



VAASAN AMMATTIKORKEAKOULU
UNIVERSITY OF APPLIED SCIENCES

THIS IS AN ELECTRONIC REPRINT OF THE ORIGINAL ARTICLE

Please cite the original article:

Häggman-Laitila, A., Mattila, L.-R. & Melender, H.-L. 2017. A systematic review of the outcomes of educational interventions relevant to nurses with simultaneous strategies for guideline implementation. *Journal of Clinical Nursing* 26 (3-4), 320-340.

<https://doi.org/10.1111/jocn.13405>

Version: Final draft

Copyright: © 2017 John Wiley & Sons Ltd

Arja Häggman-Laitila, Lea-Riitta Mattila & Hanna-Leena Melender

A SYSTEMATIC REVIEW OF THE OUTCOMES OF EDUCATIONAL INTERVENTIONS TO NURSES WITH SIMULTANEOUS STRATEGIES FOR GUIDELINE IMPLEMENTATION

Abstract

Aims. To systematically review the literature on the outcomes of educational interventions relevant to nurses with regard to guideline implementation.

Background. Previous reviews on interventions to implement guidelines have focused on particular clinical problems, but only one included nursing studies.

Design. A systematic review based on the procedure of the Centre for Reviews and Dissemination.

Methods. We searched for papers published from 1 January 2008 to 26 February 2015 using the Cochrane, CINAHL and PubMed MEDLINE databases and paper references were searched manually. Quality appraisal was conducted with tools developed by Thomas *et al.* and National Heart, Lung, and Blood Institute. Data were analysed with qualitative content analysis and narrative synthesis.

Results. The data included 13 studies based on a quasi-experimental study design of 13 different educational interventions, described according to their development and realisation, learning content and teaching and learning methods. Seven interventions were supported by simultaneous strategies, 12 studies reported statistically significant outcomes for the interventions on at least one measurement area and six studies reported improvements in the quality of patient care. Interventions with multi-dimensional content, teaching and learning methods produced several good outcomes.

Conclusion. Guidelines were implemented in a heterogeneous way and the interventions were delivered once and mainly on a local basis. In the future, we need to test these interventions in different nursing contexts, measure the outcomes on patient care and carry out randomised controlled trials on their effectiveness. It is important to standardise interventions, as this will allow them to be replicated and compared.

Relevance to clinical practice. Educational interventions to implement guidelines could be beneficial in enhancing nurses' evidence-based decision-making and care practice. The combination of teaching and learning methods proved useful and educational interventions should be supported with simultaneous strategies. There remains a lack of strong evidence on the subject.

Keywords: evidence-based nursing, guideline implementation, educational interventions, systematic review

What does this paper contribute to the wider global clinical community?

- There is a general lack of research knowledge and evidence-based strategies on the best ways to promote the successful implementation of guidelines relevant to nurses.
- This is the first systematic review to address this issue and it shows that educational interventions that focused on implementing guidelines were effective and beneficial in enhancing nurses' evidence-based decision-making and care practices.
- Our review also showed combining teaching and learning methods was useful and that guideline implementation strategies should also employ other well-known factors that promote the implementation of evidence-based nursing.

INTRODUCTION

The clinical practice guidelines issues by the Institute of Medicine (2011) include recommendations to optimise patient care that are based on a systematic review of the evidence and an assessment of the benefits and disadvantages of alternative care options. They form an essential basis for evidence-based decision-making for effective and safe patient care. Dale *et al* (2015) identified 22 factors that were assumed to inhibit or enable the implementation of guidelines in patient care. These data were gathered before the beginning of the implementation process and only a quarter of the inhibitors that they identified proved to be barriers for implementation. These were categorised into four groups: the need for new policies, a limited workforce, a lack of equipment and a lack of education and the availability of trained staff. Factors that enabled implementation included ongoing support by clinical champions, having experts in the unit who were engaged in the process, supportive leadership and easy adaption of the protocols and policies. Implementing the guidelines was a multi-phase process that required monitoring and immediate feedback for staff on positive patient outcomes (Matthew-Maich *et al* 2012, Dale *et al* 2015). Implementation should be based on the organisation's readiness for change, transformational leadership (O'Byrne & Smith 2011, Walker *et al* 2011, Dale *et al* 2015) and partnership programmes between hospitals and universities (Weeks *et al* 2011, Higuchi *et al* 2012, Matthew-Maich *et al* 2012). For example, nurses working in Magnet accredited hospitals have reported more advantages than nurses in non-Magnet institutions, namely fewer barriers to evidence-based nursing (EBN), higher levels of consistent EBN implementation, availability of EBN experts, an organisational culture supporting EBN, education offered routinely and recognition of EBN efforts (Melnyk *et al* 2012, Wilson *et al* 2015).

Matthew-Maich *et al* (2012) found several effective strategies that had been used by frontline leaders to support the uptake of guidelines. These included providing interactive education through numerous activities, rendering accountability, role modelling, collaborating with internal and external partners and facilitating and mentoring. Frontline leaders brought current research to the nurses and got them interested in using the guidelines. They inspired nurses to critically reflect on their beliefs, attitudes, feelings and previous practices. They also helped nurses to use new evidence-based practices with bedside mentoring, they followed the uptake and provided nurses with feedback on the improvements in patient care. Leaders at all organisational levels needed to be highly involved and have visible roles in supporting the implementation of guidelines and communicating the

outcomes of new evidence-based practices. This in turn had a positive impact on the organisational culture. (Higuchi *et al* 2012, Hauck *et al* 2013.) Frontline leaders had to tailor their strategies to different groups of nurses whose attitudes towards new practices varied, including those who were eager to adopt them, those who preferred to sit on the fence and the traditional old guard who were resistant to change (Matthew-Maich *et al* 2012).

