reflective diary.

I TEACHING/LEARNING EVENT (Self-Directed learning phase 1)

Topic: Introduction to the EBP

Pre-assignment will be sent to the learners by email two weeks prior the Self-Directed Learning module EBP Basics EmNurs education will start.

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
13 hours	Learning objectives of EBP 1-5	An overview of the steps of EBP	Motivation Orientation	The learner reads Melnyk et al's. (2010) article dealing with the steps of EBP and makes the necessary notes of them.	Article (Melnyk et al., 2010)

Nursing Research Foundation as a key promoter of EBP in Finnish nursing	The learner searches information on EBP using different forums.	Nursing Research Foundation www.hotus.fi
	The learner familiarizes herself/himself with Nursing Research Foundations web pages, especially Näyttö käyttöön!- and Evidence Tips pages.	An optional extra learning material with references to publications.

Resource analysis:

- The article will be sent to the learners by email.
- An optional extra learning material with references to publications will be sent to the learners by email.
- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).
- The learners will search part of the references herself/himself.

II TEACHING/LEARNING EVENT (Self-Directed learning phase 2)

Topic: The idea of EBP, its importance for nursing and steps of EBP

The email will be sent to the learner three weeks from the first email.

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
12 hours	<p>Learning objectives</p> <p>1-5</p> <p>Why is EBP important?</p> <p>The seven steps of EBP</p> <p>Step Zero: What does asking a clinical question mean? What does a research culture mean?</p> <p>Step 1: What is a PICO question?</p> <p>Step 2: What does searching for the best evidence mean?</p> <p>Step 3: What does critically appraising the evidence mean?</p> <p>Step 4: How to integrate the evidence in clinical expertise and patient preferences and values?</p> <p>Step 5: How to evaluate the outcomes of the practice decisions or changes based on evidence?</p>	<p>What is EBP?</p> <p>Why is EBP important?</p> <p>The seven steps of EBP</p> <p>Step Zero: What does asking a clinical question mean? What does a research culture mean?</p> <p>Step 1: What is a PICO question?</p> <p>Step 2: What does searching for the best evidence mean?</p> <p>Step 3: What does critically appraising the evidence mean?</p> <p>Step 4: How to integrate the evidence in clinical expertise and patient preferences and values?</p> <p>Step 5: How to evaluate the outcomes of the practice decisions or changes based on evidence?</p>	<p>Motivation</p> <p>Orientation</p> <p>Internalization</p>	<p>The learner will self-directly read the articles on EBP.</p>	<p>Articles presented at the Resource analysis</p>

5 hours	Learning objectives research article? 2, 4, 5	Anatomy of a research article and how to read a research article?	Internalization Externalization Control	The learner will read the article Alishan & Stevenson 2007. The learner will watch the Melender's (2016) video on "How to read a scientific article?"	Article: Alishahin ja Stevenson (2007): https://www.lib.ncsu.edu/tutorials/scholarly-articles/ Melender, H.-L. 2016. "How to read a scientific article?" VAMK University of Applied Sciences Available: https://youtu.be/9JwNQxEbBq Gale, L., Vedhara, K., Searle, Kemple, T. & Campbell, R. 2008. Patients' perspectives on foot complications in type 2 diabetes. British Journal of General Practice 58, 553, 555-563. http://bjgp.org/content/58/553/555
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Resource analysis:

- The following articles will be sent to the learners, the articles are available at: <http://journals.lww.com/ajnonline/pages/collectiondetails.aspx?TopicalCollectionID=10>
 - o Step 0: Melnyk, B.M., Fineout-Overholt, E., Stillwell, S.B. & Williamson, K.M. 2009. Igniting a Spirit of Inquiry: An Essential Foundation for Evidence-Based Practice. How nurses can build the knowledge and skills they need to implement EBP. The American Journal of Nursing 109 (11), 49–52.
 - o Step 1: Stillwell, S.B., Fineout-Overholt, E., Melnyk, B.M. & Williamson, K.M. 2010. Asking the Clinical Question: A Key Step in Evidence-Based Practice. A successful search strategy starts with a well-formulated question. The American Journal of Nursing 110 (3), 58–61.
 - o Step 2: Stillwell, S.B., Fineout-Overholt, E., Melnyk, B.M. & Williamson, K.M. 2010. Searching for the Evidence. Strategies to help you conduct a successful search. The American Journal of Nursing 110 (5), 41–47.
 - o Step 3: Fineout-Overholt, E., Melnyk, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part I. An introduction to gathering, evaluating, and recording the evidence. The American Journal of Nursing 110 (7), 47–52.

- Step 3: Fineout-Overholt, E., Melynky, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part II. Digging deeper examining the “keeper” studies. *The American Journal of Nursing* 110 (9), 41–48.
- Step 3: Fineout-Overholt, E., Melynky, B.M., Stillwell, S.B. & Williamson, K.M. 2010. Critical Appraisal of the Evidence: Part III, The process of synthesis: seeing similarities and differences across the body of evidence. *The American Journal of Nursing* 110 (11), 43–51.
- Step 4: Gallagher-Ford, L., Fineout-Overholt, E., Melynky, B.M. & Stillwell, S.B. 2011. Implementing an Evidence-Based Practice Change. Beginning the transformation from an idea to reality. *The American Journal of Nursing* 111 (3), 54–60.
- Step 5: Fineout-Overholt, E., Gallagher-Ford, L., Melynky, B.M. & Stillwell, S.B. 2011. Evaluating and Disseminating the Impact of an Evidence-Based Intervention: Show and Tell After the data are gathered and analyzed, it’s time to share what you’ve learned. *The American Journal of Nursing* 111 (7), 56–59.
- Step 6: Melynky, B.M., Fineout-Overholt, E., Gallagher-Ford, L. & Stillwell, S.B. 2011. Sustaining Evidence-Based Practice Through Organizational Policies and an Innovative Model The team adopts the Advancing Research and Clinical Practice Through Close Collaboration model. *The American Journal of Nursing* 111 (9), 57–60.
- The learners can access the website using the employer’s computer (and / or using her/his personal computer at home)

III TEACHING/LEARNING EVENT (Self-Directed learning phase 3)

Topic: Formulation of a PICO question and a section of database search terms

The email will be sent to the learner three week from the previous email.

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
10 hours	Learning objective 1	Formulating a research question according to PICO matrix.	Internalization Externalization Critique Control	The learner reads the article of Considine et al. (2017) The learner reads the article of Honkanen et al. (2016)	PICO matrix Article (Considine et al., 2017). Material about PICO question (available in Finnish): Honkanen et al. (2016) Hoitosuositusryhmien käsikirja kohdat: Osa I Hoitosuosituksen laatiminen -> Hoitosuosituksen laatiminen sekä Osa II Tutkimustiedon kriittinen arviointi -> Tutkimusasetelman ja tutkimuskysymyksen selvittäminen. Saatavissa: http://kaypahoito.fi/web/kh/suositusryhmien-kasikirja

Time	Learning objectives	Learning content	The stage of the learning process	Learning and teaching methods	Visualization
14 hours	Learning objective 1	General principles of database searching Searching for information in the Medic database Searching for information in the CINAHL database Searching for information in the PubMed database Data base search based on the PICO question	Motivation Orientation Internalization Externalization Critique Control	The learner reads following material: Elomaa & Mikkolan (2010) (available only in Finnish) "Näytön jäljillä" chapter "Tiedonhaun perusteet" and watches the following videos from HuiLib. 2017. Terkko. Tiedonhakutietokannasta HuiLib. The learner watches the following videos (available on in Finnish): Majjala & Melender (2015) CINAHL- data base. Melender & Majjala (2016) PubMed- data base. The learner will formulate a PICO question from clinical practice and perform a database search reports the terms used, the search results obtained, and the article found based on the search. The article is presented by using the Research article presentation table (Sarajärvi et al., 2011).	Huilib. Terkko.: Tavallisimmat tiedonhaun tekniikat. (Available in Finnish): https://www.youtube.com/watch?v=clvZBWfELQ Huilib. 2017. Terkko. Tiedonhakutietokannasta HuiLib. (Available in Finnish): https://www.youtube.com/watch?v=CnuhTgofnyg(2018) Majjala, V. & Melender, H.-L. 2015. Tiedonhaku tuiin käytön merkityksestä imetykselle – esimerkki tiedonhausta CINAHL-tietokannassa. Videotallenne. Seinäjoen ammattikorkeakoulu ja Vaasan ammattikorkeakoulu. Available: http://vamk.libguides.com/hoitotyotietokannat Melender, H.-L. & Majjala, V. 2016. Tiedonhaku päätöksenteosta hoitotyössä - esimerkki tiedonhausta PubMed-tietokannassa. Videotallenne. Vaasan ammattikorkeakoulu ja Seinäjoen ammattikorkeakoulu. Available: http://vamk.libguides.com/hoitotyotietokannat Template for presenting a research article (Sarajärvi et al., 2011)

Resource analysis:

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- The learners can access the website using the employer's computer (and/or using her/his personal computer at home).
 - The following articles will be sent to the learner:
 - o The article of Considine et al. (2017).
 - o The book of Elomaa & Mikkola (2010).
 - o Template for presenting a research article (Sarajärvi et al., 2011).
 - The following internet resources:
 - o Honkanen et al. (2016) <http://kaypahoito.fi/web/kh/suosituustyoryhminen-kasikirja>
 - o Majjala, V. & Melender, H.-L. (2015) <http://vamk.libguides.com/hoitotyotietokannat>
 - o Melender, H.-L. & Majjala, V. (2016) <http://vamk.libguides.com/hoitotyotietokannat>

Appendix 3. The research instrument.