Previous reviews on educational interventions for implementing guidelines have focused on particular clinical problems, such as catheter-associated urinary tract infections (Willson *et al* 2009) and arthritis (Lineker & Husted 2010). The review by Lineker and Husted included physicians and general practitioners, while the review by Willson *et al* included physicians, nurses and other healthcare professionals. These reviews revealed that there was very little literature on the implementation of guidelines. In some studies, statistically significant or clinically relevant changes were achieved by healthcare professionals adopting evidence-based practice. Studies have provided limited evidence on the EBN benefits of staff education and in particular of peer-facilitated inter-professional workshops with monitoring of care outcomes and regular feedback for staff. A systematic review by Thompson *et al* (2007) concluded that education was the most frequent way to implement EBN, but it was not effective on its own. For example, increased use of research was observed when education was combined with training a local opinion leader. On the basis of these conclusions (Thompson *et al* 2007, Willson *et al* 2009, Lineker & Husted 2010) our review focused on educational interventions and simultaneous strategies that aimed to enhance the implementation of guidelines and were targeted at just nurses or nurses working in multi-professional teams. There were no restrictions on the clinical content of the guidelines. Research knowledge on the interventions and strategies for promoting the implementation of guidelines in nursing is fragmented and there is a lack of an overall evidence-based picture to guide effective guideline implementation in nursing.

AIM AND RESEARCH QUESTIONS

The aim was to systematically review the literature on the outcomes of educational interventions relevant to nurses with regard to guideline implementation. The research questions were:

1. What kind of educational interventions have been used to implement guidelines in nursing?
2. What kinds of strategies have been used in conjunction with educational interventions to support the implementation of guidelines?
3. What outcomes have been achieved by using these educational interventions and simultaneous guideline implementation strategies?

METHODS

Design

A systematic review was conducted based on the procedure devised by the Centre for Reviews and Dissemination (2009).

Search methods

Search terms

A systematic literature search was carried out using the Cochrane, CINAHL and PubMed MEDLINE databases. This covered the period from 1 January 2008 to 26 February 2015 in order to provide up-to-date data. Various search terms were purposefully selected to cover different developmental initiatives that focused on educational interventions for EBN and guideline implementation in nursing units. The terms were modified as necessary for each database (Table 1) and manual searches of the references from the selected studies were also conducted.

Inclusion criteria

We included studies where the participants were nurses or where nurses and other healthcare professionals. The studies described an educational intervention for guideline implementation, with possible simultaneous strategies, and included an evaluation of these and a report of the outcomes. Other inclusion criteria were that the abstract and full text had to be available and that the empirical research was published in English. No methodological limitations were applied.

Search outcome and exclusion criteria

Details of the study identification and selection process are shown in a PRISMA flow chart (Moher *et al* 2009) (Figure 1). The database searches yielded 1,437 relevant titles and, after duplicates were removed, we had 1,057 titles. After reading the titles and abstracts, 969 studies were rejected by the two authors. A total of 88 full texts were retrieved and read by the two authors and 27 of the studies met the inclusion criteria and were included in the reviews. Manual searches produced five additional studies. The final data revealed three core categories of interventions for the implementation of EBN: journal clubs, educational interventions for learning the basics and processes of EBN and educational

interventions with simultaneous strategies for the implementation of guidelines. We decided to analyse data from these core categories separately and to report on them in three systematic reviews,

Papers were excluded if the study participants were researchers, nursing leaders or doctors. Other reasons for excluding articles were that they did not describe the intervention and contained an intervention not based on a guideline. Papers were also excluded if they described educational interventions for nurses without any connection to guideline implementation, such as critical appraisal, cognitive and research skills, problem solving or simulation. Papers were also excluded if they were descriptions of developmental projects without an evaluation by empirical studies or the description of the evaluation design was insufficient. Systematic reviews and papers on contemporary issues, such as the distribution of research knowledge, partnerships between a library and nurses and other general type of papers were excluded (Figure 1).

Quality appraisal

13 out of 14 studies (Figure 1) were subjected to quality appraisal. One study was left out at the beginning of the quality appraisal process because of lack of clarity in study participants and defects in the description of methods. Only one study was a quasi-experimental study with a comparison group while all the others were uncontrolled studies using a before- and after design. These were included in the review because of a lack of controlled studies on the subject.

The quality of the quasi-experimental study with a comparison group was evaluated in accordance with the quality assessment tool of Thomas *et al* (2004) using the format and dictionary published on the website of the Effective Public Health Practice Project (www.ehphp.ca). The tool includes 21 items separated into eight components: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity and analysis. The overall methodological strength of the studies was rated strong, moderate or weak. The tool is suitable for the evaluation of non-randomized intervention studies in any public health subject area. The quality of the uncontrolled studies using a before- and after design was appraised with a tool published on the website of the National Heart, Lung, and Blood Institute (www.nhlbi.nih.gov). The tool included 12 criteria. The quality of the studies was rated good, fair or poor (Table 2).

The authors separately evaluated the studies and subsequently compared their assessments to reach a common understanding of the contents of the quality assessment criteria. The evaluations were discussed to judge the quality of the studies. The quasi-experimental study with a comparison group was evaluated by three authors and the remaining 12 studies by two authors. The overall methodological strength was moderate in the controlled quasi-experimental study (Table S1b) and good in 4 and fair in 8 of the uncontrolled studies (Table 2 and Table S1a).

Data abstraction and synthesis

Data extraction was conducted using a descriptive matrix (Centre for Reviews and Dissemination 2009). Data were extracted from each study and placed in the matrix, namely the educational interventions and possible simultaneous strategies, participants, the evaluation design and the methods and outcomes. The information in the matrix was analysed by qualitative content analysis and narrative synthesis due to the heterogeneous nature of the guidelines, educational interventions and their evaluation methods (Centre for Reviews and Dissemination 2009, Grant & Booth 2009). Information from the matrix was reduced and expressions with similar contexts were grouped into various subcategories based on their similarities and differences. The abstraction process was continued until the subcategories excluded each other and the subcategories were combined with similar contents to form upper categories. The categories were named based on their contents. After categorising the data, the authors studied the original material again in order to specify the contents and research evidence of the categories and the narrative synthesis. The analyses produced three main categories describing the educational interventions for guideline implementation, with 16 subcategories, plus five subcategories describing the simultaneous strategies and five subcategories describing outcomes. All these categories are presented in the text and Table 4, which includes the synthesis of the two main categories of educational interventions, with their respective subcategories, and the 10 subcategories of simultaneous strategies and outcomes.

RESULTS

Description of the studies

Table 3 shows the 13 studies that were chosen for the final analysis: 10 conducted in the USA and one each in Singapore, Iran and Australia. Three of the nine studies that focused on national guidelines were carried out in paediatric inpatient units and covered healthy eating habits (Gance-Cleveland *et al* 2009), venipuncture practices (Anson *et al* 2010) and central line care (McCaskey 2013). The other six national guideline studies focused on: asthma prevention and patient education (Policicchio *et al* 2011), pain assessment and management (Ang & Chow 2010), diabetes foot ulcer assessment (Varaei *et al* 2013), venous thromboembolism prevention (Duff *et al* 2013), insulin infusion and glycaemic control in cardiac surgery (Hargraves 2014) and cervical cancer screening in adolescents (Choma &

McKeever 2015). The remaining four studies were based on guidelines developed locally by the researchers and colleagues for: pain assessment and management (Salinas & Abdolrasulnia 2011) breastfeeding (Davies *et al* 2012), neonatal abstinence syndrome (Lucas & Knobel 2012) and using hyaluronidase to treat intravenous extravasations (Hanrahan 2013).

Development and realisation of the educational interventions

The main category of development and realisation included subcategories such as: theoretical background, developers, duration, learning environment and intervention participants. Eight papers included information on the theoretical background of the interventions: Rogers' theory of Diffusion of Innovation (McCaskey 2013) and the Iowa model (Varaei *et al* 2013, Hargraves 2014), theories related to organisational empowerment (Davies *et al* 2012) and social marketing and persuasive communication (Duff *et al* 2013), social cognitive theory of self-regulation (Policicchio *et al* 2011) and Aizer's Theory of Planned Behaviour (Anson *et al* 2010). Ang and Chow (2010) used the Joanna Briggs Institute Practical Application of Clinical Evidence System (PACES) and Getting Research into Practice (GRIP) programmes. Nine papers reported interventions that had been developed for the present study: three by the researchers, one by the researchers with input from practical experts in infection control, four by multi-professional teams and one by a work group that had formulated the applied guideline. Two interventions had been developed by university staff, while one intervention had been modified by a university's centre for managing chronic disease and a national respiratory training centre based on a highly successful intervention for physicians. (see Table 3.) Varaei *et al* (2013) did not identify the developers of their educational intervention.

The duration of the face-to-face educational interventions in the learning environments comprised of one meeting that varied from two to five hours or consisted of one or 11 workshops or one educational outreach visit. In web-based learning environments, the duration varied from one short web-based tutorial session or a four-day workshop to five weeks (see Table 3). The durations were not described in three studies (Lucas & Kobel 2012, Hanrahan 2013, Hargraves 2014). The participants of most of the interventions were nurses, but in one intervention (Hanrahan 2013) they also included physicians, nurse practitioners and medical residents.

Learning contents of the educational interventions

The learning contents could be divided into five subcategories: 1) the basics of searching for evidence, 2) the presentation of the guideline and the tools based on it, 3) an overview of the need to change practices according to the guideline, 4) delivering the information in the guideline to patients and families and 5) providing education and counselling to patients and families according to the

guideline (Table 4). The presentation of the contents varied from a short mention to detailed descriptions in the original papers.

Teaching and learning methods employed by the educational interventions

The main category of teaching and learning methods consisted of six subcategories: face-to-face lectures, web-based sessions, small group work, audiovisual methods, case examples and role-play activities and demonstrations and practical exercises (Table 4). Lectures and small group work were the most popular teaching methods, with more than two teaching or learning methods being used in three of the interventions. Hanrahan (2013) did not report on the teaching and learning methods of the intervention they studied.

Simultaneous strategies for implementation

The strategies that were used simultaneously with the educational interventions to promote guideline implementation were: revisions of local procedures and protocols, facilitation and audit with feedback, support for decision-making and multi-professional collaboration (Table 4). For example, in Ang *et al*'s (2010) study, a pain management policy was replaced by a flow chart and added to patients' medical records, with a brief introduction about its use to emphasise the importance of adopting the new practice. Two papers reported the use of facilitators and clinical rounding in the units during the educational interventions, with the focus on giving feedback about performance (Duff *et al* 2013, Hargraves 2014). In the study by Varaei *et al* (2013), a researcher assessed the nurses' performance after an intervention for three months. In McCaskey's (2013) study, audits were conducted each month for six consecutive months following the educational intervention. The results of the audits were discussed in the units during monthly staff meetings. Four simultaneous strategies for supporting clinical decision-making were used in Hanrahan's study (2013) and these included a clinical algorithm, a table of specific agents with evidence-based treatments and quick reference cards.