Tutkimukseen osallistujien taustatiedot

Vastaa ystävällisesti kaikkiin alla oleviin taustatietokysymyksiin.

Tunnistetieto: _____

Mikä on ikäsi? _____ vuotta

Mikä on sukupuolesi?

1. nainen
2. mies
3. muu/en halua ilmoittaa

Mikä on ylin koulutuksesi?

1. opistoasteen tutkinto
2. ammattikorkeakoulun perustutkinto (AMK)
3. ylempi ammattikorkeakoulu tutkinto (YAMK)
4. yliopiston alempi korkeakoulututkinto (kandidaatti)
5. yliopiston ylempi korkeakoulututkinto (maisteri)
6. muu, mikä _____

Mikä on ylimmän tutkintosi valmistumisvuosi? _____

Kuinka pitkä on kaikkiaan työkokemuksesi terveydenhuollossa? ____ v ____ kk

Kuinka pitkä on työkokemuksesi sairaanhoitajan tai vastaavissa tehtävissä päivystyshoitotyössä? _____ v _____ kk

Mikä on tämänhetkinen työpaikkasi?

1. A
2. B
3. C
4. D

Mikä on tämänhetkinen koulutustaustasi?

1. sairaanhoitaja
2. ensihoitaja
3. kätilö
4. terveydenhoitaja

5. muu, mikä _____

Millaista aikaisempaa kokemusta sinulla on näyttöön perustuvasta toiminnasta?

(Valitse vain yksi vaihtoehto)

1. Olen opiskellut näyttöön perustuvaa toimintaa ammatilliseen perustutkintoon johtavassa koulutuksessa.
2. Olen opiskellut näyttöön perustuvaa toimintaa master-tason koulutuksessa (YAMK-tutkinto tai tiedekorkeakoulun maisterin tutkinto).
3. Olen suorittanut näyttöön perustuvan toiminnan täydennyskoulutuksen.
4. Työorganisaatiossani on näyttöön perustuvan toiminnan mentori, joka neuvoo näyttöön perustuvassa toiminnassa.
5. Olen näyttöön perustuvan toiminnan asiantuntijatyöryhmän jäsen.
6. Olen tällä hetkellä jäsen näyttöön perustuvan toiminnan projektissa.
7. Olen ollut aikaisemmin jäsenenä näyttöön perustuvan toiminnan projektissa.
8. Muulla tavoin. Miten? _____
9. En tiedä paljoakaan näyttöön perustuvasta toiminnasta.

Kysely näyttöön perustuvasta toiminnasta (EBPQ-FI)

Tämä kyselyn tarkoituksena on saada tietoa näyttöön perustuvan toiminnan käytöstä terveydenhuollossa. Kysymyksiin ei ole olemassa oikeaa tai väärää vastausta, vaan olemme kiinnostuneita sinun mielipiteistäsi ja siitä, kuinka sinä käytät näyttöä työssäsi.

1. Arvioi omaa toimintaasi yksittäisen potilaan hoidossa viimeisen vuoden aikana. Kuinka usein olet toiminut seuraavasti hakeaksesi vastauksia tiedonpuutteeseen (valitse \checkmark tai X):

Olet muodostanut selkeästi vastattavissa olevan kysymyksen ennen näytön hakemista.

En koskaan Säännöllisesti

Kysymyksen muotoituasi olet hakenut aiheeseen liittyvää näyttöä.

En koskaan Säännöllisesti

Olet kriittisesti arvioinut löytämäsi kirjallisuuden asetettujen kriteerien avulla.

En koskaan Säännöllisesti

Olet yhdistänyt löytämäsi näytön ja kliinisen asiantuntemuksesi.

En koskaan Säännöllisesti

Olet arvioinut toimintasi lopputuloksia.

En koskaan Säännöllisesti

Olet jakanut löytämäsi tiedon työtovereidesi kanssa.

En koskaan Säännöllisesti

2. Ole hyvä ja merkitse (\checkmark tai X), mihin kohtaan asteikkoa sijoittaisit itsesi kunkin seuraavan väittämäparin kohdalla.

Työmääräni on liian suuri, että voisin pitää itseni ajan tasalla kaikesta uudesta näytöstä.

Uusi näyttö on niin tärkeää, että löydän sille aikaa työssäni.

Närkästyn, jos käytännön toimintaani kyseenalaistetaan.

Käytännön toimintaani liittyvät kysymykset ovat tervetulleita.

Näyttöön perustuva toiminta on ajan tuhlausta.

Näyttöön perustuva toiminta on ammatillisen toiminnan perusta.

Pidän mieluummin kiinni hyväiksi koetuista menetelmistä kuin vaihdan mihinkään uuteen.

Olen muuttanut toimintaani löytämäni näytön mukaisesti.

3. Asteikolla yhdestä seitsemään (seitsemän ollessa paras), kuinka arvioisit itseäsi ja omaa osaamistasi:

Ympyröi yksi numero kunkin väittämän kohdalla.							
	Heikko						Paras
Tutkimusosaaminen	1	2	3	4	5	6	7
Tietotekniset taidot	1	2	3	4	5	6	7
Käytännön osaamisen seuranta ja arviointi	1	2	3	4	5	6	7
Tiedon tarpeen muuntaminen kysymykseksi tiedonhakua varten	1	2	3	4	5	6	7
Tieto tärkeimmistä tiedontyypeistä ja näytön lähteistä	1	2	3	4	5	6	7
Kyky tunnistaa oman ammatillisen toiminnan puutteita	1	2	3	4	5	6	7
Tietämys, siitä miten näyttöä haetaan	1	2	3	4	5	6	7
Kyky arvioida kriittisesti näyttöä asetettujen kriteereiden mukaisesti	1	2	3	4	5	6	7
Kyky arvioida, kuinka luotettava (lähellä totuutta) aineisto on	1	2	3	4	5	6	7
Kyky arvioida, kuinka hyödyllinen (kliinisesti käyttökelpoinen) aineisto on	1	2	3	4	5	6	7
Kyky soveltaa tietoa yksittäisiin tilanteisiin	1	2	3	4	5	6	7
Ideoiden ja tiedon jakaminen työtovereiden kanssa	1	2	3	4	5	6	7
Uusien hoitoon liittyvien ideoiden levittäminen työtovereille	1	2	3	4	5	6	7
Kyky tarkastella omia käytäntöjäsi	1	2	3	4	5	6	7

Ole hyvä ja kirjoita mahdolliset kommenttisi.

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*Suomenkielisen käännöksen (2016) ovat tehneet
Hoitotyön tutkimussäätiö (www.hotus.fi) ja
virallinen kääntäjä Anna Vuolteenaho*

Näyttöön perustuvaan toimintaan liittyvät uskomukset -mittari (EBPB)

Alla on 16 väittämää näyttöön perustuvasta toiminnasta (NPT). Valitse ystävällisesti vaihtoehto, joka parhaiten kuvaa mielipidettäsi jokaisesta väittämästä. Väittämissä ei ole oikeaa tai väärää mielipidettä.

1. Uskon, että näyttöön perustuva toiminta tuottaa potilaille parasta mahdollista hoitoa.
 - Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

2. Näyttöön perustuvan toiminnan vaiheet ovat minulle selvät.
 - Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

3. Olen varma, että osaan toteuttaa näyttöön perustuvaa toimintaa.
 - Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

4. Uskon, että kriittinen näytön arviointi on tärkeä vaihe näyttöön perustuvan toiminnan prosessissa.
 - Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

5. Olen varma, että näyttöön perustuvilla hoitosuosituksilla voidaan parantaa kliinistä hoitoa.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
6. Uskon, että osaan etsiä parhaan näytön käytännön kliinisiin kysymyksiin aikaa säästävällä tavalla.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
7. Uskon, että pystyn voittamaan näyttöön perustuvan toiminnan toteuttamisen esteet.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
8. Olen varma, että osaan toteuttaa näyttöön perustuvaa toimintaa aikaa säästävällä tavalla.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
9. Olen varma, että näyttöön perustuvan toiminnan toteuttaminen parantaa potilailleni antamaani hoitoa.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

10. Tiedän varmasti, miten klinisen hoidon tuloksia mitataan.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
11. Uskon, että näyttöön perustuva toiminta vie liikaa aikaa.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
12. Olen varma, että minulla on pääsy parhaisiin resursseihin näyttöön perustuvan toiminnan toteuttamiseksi.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
13. Uskon, että näyttöön perustuva toiminta on vaikeaa.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä
14. Tiedän, miten näyttöön perustuvaa toimintaa toteutetaan riittävän hyvin, jotta saadaan aikaan käytänteiden muutoksia.
- Täysin eri mieltä
 - Eri mieltä
 - Ei samaa, eikä eri mieltä
 - Samaa mieltä
 - Täysin samaa mieltä

15. Luotan kykyyni toteuttaa näyttöön perustuvaa toimintaa työpaikallani.

- Täysin eri mieltä
- Eri mieltä
- Ei samaa, eikä eri mieltä
- Samaa mieltä
- Täysin samaa mieltä

16. Uskon, että antamani hoito on näyttöön perustuvaa.

- Täysin eri mieltä
- Eri mieltä
- Ei samaa, eikä eri mieltä
- Samaa mieltä
- Täysin samaa mieltä

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Näyttöön perustuvan toiminnan implementointi –mittari (EBPI)

Alla on 18 kysymystä näyttöön perustuvasta toiminnasta (NPT). Jotkut terveystieteen ammattilaiset tekevät näitä asioita useammin kuin toiset terveystieteen ammattilaiset. Missään ei ole määritelty, miten usein sinun pitäisi tehdä näitä tehtäviä. Vastaa ystävällisesti jokaiseen kysymykseen valitsemalla se vaihtoehto, joka parhaiten kuvaa sitä, kuinka usein olet tehnyt kussakin kysymyksessä mainitun asian viimeisten kahdeksan viikon aikana.