Outcomes of the educational interventions and strategies

Five subcategories described the outcomes of the interventions for nurses: positive changes in their attitudes, improvements in their knowledge base, enhanced confidence in using the guidelines and changing practices, self-reported improvements in their evidence-based decision-making and care practices and improvements in the quality of their care (Table 4). For example, positive changes in the nurses' attitudes included perceptions of the helpfulness of the guidelines (Policicchio *et al* 2011) and increased attendance at EBN educational sessions (Ang *et al* 2010). Enhanced confidence in

using the guidelines and changing practices were reported. In Salina and Abdolrasulnia's (2011) study, this was described as nurses feeling "extremely confident" in their ability to provide optimal pain management for patients. After the interventions, nurses were more likely to base their decisions and care practices on evidence-based guidelines in pain assessment and management (Ang & Crow 2010, Salinas & Abdolrasulnia 2011), breastfeeding counselling (Davies *et al* 2012), venipuncture (Anson *et al* 2010) and central line care (McCaskey 2013) practices. There were also improvements in the quality of care (Table 4). For example, the percentage of infants who were exclusively breastfed exceeded the target in one study and there were improvements in the assessment and documentation of pain, the ability to grade intravenous infiltrates and phlebitis and the ability to master safe intravenous techniques in other studies. Nurses also reported a greater willingness to allow parents to be present during their children's venipuncture. Hanrahan (2013) reported increased incident reporting and initiation of treatment. The average time spent on treatment administration was statistically reduced and clinically significant and this effect was also visible after one year. In Hargraves's (2014) study, the incidence of hypoglycaemia was significantly reduced.

Davies *et al* (2012) noticed that the positive change in attitudes, knowledge and practice was sustained for three months and, in addition to the targeted goals of the intervention, changes also occurred in hospital policies and procedures. In Varaei *et al*'s (2013) study, improvements in assessing the risk of leg ulcers were statistically significant at the end of the three-month follow-up period. Ang and Crow (2010) also reported that practice changes lasted for three months. Seven studies (Ang & Crow 2010, Anson *et al* 2010, Salinas & Abdolrasulnia 2011, Davies *et al* 2012, Hanrahan 2013, McCaskey 2013, Varaei *et al* 2013) showed statistically significant outcomes on the evidence-based decision-making and care practices reported by nurses as a result of the guidelines. Six of the studies also reported improvements in the quality of care (Table 4). In one study, positive outcomes were achieved in four of the five measurement areas (Davies *et al* 2012). A common feature of the interventions that produced these good outcomes was that their contents were multi-dimensional. However, opposite results were also obtained. Duff *et al* (2013) concluded that educational outreach visits should not be used because they were resource-intensive and had no measurable impact on venous thromboembolism prevention in clinical practice.

DISCUSSION

Validity and limitations

To ensure that the search process was both systematic and extensive, it was carried out with an information specialist from a library and by utilising database directories. Search terms were chosen

to produce a wide range of terms focused on evidence-based nursing, taking into account the word indexes and special features of the databases. These were reported accurately to ensure repeatability.

Two researchers worked independently to select the papers, but the selection process and ambiguous cases were discussed together, which added to the reliability of the data. The papers were initially chosen based on their titles and, therefore, it was possible that some studies may have been left out. On the other hand, the reference sections of the articles chosen for the review did not indicate any need to repeat the search process. It was unlikely that there were language or publication biases in the review as researchers didn't find any publications that may have been eligible for inclusion that were published in any language other than English when they screened the titles. The review was based on three databases and comprised articles from several journals and different cultures, including non English-speaking countries.

Relevant information about the original studies was meticulously documented in a matrix and careful use of this information in the analysis increased the reliability of the review. The main categories and subcategories contained many observations extracted from the data. Repeatability was achieved in the analysis and it may be assumed that constructing essential conceptual categories was successful, even though the scope of data was limited (Centre for Reviews and Dissemination 2009). The analysed papers have been listed and readers may verify the reported classifications based on these.

However, several limitations should be considered with regard to the review and the studies included in it. Grey literature was not searched for and this may have increased the likelihood of bias in the acquisition of material for the review. The search only included three databases, but these databases are regarded as the most comprehensive ones available in healthcare. The search terms were selected to reach the variety of interventions for guideline implementation (Table 1). In spite of this, it was possible that papers focusing on the description of something other than educational interventions, but with an educational component, may have been overlooked. Moreover, the interventions used to deliver the implementation of guidelines and the measurements used to evaluate these varied. This poor integrity, and the mixed quality of the papers, restricted the synthesis of the results. All the studies, with the exception of one, were conducted by uncontrolled quasi-experimental study designs with a before and after test. Only one used a comparison group and this could be regarded as a weakness of the study designs and the evaluations of the interventions. The uncontrolled, before and after, design is known to be vulnerable to the influence of unmeasured confounding factors and sudden organisational changes, which may falsify the outcomes of the interventions. Also, the results may be overestimated. (Grimshaw *et al* 2000.) Another limitation of our review concerned the implementation of the guidelines, as the studies used multiple methods and

the descriptions of these varied when it came to the details provided. We were not able to provide exact information on how these methods were used and which of them were the most effective. The outcomes were overall estimations of the effectiveness of the educational interventions and simultaneous strategies.

The methodological strength of the intervention studies in the review was good in four and moderate in nine studies (Table S1a, b), and this is indeed one of the limitations concerning the original studies. Only five studies (Ang & Chow 2010, Anson *et al* 2010, Davies *et al* 2012, McCaskey 2013, Varaei *et al* 2013) had follow-up periods of three months or more. Evaluations of the interventions were based mainly on the participants' self-assessment and, in these cases, the respondents may have chosen to answer in a more socially acceptable way than those who did not reply. Instruments were mainly developed for the purposes of the studies reviewed and the instruments had only been developed and tested in two of the earlier studies (Gance-Cleveland *et al* 2009, Duff *et al* 2013). The studies mainly took place in the USA, which must be taken into account when applying the results to different healthcare settings.