1. Olen käyttänyt näyttöä muuttaakseni kliinistä käytäntöä...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
2. Olen kriittisesti arvioinut tieteellisen tutkimuksen tuottamaa näyttöä...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
3. Olen muotoillut PICOT-kysymyksen kliinisestä käytännöstäni...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
4. Olen keskustellut epävirallisesti tutkimuksen tuottamasta näytöstä kollegani kanssa...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin

5. Olen kerännyt tietoa potilaan ongelmasta...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
6. Olen jakanut tutkimuksen tai tutkimusten tuottamaa näyttöä raportin tai esityksen muodossa useammalle kuin kahdelle kollegalle...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
7. Olen arvioinut käytännön muutoksen tuloksia...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
8. Olen jakanut näyttöön perustuvan hoitosuosituksen kollegalle...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
9. Olen kertonut tutkimuksen tuottamasta näytöstä potilaalle tai hänen perheenjäsenelleen...
 - 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin

10. Olen jakanut tietoa tutkimuksen tuottamasta näytöstä moniammatillisen tiimin jäsenelle...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
11. Olen lukenut ja kriittisesti arvioinut kliinisen tutkimuksen...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
12. Olen etsinyt Cochrane tietokannasta järjestelmällisiä katsauksia...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
13. Olen etsinyt näyttöön perustuvia kansallisia hoitosuosituksia (Hoitotyön Tutkimussäätiön julkaisemia) ja Käypä hoito -suosituksia...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
14. Olen käyttänyt näyttöön perustuvaa hoitosuosituksia tai järjestelmällistä katsausta muuttaakseni kliinistä käytäntöä työpaikallani...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin

15. Olen arvioinut hoidon kehittämishanketta keräämällä aineistoa potilaiden hoidon tuloksellisuudesta...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
16. Olen jakanut tuloksellisuudesta kertovan aineiston kollegoilleni...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
17. Olen muuttanut käytäntöä potilashoidon tuloksellisuudesta kertovan aineiston perusteella...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin
18. Olen edistänyt näyttöön perustuvaa toimintaa kollegoideni keskuudessa...
- 0 kertaa
 - 1–3 kertaa
 - 4–5 kertaa
 - 6–7 kertaa
 - Kahdeksan kertaa tai useammin

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EBP Basics EmNurs Tietotesti

Tällä kyselylomakkeella arvioidaan tietojasi näyttöön perustuvasta toiminnasta. Vastaa ystävällisesti alla esitettyihin kysymyksiin valitsemalla yksi vaihtoehto joka sinun mielestäsi on oikea.

1. Kun ryhdytään parantamaan potilaiden/asiakkaiden hoidon laatua näyttöön perustuvan toiminnan avulla, niin mikä on lähtökohta?
 - Tarvittaessa kyseenalaistetaan olemassa olevia käytäntöjä
 - Käytetään puhtaasti maalaisjärkeä potilaan hoidon lähtökohtana
 - Toimitaan siten kuin aina on toimittu
 - Kokeillaan uusia hoitokäytänteitä osavuosittain
2. Mikä seuraavista on sisäisen näytön lähde? (Sisäinen näyttö = näyttö, jota tuotetaan sisäisesti kliinisen käytännön yksikössä, esimerkiksi potilaan tilan, hoidon tuloksellisuuden sekä toiminnan laadun arviointi.)
 - Internetin tuottaman näytön käyttö potilaan sairaudesta
 - Ympärivuorokautinen tietotekniikan käyttö potilaan hoidossa
 - Potilaskertomusjärjestelmän sisältämä tieto potilaan hoidosta, tutkimuksista ja hoidon tuloksista
 - Systemaattisen katsauksen käyttö potilaan hoidossa
3. Mitä tarkoittaa PICO-kysymys?
 - Työkalu, joka auttaa muotoilemaan tutkimuskysymyksen oikein
 - Kirjainyhdistelmä, joka ratkaisee käytännön ongelman
 - Informaatikolta saatava vastaus tutkimuskysymyksen tarkentamiseen
 - Joanna Briggs Instituutin määrittelemä kirjainyhdistelmä tutkimuksen tueksi
4. Mikä seuraavista on luotettavin ulkoisen näytön lähde?
 - Tieteellisessä lehdessä julkaistun tutkimusartikkelin tuottama tieto
 - Perinteinen yksikön henkilökunnan työkokemuksella oikeaksi havaitsema tieto
 - Vertailukehittämällä saatu tieto (benchmarking)
 - Asiakaslehden tuottama tieto
5. Mikä on pisimmälle kehitelty ja sillä tavalla käyttökelpoisin tutkitun tiedon julkaisu- tai muoto kliinisen käytännön näkökulmasta?
 - Yksittäisen tutkimuksen tulos
 - Järjestelmällinen katsaus
 - Näyttöön perustuva hoitosuositus
 - Potilaan hoidon lopputulos

6. Millä tavalla tuotettu tieto voidaan arvioida vahvimaksi näytöksi hoito-
menetelmän vaikuttavuudesta?
 - Kokemuksellinen tieto
 - Satunnaistettu kontrolloitu koe
 - Asiantuntijaryhmän lausunto
 - Laadullinen tutkimus
7. Millä tavalla arvioidaan näytön sisällön vahvuutta ja sovellettavuutta kliiniseen
käytäntöön?
 - Määritellään kliininen kysymys, etsitään oleellinen tieto, arvioidaan,
kuinka luotettavaa tieto on ja miten se soveltuu käytäntöön
 - Etsitään samanlainen yksikkö ja arvioidaan heidän käyttämänsä näyttö
 - Määritellään kliininen kysymys ja etsitään kaikki mahdollinen tieto
vastaamaan muotoiltuun kysymykseen
 - Määritellään tapauskohtaisesti mitä tietoa kannattaa käyttää missäkin
tilanteessa
8. Miksi hoitotyön päätöksenteon perustelevien yksittäisen tutkimuksen avulla
ei ole perusteltua?
 - Yksittäiset tutkimukset kuvaavat usein rajatun näkökulman aiheesta
 - Yksittäinen tutkimus on tehty yleensä väärälle potilasryhmälle
 - Yksittäiset tutkimukset on toteutettu yksittäiselle potilaalle
 - Yksittäinen tutkimus on julkaistu yhdessä asiakaslehdessä
9. Mitä seuraavista vaihtoehdoista ei käytetä näyttöön perustuvassa
päättöksenteossa
 - Tutkimustietoa
 - Kliinistä asiantuntijuutta
 - Ohjattua havaintoa
 - Potilaan arvoja ja toiveita
10. Mistä tiivistettyä ja luotettavaksi arvioitua näyttöä, jota voidaan
implementoida käytännön toimintaan, löytyy?
 - Julkaisemattomista opinnäytetöistä
 - Potilaskertomuksista
 - Asiantuntijan tekemästä tekstistä asiakaslehdessä
 - Tieteellisistä julkaisuista

11. Tutkimustiedon hyödyntäminen potilaiden hoidossa ja sen käytön arviointi on tärkeää. Siitä esimerkkinä voi olla
- Käsihygieniatoimintamallin käyttö ja vaikutusten arviointi seuraamalla hoitoon liittyvien infektioiden lukumääriä
 - Katkaistulla avainsanalla suoritettujen tieteellisten tiedonhaun tulokset
 - Itsearviointitaitojen kohentuminen vaativien tilanteiden ymmärtämisessä
 - Internet-haun tekeminen luotettavasta ja käyttökelpoisesta tiedosta
12. Mitä keinoja voidaan käyttää näyttöön perustuvan toiminnan edistämiseksi?
- Yksikössä hoidettavien potilaiden hoitopaikkojen määrän lisääminen
 - Yksikössä hoidettavien potilaiden hoitopaikkojen määrän vähentäminen
 - Yksikön asiantuntijaryhmien määrän vahvistaminen
 - Yksikön tutkimusklubitoiminnan vahvistaminen
13. Mitä tarkoittaa näyttöön perustuvan toiminnan toimintakulttuuri?
- Toimintayksikön käytössä olevat tietokannat ja niiden helppokäyttöisyys
 - Toimintayksikön vallitsevat rakenteet, toimintakäytänteet, arvot ja päämäärät
 - Toimintayksikön potilaat ja heidän määränsä ja hoitoisuusluokkansa
 - Toimintayksikön työilmapiiri ja sijaisten käyttö

Kurssipalaute

Arvioi EBP Basics EmNurs koulutusta asteikolla 5–1, jossa 5 = paras arvosana ja 1 = heikoin arvosana

1. Arvioi miten hyvin opettajan opetustyyli innosti sinua esittämään klinisiä kysymyksiä?

paras 5 4 3 2 1 heikoin

2. Arvioi miten riittävästi aikaa oli mielestäsi varattu tiedonhakujen harjoitteluun?

paras 5 4 3 2 1 heikoin

3. Arvioi miten syvällisesti tutkimustiedon arviointia opiskeltiin suhteessa sinun oppimistarpeisiisi?

paras 5 4 3 2 1 heikoin

4. Arvioi miten hyvin opetuksessa käytetyt käytännön esimerkit liittyivät sinun tilanteeseesi?

paras 5 4 3 2 1 heikoin

5. Arvioi miten hyödyllistä oppimisesi kannalta oli pohdiskella omaa tutkitun tiedon käyttöäsi käytännön hoitotyössä?

paras 5 4 3 2 1 heikoin

Lopuksi sinulla on mahdollisuus kirjoittaa vapaasti mistä tahansa koulutuksen toteutukseen liittyvästä asiasta, josta haluat vielä kertoa.