Consideration of the results

This was the first systematic review on the general implementation of guidelines relevant to nurses. We only found one previous review that covered nursing studies, but this was limited to guidelines on a particular clinical problem, namely reducing the risk of catheter-associated urinary tract infection (Willson *et al* 2009).

We found 13 different interventions for 13 different guidelines, of which nine were self-developed. The effectiveness of the educational interventions was supported by simultaneous strategies in seven studies. The original studies provided general evaluation of the implementation and we were unable to discover data for the specific impact of these strategies. The process by which guidelines were implemented, and how the organisations' characteristics were linked to greater EBN implementation, are still poorly understood (Higuchi *et al* 2012, Dogherty *et al* 2014, Wilson *et al* 2015). The situation is no better in medical education. Olson *et al* (2011) and Phillips *et al* (2014) stated that research evidence on the effectiveness of continuing medical education on evidence-based practice (EBP) did not provide a strong basis for choosing intervention strategies to fit a given context. The implementation of EBN was a complicated process and it was important to support several simultaneously occurring factors related to nursing staff, leadership practices, organisational culture and the availability and applicability of evidence and the infrastructure supporting its utilisation (Gerrish *et al* 2011, Matthew-Maich *et al* 2012, Dale *et al* 2015). Educational interventions for guideline implementation should be an established part of promoting EBN in working communities

and should note the previously mentioned factors. Further research is needed on the effectiveness of combining interventions and strategies for guideline implementation.

The interventions were implemented once, mainly on a local basis, and the teaching and learning methods varied. Eight of the interventions were based on theoretical background, which was different in almost all of the cases. Teachers were only mentioned in one of the studies (Lucas & Knobel 2012) and this was also one of the most poorly described items in Phillips *et al*'s (2014) systematic review. The most consistently reported items were information on participants' professional fields, their working environments, the number of teaching sessions, the duration of the programme and the evaluation method that was used. The review by Lineker and Husted (2010) reported that few strategies for guideline implementation were theory based and pointed out that greater use of theory may lead to the design of better interventions. Lineker and Husted (2010) and Olson *et al* (2011) also recommended multi-disciplinary training to implement guidelines. According to our review, multi-professional collaboration was still under-utilised in guideline implementation. Our review included studies conducted among nurses or among nurses and other healthcare professionals, but we only found four studies that reported multi-professional collaboration in guideline development or implementation.

The educational assessment categories for EBN should include: the learner's experiences of the learning process, their attitudes and knowledge of EBN, self-efficacy and skills for conducting EBN, clinical performance compatible with EBN and the benefits for patients (Tilson *et al* 2011). These categories were taken into account quite well in our review. Although the content of learning activities did not provide competencies for the implementation of the evidence into patient care in every case, it was still assessed and the results were good. This could be because of the simultaneous implementation strategies used to enhance the effectiveness of educational interventions. Furthermore, it is worth noting that the outcomes were evaluated with patient records and laboratory results in some of the studies. Developing the measurement of patient care and outcomes is of great importance. Positive changes in nurses' attitudes and, improvements in nurses' knowledge base, skills and self-efficacy do not, as such suffice as indicators of successful guideline implementation. The interventions on the implementation of guidelines had previously been assessed, mainly by uncontrolled quasi-experimental designs with before and after tests. However, using randomised controlled trial studies to indicate the efficacy of interventions could be set as a future goal. Strategies for implementing guidelines were an example of complex interventions (Campbell *et al* 2000), which comprised multiple interacting components. Process evaluation within trials was also recommended (Moore *et al* 2015). The realisation of interventions should also be evaluated from the viewpoint of instructors, in order to gain new perspectives for developing methods.

Yong *et al* (2014) synthesised evidence from systematic reviews of studies for teaching EBP to doctors and healthcare professionals. In many cases, outcomes were narratively reported and based mostly on self-assessment. The focus was on short-term outcomes, such as attitudes, knowledge and skills of EBP and appraisal skills of studies. The current research was limited to the results of the first year of the guideline uptake (Higuchi *et al* 2012) and the follow-up periods of the studies included in our review were often short. However, one positive feature of our systematic review, compared to the review by Young *et al* (2014), was that in most of the original studies, the outcomes were described using statistical significance tests. The outcomes of the educational interventions were positive in seven studies on nurses' evidence-based decision-making and care practices based on guidelines and six of them also reported improvements in the quality of care. In one study (Gance-Cleveland *et al* 2009), outcomes were achieved in four of the five measurement areas, which showed that the educational interventions had an impact on the implementation of EBN. However, it is important to note that these outcomes were based mainly on nurses' self-evaluations. In future it is important to use multiple methods to objectively evaluate the connections between improvements in the nurses' knowledge base and their abilities to implement guidelines to improve patient care (Tilson *et al* 2011, Phillips *et al* 2014, Young *et al* 2014).

Conclusion

The guideline implementations were carried out in a heterogeneous way. All of the studies, except one, showed positive outcomes. Based on this review, the following conclusions can be drawn:

1. There remains a lack of strong evidence on educational interventions to implement guidelines in nursing.
2. It is very important to standardise the interventions in order to make them replicable and comparable in different nursing contexts. Interventions for guideline implementation should be described in detail.
3. Educational interventions on guideline implementation should be combined in work communities with other well-known factors and strategies that promote the implementation of EBN. Further research is needed on the implementation processes and the organisational characteristics that enhance greater implementation of the guidelines.
4. Multi-professional collaboration in guideline implementation has been inadequately studied. Educational interventions for guideline implementation should be organised, and studied, in the context of multi-disciplinary work groups.

5. Guideline implementation should be assessed with standardised measurements and should cover all learning categories of EBN. The evaluation of the effectiveness of patient care is of great importance.
6. Attention should be paid to the stability of the outcomes with a follow-up period of more than one year. In the future, randomised controlled trials studies are needed to indicate effectiveness.

Relevance to clinical practice

Educational interventions for guideline implementation could be beneficial in enhancing nurses' evidence-based decision-making and care practices. The combination of teaching and learning methods is useful and educational interventions should be supported with simultaneous strategies.

Funding Statement

This research received no specific grant from any funding agency.

Author contributions

All authors have made substantial contributions to all of the following: 1. the conception and design of the study, acquisition of data, analysis and interpretation of data, 2. drafting the article and revising it critically and 3. final approval of the version to be submitted.

Conflict of interest

No conflict of interest has been declared by the authors.

References

- *Ang E & Chow YL (2010) General pain assessment among patients with cancer in an acute care setting: a best practice implementation project. *International Journal of Evidence Based Healthcare* **8** (2), 90-6.
- *Anson L, Edmundson E & Teasley S (2010) Implications of evidence-based venipuncture practice in a pediatric health care Magnet facility. *The Journal of Continuing Education in Nursing* **41** (4), 179-85.

- Campbell M, Fitzpatrick R, Haines A, Kinmonth AL, Sandercock P, Spiegelhalter D & Tyrer P (2000) Framework for design and evaluation of complex interventions to improve health. *BMJ* **321** (16), 694-696.
- Centre for Reviews and Dissemination (2009) *Systematic Reviews. CRD's Guidance for Undertaking Reviews in Health Care*. University of York, York.
- *Choma K & McKeever AE (2015) Cervical Cancer Screening in Adolescents: An Evidence-Based Internet Education Program for Practice Improvement Among Advanced Practice Nurses. *Worldviews on Evidence-Based Nursing* **12** (1), 51-60.
- Dale S, Levi C, Ward J, Grimshaw J M, Jammali-Blasi A, D'Este C, Griffiths R, Quinn C, Evans M, Cadilhac D, Cheung NW & Middleton S (2015) Barriers and Enablers to Implementing Clinical Treatment Protocols for Fever, Hyperglycaemia, and Swallowing Dysfunction in the Quality in Acute Stroke Care (QASC) Project – A Mixed Methods Study. *Worldviews on Evidence-Based Nursing* **12** (1), 41-50.
- *Davis SK, Stichler JF & Poeltler DM (2012) Increasing exclusive breastfeeding rates in the well-baby population: an evidence-based change project. *Nursing of Women's Health* **16** (6), 460-70.
- Dogherty EJ, Harrison M, Graham I & Keeping-Burke L (2014) Examining the use of facilitation within guideline dissemination and implementation studies in nursing. *International Journal of Evidence-Based Healthcare* **12** (2), 105-27.
- *Duff J, Walker K, Omari A, Middleton S & McInnes E (2013) Educational outreach visits to improve nurses' use of mechanical venous thromboembolism prevention in hospitalized medical patients. *Journal of Vascular Nursing* **31** (4), 139-49.
- Effective Public Health Practice Project (2016) Quality Assessment Tool for Quantitative Studies. Available at: <http://www.ehpp.ca> (Accessed 24 March 2016).
- Effective Public Health Practice Project (2016) Quality Assessment Tool for Quantitative Studies Dictionary. Available at: <http://www.ehpp.ca> (Accessed 24 March 2016).
- *Gance-Cleveland B, Sidora-Arcoleo K, Keesing H, Gottesman MM & Brady M (2009) Changes in nurse practitioners' knowledge and behaviors following brief training on the healthy eating and activity together (HEAT) guidelines. *Journal of Pediatric Healthcare* **23** (4), 222-230.
- Grant MJ & Booth A (2009) A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal* **26**, 91-108.
- Grimshaw J, Campbell M, Eccles M & Seen N (2000) Experimental and quasi-experimental designs for evaluating guideline implementation strategies. *Family Practice* **17** (1), 11-16.

- Johansson B, Fogelberg-Dahm M & Wadensten B (2010) Evidence-based practice: the importance of education and leadership. *Journal of Nursing Management* **18**, 70-77.
- *Hanrahan K (2013) Hyaluronidase for treatment of intravenous extravasations: Implementation of an evidence-based guideline in a pediatric population. *Journal for Specialists in Pediatric Nursing* **18** (3), 253-62.
- *Hargraves JD (2014) Glycemic control in cardiac surgery: implementing an evidence-based insulin infusion protocol. *American Journal of Critical Care* **23** (3), 250-8.
- Hauck S, Winsett RP & Kuric J (2013) Leadership facilitation strategies to establish evidence-based practice in an acute care hospital. *Journal of Advanced Nursing* **69** (3), 664-674.
- Higuchi KS, Downey A, Davies B, Bajnok I & Waggott M (2012) Using the NHS sustainability framework to understand the activities and resource implications of Canadian nursing guideline early adopters. *Journal of Clinical Nursing* **22**, 1707-1716.
- Institute of Medicine (2011) Clinical Practice Guidelines. We Can Trust. Washington, DC: The National Academic Press.
- Lineker SC & Husted JA (2010) Educational interventions for implementation of arthritis clinical practice guidelines in primary care: effects on health professional behaviour. *Journal of Rheumatology* **37** (8), 1562-1569.
- *Lucas K & Knobel RB (2012) Implementing practice guidelines and education to improve care of infants with neonatal abstinence syndrome. *Advances in Neonatal Care* **12** (1), 40-45.
- Matthew-Maich N, Ploeg J, Jack S & Dobbins M (2012) Leading on the frontlines with passion and persistence: a necessary condition for Breastfeeding Best Practice Guideline uptake. *Journal of Clinical Nursing* **22**, 1759-1770.
- *McCaskey MS (2013) Transferring Central Line Care Evidence Into Practice on Pediatric Acute Care Units. *Journal of Pediatric Nursing* **28** (6), e57-63.
- Melnyk BM, Fineout-Overholt E, Gallagher L & Kaplan L (2012) The State of Evidence-Based Practice in US Nurses. Critical Implications for Nurse Leaders and Educators. *The Journal of Nursing Administration* **42** (9), 410-417.
- Moher D, Liberati A, Tetzlaff J & Altman DG (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Open Medicine* **3** (3), 123-130.
- Moore GF, Audrey S, Barker M, Bond L, Bonell C, Hardeman W, Moore L, O’Cathain A, Tinati T, Wight D & Baird J (2015) Process evaluation of complex interventions: Medical Research Council