Kiitos vastauksestasi!

The EBP Basics EmNurs koulutuksen kurssipalaute © Elina Koota

Appendix 4. The full item data.

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
I am sure that evidence-based guidelines can improve clinical care	Exp. group1	4.03 ± 0.73	4.30 ± 0.65	4.40 ± 0.55	4.54 ± 0.61	0.28 ± 0.68	0.38 ± 0.74	0.43 ± 0.65
	Cont. group2	4.22 ± 0.58	4.22 ± 0.58	4.30 ± 0.57	4.17 ± 0.47	0.00 ± 0.00	0.03 ± 0.16	-0.14 ± 0.44
	p-value	0.24	0.52	0.45	0.005	0.007	0.004	<0.001
I am sure that implementing EBP will improve the care that I deliver to my patients.	Exp. group	4.25 ± 0.74	4.30 ± 0.65	4.55 ± 0.50	4.31 ± 0.63	0.05 ± 0.64	0.30 ± 0.82	0.06 ± 0.68
	Cont. group	4.20 ± 0.72	4.30 ± 0.72	4.32 ± 0.71	4.17 ± 0.71	0.10 ± 0.30	0.11 ± 0.31	-0.03 ± 0.42
	p-value	0.71	0.87	0.19	0.47	0.34	0.37	0.63
I believe that EBP results in the best clinical care for patients	Exp. group	4.12 ± 0.76	4.20 ± 0.69	4.67 ± 0.47	4.37 ± 0.65	0.07 ± 0.76	0.55 ± 0.88	0.29 ± 0.89
	Cont. group	4.17 ± 0.55	4.20 ± 0.56	4.27 ± 0.61	3.83 ± 0.76	0.03 ± 0.16	0.08 ± 0.28	-0.38 ± 0.62
	p-value	0.95	0.82	0.003	0.004	0.96	0.002	<0.001
I believe that critically appraising evidence is an important step in the EBP process.	Exp. group	4.20 ± 0.82	4.10 ± 0.63	4.40 ± 0.50	4.20 ± 0.47	-0.10 ± 0.96	0.20 ± 1.04	-0.11 ± 0.76
	Cont. group	4.08 ± 0.57	4.10 ± 0.59	4.11 ± 0.57	3.97 ± 0.57	0.03 ± 0.28	0.03 ± 0.29	-0.14 ± 0.44
	p-value	0.19	0.99	0.03	0.09	0.08	0.61	0.86
I believe that I can overcome barriers in implementing EBP	Exp. group	3.42 ± 0.64	3.25 ± 0.71	4.00 ± 0.60	3.69 ± 0.68	-0.17 ± 0.84	0.57 ± 0.75	0.34 ± 0.80
	Cont. group	3.30 ± 0.65	3.40 ± 0.59	3.54 ± 0.69	3.31 ± 0.60	0.10 ± 0.44	0.27 ± 0.65	0.07 ± 0.65
	p-value	0.47	0.29	0.004	0.02	0.06	0.03	0.14
I believe that EBP takes too much time	Exp. group	2.45 ± 1.01	2.60 ± 0.98	1.68 ± 0.47	1.94 ± 0.94	0.15 ± 1.10	-0.78 ± 1.05	-0.46 ± 1.29
	Cont. group	2.50 ± 0.72	2.48 ± 0.75	2.41 ± 0.93	2.41 ± 0.73	-0.03 ± 0.28	-0.05 ± 0.70	0.03 ± 0.68
	p-value	0.80	0.62	<0.001	0.03	0.26	<0.001	0.17

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
I believe EBP is difficult.	Exp. group	2.33 ± 0.86	2.33 ± 0.86	1.80 ± 0.61	1.74 ± 0.85	0.00 ± 0.75	-0.53 ± 0.88	-0.54 ± 1.15
	Cont. group	2.30 ± 0.69	2.27 ± 0.68	2.08 ± 0.83	2.14 ± 0.58	-0.03 ± 0.28	-0.22 ± 0.58	-0.03 ± 0.63
	p-value	0.94	1.00	0.14	0.02	0.47	0.08	0.06
I believe the care that I deliver is evidence-based	Exp. group	3.58 ± 0.78	3.65 ± 0.74	3.88 ± 0.61	3.54 ± 0.61	0.07 ± 0.69	0.30 ± 0.88	0.03 ± 0.98
	Cont. group	3.65 ± 0.66	3.67 ± 0.66	3.70 ± 0.62	3.48 ± 0.74	0.03 ± 0.28	0.03 ± 0.29	-0.17 ± 0.60
	p-value	0.65	0.78	0.35	0.99	0.57	0.14	0.54
EBPB attitude	Exp. group	3.85 ± 0.49	3.86 ± 0.50	4.30 ± 0.23	4.12 ± 0.49	0.01 ± 0.42	0.45 ± 0.47	0.25 ± 0.52
	Cont. group	3.85 ± 0.42	3.89 ± 0.42	3.97 ± 0.42	3.80 ± 0.43	0.04 ± 0.16	0.10 ± 0.23	-0.10 ± 0.30
	p-value	0.97	0.84	< 0.001	0.010	0.21	< 0.001	0.002
My workload is too great for me to keep up-to-date with all the new evidence	Exp. group	3.52 ± 1.60	3.45 ± 1.66	4.45 ± 1.48	3.94 ± 1.57	-0.07 ± 1.44	0.93 ± 1.85	0.46 ± 1.65
	Cont. group	2.98 ± 1.37	2.83 ± 1.34	3.19 ± 1.02	3.28 ± 1.16	-0.15 ± 0.89	0.14 ± 1.34	0.07 ± 1.33
	p-value	0.10	0.08	< 0.001	0.07	0.96	0.03	0.46
I resent having my clinical practice questioned	Exp. group	5.62 ± 1.43	5.42 ± 1.74	5.72 ± 1.15	5.74 ± 1.07	-0.20 ± 1.64	0.10 ± 1.84	0.20 ± 1.51
	Cont. group	5.72 ± 1.24	5.67 ± 1.25	5.86 ± 0.98	5.86 ± 0.92	-0.05 ± 0.39	0.16 ± 0.99	0.07 ± 0.96
	p-value	0.93	0.95	0.81	0.76	0.53	0.70	0.58
Evidence-based practice is a waste of time	Exp. group	6.22 ± 0.97	5.80 ± 1.68	6.58 ± 0.55	5.97 ± 1.22	-0.42 ± 1.41	0.35 ± 0.89	-0.23 ± 1.14
	Cont. group	6.05 ± 1.43	6.03 ± 1.44	6.16 ± 1.01	5.79 ± 1.01	-0.03 ± 0.36	0.16 ± 0.73	-0.10 ± 1.18
	p-value	0.90	0.57	0.12	0.26	0.24	0.27	0.82
I stick to tried and trusted methods rather than changing to anything new	Exp. group	5.50 ± 1.52	5.55 ± 1.71	6.17 ± 0.93	5.77 ± 1.14	0.05 ± 1.32	0.68 ± 1.23	0.40 ± 1.46
	Cont. group	5.75 ± 1.21	5.80 ± 1.18	5.65 ± 1.25	5.62 ± 1.08	0.05 ± 0.45	-0.05 ± 0.78	-0.14 ± 1.16
	p-value	0.54	0.95	0.06	0.56	0.64	0.01	0.17
EBPQ attitude	Exp. group	5.22 ± 0.95	5.06 ± 1.32	5.73 ± 0.58	5.36 ± 0.95	-0.16 ± 1.01	0.51 ± 0.85	0.21 ± 0.82
	Cont. group	5.12 ± 0.85	5.08 ± 0.84	5.22 ± 0.68	5.14 ± 0.66	-0.04 ± 0.40	0.10 ± 0.57	-0.03 ± 0.77
	P-value	0.42	0.40	< 0.001	0.10	0.55	0.02	0.18

Variable	Group	Timepoint comparisons			Delta from baseline comparisons				
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	
Used evidence to change my clinical practice...	Exp. group	1.55 ± 0.71	1.62 ± 0.74	1.62 ± 0.74	1.26 ± 0.51	0.07 ± 0.76	0.07 ± 0.76	0.07 ± 0.76	-0.20 ± 0.58
	Cont. group	2.12 ± 1.16	2.20 ± 1.11	2.14 ± 1.06	1.52 ± 0.74	0.07 ± 0.42	0.08 ± 0.43	0.07 ± 0.42	-0.62 ± 1.21
	p-value	0.01	0.008	0.02	0.15	0.61	0.65	0.61	0.11
Critically appraised evidence from a research study ...	Exp. group	1.75 ± 1.03	1.45 ± 0.81	1.45 ± 0.81	1.34 ± 0.84	-0.30 ± 0.97	-0.30 ± 0.97	-0.30 ± 0.97	-0.31 ± 1.02
	Cont. group	2.02 ± 0.97	2.02 ± 1.00	2.00 ± 1.03	1.45 ± 0.51	0.00 ± 0.32	0.00 ± 0.33	0.00 ± 0.32	-0.62 ± 1.08
	p-value	0.07	0.001	0.003	0.08	0.15	0.16	0.15	0.26
Generated a PICOT question about my clinical practice...	Exp. group	1.10 ± 0.30	1.18 ± 0.38	2.10 ± 0.93	1.20 ± 0.47	0.07 ± 0.35	1.00 ± 0.91	0.07 ± 0.35	0.14 ± 0.55
	Cont. group	1.11 ± 0.32	1.22 ± 0.42	1.20 ± 0.41	1.21 ± 0.41	0.06 ± 0.24	0.06 ± 0.24	0.06 ± 0.24	0.07 ± 0.27
	P-value	0.85	0.66	< 0.001	0.77	0.78	< 0.001	0.78	0.63
Informally discussed evidence from a research study with a colleague...	Exp. group	1.52 ± 0.55	1.75 ± 0.93	2.38 ± 0.95	1.63 ± 0.81	0.23 ± 0.89	0.85 ± 1.05	0.23 ± 0.89	0.14 ± 0.91
	Cont. group	2.05 ± 1.01	1.95 ± 1.04	1.86 ± 0.95	1.66 ± 0.77	-0.10 ± 0.44	-0.11 ± 0.46	-0.10 ± 0.44	-0.31 ± 0.93
	p-value	0.01	0.32	0.007	0.86	0.09	< 0.001	0.09	0.08
Collected data on a patient problem...	Exp. group	3.17 ± 1.47	2.70 ± 1.22	2.70 ± 1.22	1.71 ± 1.10	-0.47 ± 1.60	-0.47 ± 1.60	-0.47 ± 1.60	-1.51 ± 1.63
	Cont. group	2.70 ± 1.54	2.83 ± 1.50	2.81 ± 1.51	1.31 ± 0.54	0.12 ± 0.69	0.14 ± 0.71	0.12 ± 0.69	-1.21 ± 1.54
	p-value	0.11	0.94	0.97	0.19	0.05	0.05	0.05	0.33
Shared evidence from a study or studies in the form of a report or presentation to more than 2 colleagues...	Exp. group	1.40 ± 0.78	1.30 ± 0.56	2.10 ± 0.87	1.31 ± 0.68	-0.10 ± 0.81	0.70 ± 1.24	-0.10 ± 0.81	-0.11 ± 1.11
	Cont. group	1.48 ± 0.82	1.50 ± 0.82	1.46 ± 0.80	1.24 ± 0.51	0.03 ± 0.28	0.03 ± 0.29	0.03 ± 0.28	-0.14 ± 0.64
	p-value	0.73	0.29	< 0.001	0.81	0.60	< 0.001	0.60	0.98
Evaluated the outcomes of a practice change...	Exp. group	1.40 ± 0.74	1.27 ± 0.51	1.27 ± 0.51	1.20 ± 0.58	-0.12 ± 0.85	-0.12 ± 0.85	-0.12 ± 0.85	-0.20 ± 0.99
	Cont. group	1.57 ± 0.78	1.55 ± 0.78	1.43 ± 0.55	1.31 ± 0.54	-0.03 ± 0.36	-0.03 ± 0.37	-0.03 ± 0.36	-0.14 ± 0.52
	p-value	0.17	0.06	0.16	0.21	0.78	0.80	0.78	0.76

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
Shared an EBP guideline with a colleague...	Exp. group	1.48 ± 0.78	1.48 ± 0.60	2.50 ± 0.75	1.74 ± 0.89	0.00 ± 0.88	1.02 ± 1.00	0.26 ± 0.98
	Cont. group	1.95 ± 0.90	1.98 ± 0.89	1.92 ± 0.86	1.72 ± 0.80	0.03 ± 0.28	0.03 ± 0.29	-0.10 ± 0.94
	p-value	0.003	0.005	< 0.001	0.98	0.41	< 0.001	0.04
Shared evidence from a research study with a patient/family member...	Exp. group	1.65 ± 0.98	1.57 ± 0.78	1.80 ± 0.94	1.37 ± 0.81	-0.07 ± 1.14	0.15 ± 1.17	-0.29 ± 1.05
	Cont. group	1.90 ± 0.93	1.88 ± 0.94	1.78 ± 0.82	1.31 ± 0.81	-0.03 ± 0.16	-0.03 ± 0.16	-0.55 ± 1.24
	p-value	0.07	0.09	0.86	0.63	0.84	0.24	0.16
Shared evidenced from a research study with a multi-disciplinary team member...	Exp. group	1.32 ± 0.73	1.25 ± 0.49	1.90 ± 0.67	1.66 ± 0.76	-0.07 ± 0.80	0.57 ± 0.87	0.34 ± 1.11
	Cont. group	1.60 ± 0.93	1.55 ± 0.93	1.49 ± 0.87	1.34 ± 0.61	-0.05 ± 0.32	-0.05 ± 0.33	-0.17 ± 0.85
	p-value	0.12	0.16	0.002	0.06	0.63	< 0.001	0.008
Read and critically appraised a clinical research study...	Exp. group	1.55 ± 0.90	1.65 ± 0.98	1.65 ± 0.98	1.40 ± 0.74	0.10 ± 0.98	0.10 ± 0.98	-0.06 ± 0.84
	Cont. group	1.93 ± 1.16	1.95 ± 1.22	1.89 ± 1.22	1.31 ± 0.54	0.03 ± 0.53	0.03 ± 0.55	-0.66 ± 1.20
	p-value	0.09	0.27	0.44	0.84	0.96	0.97	0.04
Accessed the Cochrane database of systematic reviews...	Exp. group	1.20 ± 0.72	1.23 ± 0.73	1.23 ± 0.73	1.23 ± 0.73	0.03 ± 0.28	0.03 ± 0.28	0.09 ± 0.37
	Cont. group	1.40 ± 0.98	1.35 ± 0.95	1.35 ± 0.98	1.14 ± 0.44	-0.05 ± 0.32	-0.05 ± 0.33	-0.38 ± 1.08
	p-value	0.22	0.53	0.63	0.66	0.32	0.32	0.02
Accessed the National Guidelines Clearinghouse...	Exp. group	2.92 ± 1.23	2.42 ± 1.17	3.30 ± 1.04	2.26 ± 1.09	-0.50 ± 1.22	0.38 ± 1.44	-0.71 ± 1.34
	Cont. group	3.12 ± 1.44	3.08 ± 1.38	3.05 ± 1.37	2.00 ± 0.89	-0.05 ± 0.60	-0.03 ± 0.64	-1.03 ± 1.50
	p-value	0.69	0.03	0.33	0.36	0.03	0.04	0.58
Used an EBP guideline or systematic review to change clinical practice where I work...	Exp. group	1.38 ± 0.70	1.45 ± 0.81	1.70 ± 0.79	1.37 ± 0.88	0.07 ± 0.92	0.33 ± 0.97	0.03 ± 0.82
	Cont. group	1.90 ± 1.24	1.80 ± 1.18	1.76 ± 1.09	1.31 ± 0.54	-0.10 ± 0.87	-0.05 ± 0.94	-0.45 ± 1.12
	p-value	0.03	0.18	0.65	0.74	0.61	0.04	0.06
Evaluated a care initiative by collecting patient outcome data...	Exp. group	1.18 ± 0.55	1.20 ± 0.72	1.82 ± 0.71	1.26 ± 0.56	0.03 ± 0.73	0.65 ± 0.80	0.09 ± 0.51
	Cont. group	1.30 ± 0.91	1.35 ± 0.92	1.43 ± 0.96	1.14 ± 0.35	0.05 ± 0.22	0.14 ± 0.35	-0.21 ± 0.94
	p-value	0.72	0.24	< 0.001	0.47	0.17	< 0.001	0.24

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
Shared the outcome data collected with colleagues...	Exp. group	1.12 ± 0.40	1.15 ± 0.43	1.55 ± 0.93	1.34 ± 0.68	0.03 ± 0.48	0.42 ± 0.81	0.23 ± 0.49
	Cont. group	1.23 ± 0.42	1.25 ± 0.44	1.22 ± 0.42	1.10 ± 0.31	0.03 ± 0.28	0.03 ± 0.29	0.00 ± 0.27
	p-value	0.15	0.18	0.14	0.11	0.77	0.005	0.03
Changed practice based on patient outcome data...	Exp. group	1.27 ± 0.60	1.23 ± 0.70	1.23 ± 0.70	1.23 ± 0.73	-0.05 ± 0.88	-0.05 ± 0.88	0.00 ± 0.87
	Cont. group	1.62 ± 1.08	1.60 ± 1.08	1.51 ± 0.96	1.07 ± 0.26	-0.03 ± 0.28	-0.03 ± 0.29	-0.48 ± 1.02
	p-value	0.09	0.04	0.07	0.34	0.53	0.56	0.08
Promoted the use of EBP to my colleagues...	Exp. group	1.35 ± 0.53	1.43 ± 0.75	2.92 ± 1.02	1.71 ± 1.02	0.07 ± 0.80	1.57 ± 1.08	0.37 ± 0.88
	Cont. group	1.75 ± 1.01	1.70 ± 1.02	1.84 ± 0.96	1.38 ± 0.56	-0.05 ± 0.22	0.19 ± 0.66	-0.28 ± 0.96
	p-value	0.08	0.21	< 0.001	0.25	0.65	< 0.001	0.008
EBPI behavior	Exp. group	1.57 ± 0.37	1.52 ± 0.41	1.96 ± 0.35	1.46 ± 0.56	-0.06 ± 0.38	0.38 ± 0.39	-0.10 ± 0.47
	Cont. group	1.76 ± 0.63	1.77 ± 0.62	1.78 ± 0.61	1.36 ± 0.35	0.01 ± 0.15	0.04 ± 0.18	-0.37 ± 0.67
	p-value	0.37	0.04	0.003	0.58	0.34	< 0.001	0.10
Formulated a clearly answerable question as the beginning of the process towards filling this gap?	Exp. group	4.70 ± 1.54	4.17 ± 1.68	4.95 ± 1.22	4.09 ± 1.27	-0.53 ± 1.57	0.25 ± 1.50	-0.63 ± 1.42
	Cont. group	4.47 ± 1.30	4.35 ± 1.37	4.16 ± 1.28	3.59 ± 1.05	-0.12 ± 0.61	-0.38 ± 1.04	-1.10 ± 1.08
	p-value	0.29	0.86	0.005	0.07	0.02	0.07	0.24
Tracked down the relevant evidence once you have formulated the question?	Exp. group	4.47 ± 1.60	4.12 ± 1.62	4.85 ± 1.14	4.09 ± 1.20	-0.35 ± 1.55	0.38 ± 1.44	-0.34 ± 1.41
	Cont. group	4.50 ± 1.32	4.45 ± 1.43	4.24 ± 1.38	3.72 ± 1.07	-0.05 ± 0.81	-0.30 ± 0.78	-1.03 ± 1.12
	p-value	0.81	0.41	0.05	0.15	0.22	0.02	0.12
Critically appraised, against set criteria, any literature you have discovered?	Exp. group	4.00 ± 1.71	4.10 ± 1.72	4.97 ± 1.12	4.37 ± 1.40	0.10 ± 1.22	0.97 ± 1.48	0.43 ± 1.40
	Cont. group	4.38 ± 1.67	4.35 ± 1.63	4.16 ± 1.48	4.17 ± 1.42	-0.03 ± 0.70	-0.30 ± 0.91	-0.34 ± 1.32
	P-value	0.35	0.64	0.010	0.49	0.48	< 0.001	0.05