- guidance. *BMJ* **350**: h 1258 doi: 10.1136/bmj.h1248.
- National Heart, Lung, and Blood Institute (2016) Quality assessment tool for before-after (pre-post) studies with no control group. Available at: [http:// www.nhlbi.nih.gov](http://www.nhlbi.nih.gov) (Accessed 29 April 2016).
- O'Byrne L & Smith S (2011) Models to enhance research capacity and capability in clinical nurses: a narrative review. *Journal of Clinical Nursing* **20** (9-10), 1365-1371.
- Olson CA, Shershneva MB & Brownstein MH (2011) Peering inside the clock: Using success case method to determine how and why practice-based educational interventions succeed. *Journal of Continuing Education in the Health Professions* **31**, Supplement, S50-59.
- Phillips AC, Lewis LK, McEvoy MP, Galipeau J, Glasziou P, Hammick M, Moher D, Tilson JK & Williams MT (2014) A systematic review of how studies describe educational interventions for evidence-based practice: stage 1 of the development of a reporting guide. *BMC Medical Education* **14**, 152.
- *Policicchio J, Nelson B & Duffy S (2011) Bringing evidence-based continuing education on asthma to nurses. *Clinical Nurse Specialist* **25** (3), 125-132.
- Rogers JL (2009) Transferring Research Into Practice. An Integrative Review. *Clinical Nurse Specialist* **23** (4), 192-199.
- *Salinas GD & Abdolrasulnia M (2011) Effectiveness of INROADS into pain management, a nursing educational intervention. *The Journal of Continuing Education in Nursing* **42** (7), 328-336.
- Thomas BH, Ciliska D, Dobbins M & Micucci S (2004) A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews on Evidence-based Nursing* **1**, 176-184.
- Thompson D, Estabrooks C, Scott-Findlay S, Moore K & Wallin L (2007) Interventions aimed at increasing research use in nursing: A systematic review. *Implementation Science* **2** (1), 1-16.
- Tilson JK, Kaplan SL, Harris JL, Hutchinson A, Ilic D, Niederman R, Potomkova J & Zwolsman SE (2011) Sicily statement on classification and development of evidence-based practice learning assessment tools. *BMC Medical Education* **11**, 78.
- *Varaei S, Salsali M, Cheraghi MA, Tehrani MR & Heshmat R (2013) Education and implementing evidence-based nursing practice for diabetic patients. *Iran Journal of Nursing and Midwifery Research* **18** (3), 251-7.
- Walker R, Cooke M, Henderson A & Creedy DK (2011) Characteristics of leadership that

- influence clinical learning: A narrative review. *Nurse Education Today* **31**, 743-756.
- Weeks SM, Moore P & Allender M (2011) A Regional Evidence-Based Practice Fellowship. Collaborative Competitors. *The Journal of Nursing Administration* **41** (1),10-14.
- Willson M,Wilde M, Webb M, Thompson D, Parker D, Harwood J, Callan L & Gray M (2009) Nursing interventions to reduce the risk of catheter-associated urinary tract infection: part 2: staff education, monitoring, and care techniques. *Journal of Wound, Ostomy & Continence Nursing* **36** (2), 137-154.
- Wilson M, Sleutel M, Newcomb P, Behan D, Walsh J, Wells JN & Baldwin KM (2015) Empowering nurses with evidence-based practice environments: surveying magnet®, pathway to excellence®, and non-magnet facilities in one healthcare system. *Worldviews on Evidence-Based Nursing* **2** (1), 12-21.
- Yost J, Thompson D, Ganann R, Aloweni F, Newman K, McKibbin A, Dobbins M & Ciliska D (2014) Knowledge translation strategies for enhancing nurses' evidence-informed decision-making: a scoping review. *Worldviews on Evidence-Based Nursing* **11** (3), 156-67.
- Young T, Rohwer A, Volmink J & Clarke M (2014) What Are the Effects of Teaching Evidence-Based Health Care (EBHC)? Overview of Systematic Reviews. *PLOS ONE* **9** (1): e86706. doi:10.1371/journal.pone.0086706.