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
Integrated the evidence you have found with your expertise?	Exp. group	4.75 ± 1.64	4.53 ± 1.40	4.97 ± 0.97	4.37 ± 0.97	-0.23 ± 1.48	0.23 ± 1.54	-0.29 ± 1.72
	Cont. group	4.88 ± 1.38	4.80 ± 1.29	4.54 ± 1.19	4.31 ± 1.07	-0.07 ± 0.53	-0.35 ± 0.75	-0.72 ± 0.96
	p-value	0.89	0.39	0.13	0.81	0.78	0.17	0.40
Evaluated the outcomes of your practice?	Exp. group	4.72 ± 1.58	4.40 ± 1.65	4.95 ± 1.20	4.54 ± 1.12	-0.33 ± 1.29	0.23 ± 1.49	-0.23 ± 1.63
	Cont. group	4.90 ± 1.41	4.95 ± 1.43	4.54 ± 0.99	4.31 ± 0.89	0.05 ± 0.88	-0.32 ± 0.97	-0.52 ± 1.27
	p-value	0.79	0.21	0.08	0.42	0.14	0.13	0.69
Shared this information with colleagues?	Exp. group	4.83 ± 1.63	4.62 ± 1.55	5.22 ± 1.03	4.63 ± 1.44	-0.20 ± 1.54	0.40 ± 1.55	-0.20 ± 1.89
	Cont. group	4.50 ± 1.55	4.62 ± 1.51	4.30 ± 1.37	4.28 ± 1.19	0.12 ± 0.91	-0.16 ± 0.96	-0.21 ± 1.24
	p-value	0.29	0.96	0.006	0.40	0.32	0.11	0.94
Sharing of ideas and information with colleagues	Exp. group	4.92 ± 1.27	4.80 ± 1.34	5.17 ± 1.08	5.00 ± 1.08	-0.12 ± 1.14	0.25 ± 1.19	0.09 ± 0.92
	Cont. group	4.72 ± 0.96	4.65 ± 1.03	4.62 ± 1.06	4.59 ± 1.18	-0.07 ± 0.47	-0.08 ± 0.49	-0.21 ± 0.62
	p-value	0.41	0.52	0.03	0.13	0.54	0.12	0.21
EBPQ behavior	Exp. group	4.63 ± 1.15	4.39 ± 1.22	5.01 ± 0.75	4.44 ± 0.82	-0.24 ± 0.81	0.39 ± 0.95	-0.17 ± 0.96
	Cont. group	4.62 ± 0.99	4.60 ± 0.95	4.37 ± 0.81	4.14 ± 0.73	-0.03 ± 0.45	-0.27 ± 0.50	-0.59 ± 0.67
	p-value	0.75	0.64	< 0.001	0.11	0.12	< 0.001	0.04
Awareness of major information types and sources	Exp. group	4.05 ± 1.34	3.95 ± 1.43	4.80 ± 1.02	4.26 ± 1.38	-0.10 ± 1.34	0.75 ± 1.37	0.26 ± 1.07
	Cont. group	3.70 ± 1.09	3.60 ± 1.10	3.54 ± 1.07	3.69 ± 0.85	-0.10 ± 0.55	-0.11 ± 0.57	-0.07 ± 0.70
	P-value	0.28	0.31	< 0.001	0.05	0.62	< 0.001	0.19
Knowledge of how to retrieve evidence	Exp. group	4.50 ± 1.45	4.53 ± 1.50	5.17 ± 0.98	4.83 ± 1.27	0.03 ± 1.03	0.68 ± 1.40	0.31 ± 1.21
	Cont. group	4.12 ± 0.94	4.28 ± 0.99	4.24 ± 0.98	4.24 ± 0.91	0.15 ± 0.48	0.16 ± 0.50	0.03 ± 0.68
	p-value	0.10	0.27	< 0.001	0.02	0.12	0.10	0.39
EBPQ knowledge	Exp. group	4.28 ± 1.28	4.24 ± 1.35	4.99 ± 0.84	4.54 ± 1.26	-0.04 ± 0.98	0.71 ± 1.23	0.29 ± 0.99
	Cont. group	3.91 ± 0.86	3.94 ± 0.92	3.89 ± 0.89	3.97 ± 0.76	0.03 ± 0.41	0.03 ± 0.42	-0.02 ± 0.54
	P-value	0.10	0.22	< 0.001	0.01	0.37	0.005	0.26

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
When improving the quality of patient/client care based on EBP, what is the starting point?	Exp. group	1.20 ± 0.41	1.00 ± 0.00	1.00 ± 0.00	1.03 ± 0.17	-0.20 ± 0.41	-0.20 ± 0.41	-0.20 ± 0.41
	Cont. group	1.27 ± 0.45	1.20 ± 0.41	1.22 ± 0.42	1.03 ± 0.19	-0.07 ± 0.27	-0.08 ± 0.28	-0.28 ± 0.45
	p-value	0.44	0.003	0.002	0.91	0.11	0.14	0.48
Which of the following is a source of internal evidence?	Exp. group	1.57 ± 0.50	1.00 ± 0.00	1.00 ± 0.00	1.06 ± 0.24	-0.57 ± 0.50	-0.57 ± 0.50	-0.49 ± 0.61
	Cont. group	1.43 ± 0.50	1.35 ± 0.48	1.32 ± 0.47	1.17 ± 0.38	-0.07 ± 0.27	-0.08 ± 0.28	-0.21 ± 0.41
	p-value	0.18	< 0.001	< 0.001	0.15	< 0.001	< 0.001	0.02
What is a PICO-question?	Exp. group	1.30 ± 0.46	1.05 ± 0.22	1.05 ± 0.22	1.03 ± 0.17	-0.25 ± 0.49	-0.25 ± 0.49	-0.31 ± 0.47
	Cont. group	1.30 ± 0.46	1.25 ± 0.44	1.24 ± 0.43	1.24 ± 0.44	-0.05 ± 0.32	-0.05 ± 0.33	-0.07 ± 0.37
	p-value	1.00	0.01	0.02	0.01	0.03	0.04	0.03
Which of the following is the most reliable source of external evidence?	Exp. group	1.57 ± 0.50	1.27 ± 0.45	1.25 ± 0.44	1.11 ± 0.32	-0.30 ± 0.56	-0.33 ± 0.57	-0.49 ± 0.56
	Cont. group	1.27 ± 0.45	1.30 ± 0.46	1.32 ± 0.47	1.31 ± 0.47	0.03 ± 0.16	0.03 ± 0.16	0.00 ± 0.27
	p-value	0.007	0.81	0.48	0.06	< 0.001	< 0.001	< 0.001
What is the most refined and therefore most usable publication form of evidence from the point of view of clinical practice?	Exp. group	1.30 ± 0.46	1.10 ± 0.30	1.07 ± 0.27	1.11 ± 0.32	-0.20 ± 0.52	-0.23 ± 0.53	-0.20 ± 0.53
	Cont. group	1.57 ± 0.50	1.60 ± 0.50	1.62 ± 0.49	1.59 ± 0.50	0.03 ± 0.28	0.03 ± 0.29	0.00 ± 0.27
	p-value	0.01	< 0.001	< 0.001	< 0.001	0.02	0.01	0.06
Which of the following ways of producing knowledge can be deemed the strongest evidence of effectiveness of an intervention?	Exp. group	1.77 ± 0.42	1.52 ± 0.51	1.45 ± 0.50	1.46 ± 0.51	-0.25 ± 0.67	-0.33 ± 0.69	-0.34 ± 0.64
	Cont. group	1.73 ± 0.45	1.75 ± 0.44	1.73 ± 0.45	1.55 ± 0.51	0.03 ± 0.16	0.03 ± 0.16	-0.14 ± 0.44
	p-value	0.61	0.04	0.01	0.46	0.008	0.002	0.10
Which of the following is the best way to appraise evidence and its strength and applicability to clinical practice?	Exp. group	1.20 ± 0.41	1.10 ± 0.30	1.10 ± 0.30	1.11 ± 0.32	-0.10 ± 0.30	-0.10 ± 0.30	-0.11 ± 0.40
	Cont. group	1.18 ± 0.38	1.20 ± 0.41	1.24 ± 0.43	1.17 ± 0.38	0.03 ± 0.28	0.11 ± 0.39	0.03 ± 0.33
	p-value	0.78	0.22	0.10	0.52	0.06	0.01	0.12

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
Why is it not justified to base care decisions on the findings of a single study?	Exp. group	1.07 ± 0.27	1.02 ± 0.16	1.02 ± 0.16	1.06 ± 0.24	-0.05 ± 0.32	-0.05 ± 0.32	-0.03 ± 0.38
	Cont. group p-value	1.12 ± 0.33 0.46	1.10 ± 0.30 0.17	1.24 ± 0.43 0.005	1.21 ± 0.41 0.08	-0.03 ± 0.16	0.11 ± 0.39	0.07 ± 0.37 0.31
Which of the following is not used in evidence-based decision making?	Exp. group	1.57 ± 0.50	1.07 ± 0.27	1.07 ± 0.27	1.09 ± 0.28	-0.50 ± 0.55	-0.50 ± 0.55	-0.49 ± 0.61
	Cont. group p-value	1.45 ± 0.50 0.27	1.43 ± 0.50 < 0.001	1.51 ± 0.51 < 0.001	1.34 ± 0.48 0.01	-0.03 ± 0.28	0.08 ± 0.36	-0.14 ± 0.52 0.01
Where can you find compact, reliable information that you can implement in practice to improve clinical practice?	Exp. group	1.35 ± 0.48	1.12 ± 0.33	1.12 ± 0.33	1.09 ± 0.28	-0.23 ± 0.53	-0.23 ± 0.53	-0.31 ± 0.58
	Cont. group p-value	1.43 ± 0.50 0.50	1.38 ± 0.49 0.01	1.49 ± 0.51 < 0.001	1.38 ± 0.49 0.005	-0.05 ± 0.32	0.05 ± 0.47	-0.03 ± 0.57 0.06
Using research evidence in patient care and evaluating its use is important. An example of this is...	Exp. group	1.30 ± 0.46	1.02 ± 0.16	1.02 ± 0.16	1.06 ± 0.24	-0.28 ± 0.51	-0.28 ± 0.51	-0.23 ± 0.43
	Cont. group p-value	1.12 ± 0.33 0.06	1.10 ± 0.30 0.17	1.24 ± 0.43 0.005	1.17 ± 0.38 0.15	-0.03 ± 0.16	0.11 ± 0.39	0.03 ± 0.50 0.03
What can be done to promote EBP?	Exp. group	1.80 ± 0.41	1.00 ± 0.00	1.00 ± 0.00	1.00 ± 0.00	-0.80 ± 0.41	-0.80 ± 0.41	-0.77 ± 0.43
	Cont. group p-value	1.40 ± 0.50 < 0.001	1.32 ± 0.47 < 0.001	1.30 ± 0.46 < 0.001	1.10 ± 0.31 0.06	-0.07 ± 0.27	-0.11 ± 0.52	-0.28 ± 0.53 < 0.001
What does a culture of EBP mean?	Exp. group	1.62 ± 0.49	1.05 ± 0.22	1.05 ± 0.22	1.00 ± 0.00	-0.57 ± 0.55	-0.57 ± 0.55	-0.60 ± 0.50
	Cont. group p-value	1.43 ± 0.50 0.08	1.40 ± 0.50 < 0.001	1.46 ± 0.51 < 0.001	1.28 ± 0.45 0.001	-0.03 ± 0.28	0.03 ± 0.50	-0.24 ± 0.51 0.008
The EBP Basic EmNurs knowledge test	Exp. group	7.35 ± 1.58	11.65 ± 0.98	11.78 ± 0.92	11.80 ± 1.02	4.30 ± 1.54	4.42 ± 1.53	4.57 ± 1.70
	Cont. group P-value	8.32 ± 2.48 0.01	8.65 ± 2.48 < 0.001	8.16 ± 2.18 < 0.001	9.52 ± 1.45 < 0.001	0.33 ± 1.40	-0.16 ± 2.08	1.28 ± 2.36 < 0.001
I am clear about the steps of EBP	Exp. group	3.12 ± 1.11	3.12 ± 1.09	4.40 ± 0.67	3.83 ± 0.92	0.00 ± 0.72	1.27 ± 1.24	0.71 ± 1.02
	Cont. group p-value	3.10 ± 0.87 0.70	3.17 ± 0.90 0.86	3.43 ± 0.99 < 0.001	3.34 ± 0.90 0.03	0.07 ± 0.27	0.35 ± 0.68	0.28 ± 0.70 0.04

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
I am sure that I can implement EBP	Exp. group	3.50 ± 0.93	3.52 ± 0.82	4.08 ± 0.57	3.83 ± 0.86	0.03 ± 0.73	0.57 ± 0.96	0.40 ± 0.81
	Cont. group p-value	3.33 ± 0.80 0.31	3.30 ± 0.79 0.20	3.57 ± 0.99 0.01	3.45 ± 0.87 0.07	-0.03 ± 0.28 0.85	0.24 ± 0.80 0.04	0.10 ± 0.67 0.11
I am sure that I can implement EBP in a time efficient way.	Exp. group	3.27 ± 0.82	3.23 ± 0.66	3.88 ± 0.52	3.51 ± 0.82	-0.05 ± 0.78	0.60 ± 0.96	0.26 ± 0.74
	Cont. group p-value	3.30 ± 0.56 0.91	3.30 ± 0.61 0.64	3.32 ± 0.63 < 0.001	3.38 ± 0.49 0.35	0.00 ± 0.32 0.37	0.05 ± 0.40 0.003	0.07 ± 0.37 0.24
I am sure about how to measure the outcomes of clinical care	Exp. group	2.67 ± 1.00	2.83 ± 0.90	3.35 ± 0.70	3.23 ± 0.73	0.15 ± 0.74	0.68 ± 0.94	0.60 ± 0.74
	Cont. group p-value	2.90 ± 0.81 0.19	2.95 ± 0.88 0.54	2.92 ± 0.83 0.009	2.79 ± 0.68 0.01	0.05 ± 0.39 0.29	0.14 ± 0.48 0.002	-0.03 ± 0.63 < 0.001
I am sure that I can access the best resources in order to implement EBP	Exp. group	2.95 ± 0.81	3.58 ± 0.78	3.92 ± 0.69	3.40 ± 0.65	0.62 ± 0.81	0.97 ± 1.14	0.49 ± 0.95
	Cont. group p-value	3.10 ± 0.81 0.44	3.10 ± 0.87 0.01	3.24 ± 0.93 < 0.001	3.21 ± 0.82 0.40	0.00 ± 0.39 < 0.001	0.11 ± 0.52 < 0.001	0.14 ± 0.58 0.13
I know how to implement EBP sufficiently enough to make practice changes.	Exp. group	2.95 ± 0.78	3.00 ± 0.82	3.92 ± 0.69	3.51 ± 0.82	0.05 ± 0.81	0.97 ± 0.83	0.63 ± 0.84
	Cont. group p-value	3.10 ± 0.71 0.46	3.23 ± 0.70 0.18	3.49 ± 0.93 0.02	3.55 ± 0.83 1.00	0.12 ± 0.52 1.00	0.41 ± 0.93 < 0.001	0.48 ± 0.91 0.26
I am confident about my ability to implement EBP where I work	Exp. group	3.58 ± 0.84	3.60 ± 0.78	4.05 ± 0.60	3.77 ± 0.69	0.03 ± 0.80	0.47 ± 0.93	0.23 ± 0.81
	Cont. group p-value	3.48 ± 0.68 0.39	3.52 ± 0.68 0.59	3.68 ± 0.71 0.02	3.52 ± 0.74 0.16	0.05 ± 0.22 0.92	0.16 ± 0.50 0.06	0.00 ± 0.65 0.12
I believe that I can search for the best evidence to answer clinical questions in a time efficient way	Exp. group	2.92 ± 0.86	2.95 ± 0.81	3.35 ± 0.66	3.03 ± 0.75	0.03 ± 0.77	0.42 ± 0.93	0.14 ± 0.81
	Cont. group p-value	2.80 ± 0.65 0.51	2.92 ± 0.66 1.00	3.14 ± 0.71 0.23	3.28 ± 0.70 0.16	0.12 ± 0.33 0.32	0.32 ± 0.63 0.46	0.38 ± 0.73 0.35

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
EBPB self-efficacy	Exp. group	3.12 ± 0.60	3.23 ± 0.60	3.87 ± 0.28	3.51 ± 0.53	0.11 ± 0.36	0.75 ± 0.56	0.43 ± 0.38
	Cont. group	3.14 ± 0.42	3.19 ± 0.44	3.35 ± 0.57	3.31 ± 0.46	0.05 ± 0.14	0.22 ± 0.44	0.18 ± 0.41
	p-value	0.83	0.64	< 0.001	0.06	0.66	< 0.001	0.003
Research skills	Exp. group	4.03 ± 1.23	3.65 ± 1.23	4.55 ± 0.68	4.11 ± 1.11	-0.38 ± 1.00	0.53 ± 1.15	0.09 ± 1.20
	Cont. group	3.42 ± 1.11	3.40 ± 0.98	3.70 ± 0.78	3.55 ± 0.87	-0.03 ± 0.58	0.24 ± 0.83	0.00 ± 1.00
	p-value	0.01	0.20	< 0.001	0.01	0.04	0.45	0.99
IT skills	Exp. group	4.78 ± 1.39	4.58 ± 1.36	5.40 ± 1.06	4.80 ± 1.35	-0.20 ± 0.76	0.62 ± 1.35	0.00 ± 1.51
	Cont. group	4.78 ± 1.07	4.78 ± 1.17	4.76 ± 1.12	4.79 ± 1.08	0.00 ± 0.60	0.05 ± 0.74	-0.03 ± 0.78
	p-value	0.78	0.68	0.01	0.91	0.18	0.07	0.84
Monitoring and reviewing of practice skills	Exp. group	4.97 ± 1.00	4.70 ± 1.02	5.42 ± 0.75	5.00 ± 0.73	-0.28 ± 1.06	0.45 ± 1.15	0.11 ± 1.05
	Cont. group	4.58 ± 0.96	4.53 ± 0.99	4.43 ± 1.07	4.48 ± 1.06	-0.05 ± 0.55	-0.08 ± 0.95	-0.10 ± 0.94
	p-value	0.05	0.25	< 0.001	0.02	0.21	0.06	0.38
Converting your information needs into a research question	Exp. group	4.40 ± 1.34	4.00 ± 1.34	4.97 ± 0.77	4.43 ± 1.07	-0.40 ± 0.90	0.57 ± 1.41	0.06 ± 0.94
	Cont. group	4.20 ± 1.02	4.10 ± 1.06	4.05 ± 1.08	4.21 ± 0.90	-0.10 ± 0.38	-0.11 ± 0.39	-0.21 ± 0.62
	p-value	0.32	0.82	< 0.001	0.38	0.005	0.02	0.54
Ability to identify gaps in your professional practice	Exp. group	5.28 ± 0.91	5.25 ± 0.74	5.35 ± 0.74	5.03 ± 0.92	-0.03 ± 0.86	0.07 ± 0.86	-0.26 ± 0.85
	Cont. group	5.33 ± 0.69	5.28 ± 0.68	5.22 ± 0.67	5.07 ± 0.75	-0.05 ± 0.39	-0.05 ± 0.40	-0.14 ± 0.69
	p-value	0.98	0.93	0.32	0.70	0.50	0.79	0.44
Ability to analyse critically evidence against set standards	Exp. group	4.21 ± 1.30	4.10 ± 1.35	4.75 ± 0.95	4.46 ± 1.15	-0.15 ± 0.84	0.51 ± 1.48	0.21 ± 1.09
	Cont. group	3.98 ± 1.03	3.90 ± 0.96	3.95 ± 0.91	4.10 ± 0.86	-0.07 ± 0.42	-0.08 ± 0.43	-0.14 ± 0.52
	p-value	0.22	0.34	< 0.001	0.12	0.48	0.04	0.18
Ability to determine how valid (close to the truth) the material is	Exp. group	4.58 ± 1.30	4.35 ± 1.55	5.03 ± 1.03	4.71 ± 1.25	-0.23 ± 1.00	0.45 ± 1.38	0.11 ± 1.16
	Cont. group	4.40 ± 1.08	4.30 ± 0.97	4.38 ± 0.89	4.62 ± 0.78	-0.10 ± 0.50	-0.11 ± 0.52	-0.07 ± 0.53
	p-value	0.31	0.54	0.003	0.51	0.59	0.04	0.59

Variable	Group	Timepoint comparisons			Delta from baseline comparisons			
		Baseline mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd	After mean ± sd	6 mo mean ± sd	12 mo mean ± sd
Ability to determine how useful (clinically applicable) the material is	Exp. group	4.55 ± 1.24	4.38 ± 1.43	5.08 ± 0.94	4.77 ± 1.17	-0.17 ± 0.98	0.53 ± 1.48	0.23 ± 1.24
	Cont. group p-value	4.45 ± 0.96 0.31	4.45 ± 0.90 0.90	4.46 ± 0.87 0.006	4.59 ± 0.87 0.36	0.00 ± 0.39 0.27	0.00 ± 0.41 0.12	0.00 ± 0.46 0.79
Ability to apply information to individual cases	Exp. group	4.70 ± 1.11	4.38 ± 1.23	5.03 ± 0.80	4.74 ± 0.95	-0.33 ± 1.27	0.33 ± 1.25	0.03 ± 1.04
	Cont. group p-value	4.58 ± 0.90 0.46	4.53 ± 0.85 0.99	4.54 ± 0.87 0.01	4.59 ± 0.91 0.41	-0.05 ± 0.64 0.14	-0.05 ± 0.66 0.30	-0.14 ± 0.64 0.66
Dissemination of new ideas about care to colleagues	Exp. group	4.78 ± 1.12	4.58 ± 1.17	4.83 ± 1.03	4.37 ± 1.00	-0.20 ± 1.07	0.05 ± 0.99	-0.40 ± 1.03
	Cont. group p-value	4.40 ± 1.17 0.14	4.30 ± 1.24 0.32	4.30 ± 1.27 0.05	4.31 ± 1.17 0.70	-0.10 ± 0.59 0.42	-0.11 ± 0.61 0.35	-0.14 ± 1.06 0.12
Ability to review your own practice	Exp. group	4.95 ± 0.93	4.92 ± 0.94	5.12 ± 0.72	4.63 ± 0.88	-0.03 ± 0.92	0.17 ± 0.93	-0.31 ± 1.02
	Cont. group p-value	4.92 ± 0.89 0.83	4.83 ± 0.90 0.45	4.84 ± 0.87 0.10	4.62 ± 0.94 0.83	-0.10 ± 0.38 0.75	-0.11 ± 0.39 0.10	-0.24 ± 0.74 0.89
EBPQ skills	Exp. group	4.64 ± 0.76	4.44 ± 0.82	5.05 ± 0.42	4.64 ± 0.71	-0.22 ± 0.47	0.40 ± 0.76	-0.01 ± 0.43
	Cont. group p-value	4.46 ± 0.45 0.08	4.40 ± 0.42 0.30	4.42 ± 0.39 < 0.001	4.45 ± 0.35 0.04	-0.06 ± 0.18 0.01	-0.04 ± 0.21 0.003	-0.11 ± 0.36 0.59

1 Experimental group, 2 Control group

Appendix 5. The number and percentage of correct answers in the EBP Basic EmNurs knowledge test.

Variable	Baseline			After education			6 mo			12 mo		
	Exp. group ¹	Cont. group ²	p-value	Exp. group	Cont. group	p-value	Exp. group	Cont. group	p-value	Exp. group	Cont. group	p-value
Using research evidence in patient care and evaluating its use is important. An example of this is...	28 (70%)	35 (88%)	0.10	39 (98%)	36 (90%)	0.36	39 (98%)	28 (76%)	0.01	33 (94%)	24 (83%)	0.23
What can be done to promote evidence-based practice?	8 (20%)	24 (60%)	< 0.001	40 (100%)	27 (68%)	< 0.001	40 (100%)	26 (70%)	< 0.001	35 (100%)	26 (90%)	0.09
What does a culture of evidence-based practice mean?	15 (38%)	23 (57%)	0.12	38 (95%)	24 (60%)	< 0.001	38 (95%)	20 (54%)	< 0.001	35 (100%)	21 (72%)	< 0.001
What is a PICO-question?	28 (70%)	28 (70%)	1.00	38 (95%)	30 (75%)	0.03	38 (95%)	28 (76%)	0.02	34 (97%)	22 (76%)	0.02
What is the most refined and therefore most usable publication form of evidence from the point of view of clinical practice?	28 (70%)	17 (42%)	0.02	36 (90%)	16 (40%)	< 0.001	37 (92%)	14 (38%)	< 0.001	31 (89%)	12 (41%)	< 0.001
When improving the quality of patient/client care based on EBP, what is the starting point?	32 (80%)	29 (72%)	0.60	40 (100%)	32 (80%)	0.01	40 (100%)	29 (78%)	< 0.001	34 (97%)	28 (97%)	1.00
Where can you find compact, reliable information that you can implement in practice to improve clinical practice?	26 (65%)	23 (57%)	0.65	35 (88%)	25 (62%)	0.02	35 (88%)	19 (51%)	< 0.001	32 (91%)	18 (62%)	0.01
Which of the following is a source of internal evidence? (Internal evidence = evidence generated internally within a clinical setting)	17 (42%)	23 (57%)	0.26	40 (100%)	26 (65%)	< 0.001	40 (100%)	25 (68%)	< 0.001	33 (94%)	24 (83%)	0.23

Original publications

- I Koota, E., Kääriäinen, M. & Melender, H.-L. (2018). Educational interventions promoting evidence-based practice among emergency nurses: A systematic review. *International Emergency Nursing*, 41, 51–58. <https://doi.org/10.1016/j.ienj.2018.06.004>
- II Koota, E., Kääriäinen, M., Lääperi, M. & Melender, H.-L. (2019). Emergency nurses' evidence-based practice attitudes, self-efficacy, knowledge, skills and behaviors before an educational intervention – Baseline of a randomized controlled trial. *Collegian*, 27, 361–369. <https://doi.org/10.1016/j.colegn.2019.11.002>
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1568. Kinnunen, Sini (2020) The interaction of transcription factors GATA4 and NKX2-5 and the effect of interaction-targeted small molecules on the heart
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ISBN 978-952-62-2716-0 (Paperback)
ISBN 978-952-62-2717-7 (PDF)
ISSN 0355-3221 (Print)
ISSN 1796-2234 (Online)