Included in the review (*)

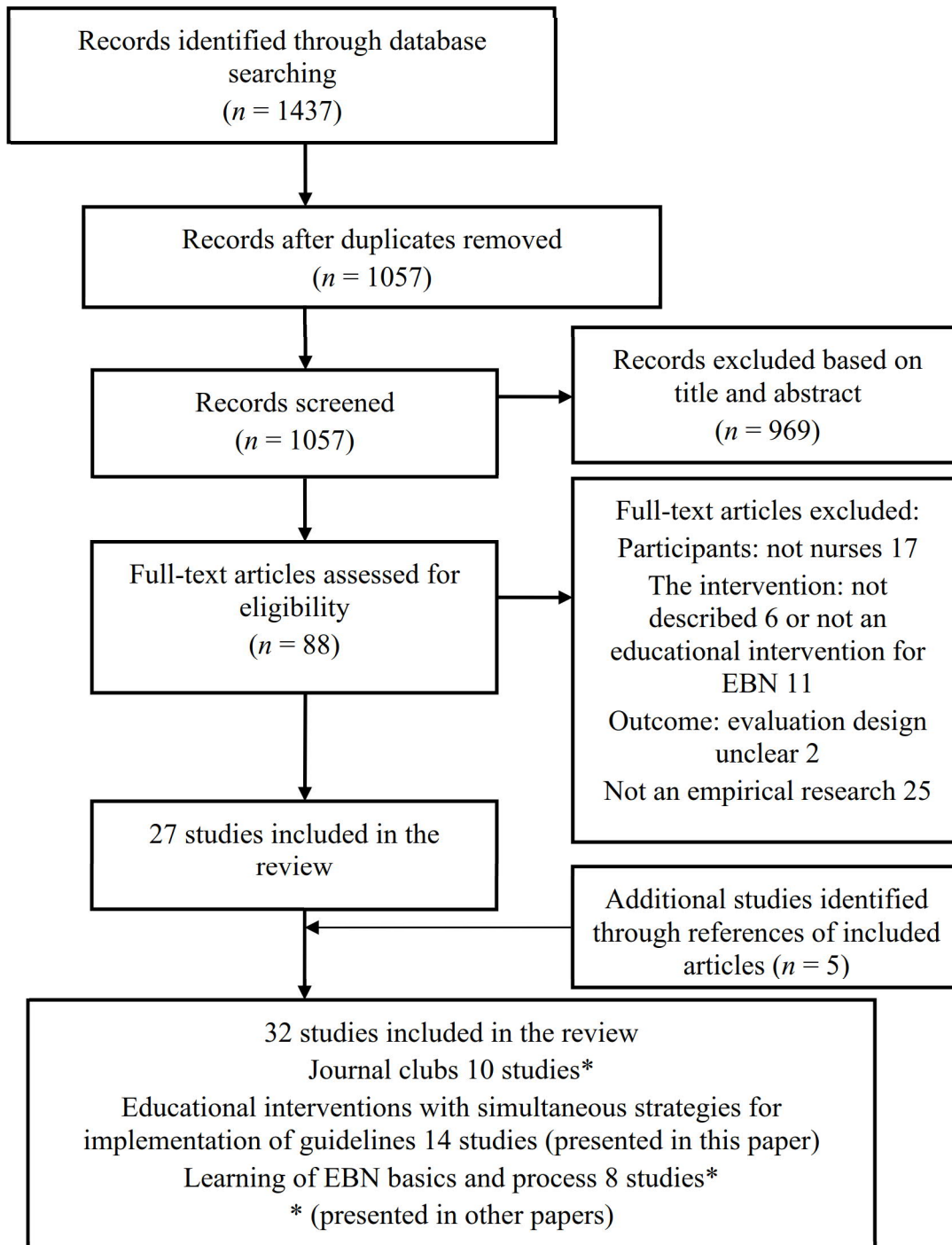


Figure 1. PRISMA flow chart.

Table 1. Search terms from databases.

Cinahl	PubMed	Cochrane
(MH "Research, Nursing") AND journal clubs OR (MH "Professional Practice, Research-Based") OR (MH "Nursing Practice, Research-Based") OR (MH "Nursing Practice, Evidence-Based") OR (MH "Practice Guidelines"), (MH "Quality Improvement") OR (MH "Quality Assessment") OR (MH "Quality Management, Organizational") OR (MH "Evaluation and Quality Improvement Program") OR (MH "Quality of Nursing Care"), (MH "Collaboration"), Peer Reviewed; Research Article	"Evidence-Based Nursing" AND journal clubs AND ("nursing education" OR collaboration OR quality OR development* OR improvement*), Case Reports; Journal Article; Clinical Trial; Evaluation Studies; Meta-Analysis; Practice Guideline; Randomized Controlled Trial; Review	"Evidence-based nursing", Cochrane Reviews, Other Reviews, Trials, Methods Studies, Technology Assessments, Economic Evaluations, Cochrane Groups

Table 2. Summary of the quality assessment of uncontrolled studies using a before- and after design (National Heart, Lung, and Blood Institute 2016).

Quality appraisal criteria	Yes/ studies (n)	No/ studies (n)	Other* (CD, NR, NA)/ studies (n)
1. Was the study question or objective clearly stated?	10	2	
2. Were eligibility/selection criteria for the study population prespecified and clearly described?	12		
3. Were the participants in the study representative of those who would be eligible for the test/service/ intervention in the general or clinical population of interest?	12		
4. Were all eligible participants that met the prespecified entry criteria enrolled?	3	8	1
5. Was the sample size sufficiently large to provide confidence in the findings?	5	7	
6. Was the test/service/intervention clearly described and delivered consistently across the study population?	12		
7. Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	10	2	
8. Were the people assessing the outcomes blinded to the participants' exposures/interventions?		11	1
9. Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	8	3	1
10. Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided p values for the pre-to-post changes?	12		
11. Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	6	6	
12. If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	12		
Quality rating (good, fair and poor)			

CD=cannot determine; NA=not applicable; NR=not reported

Quality appraisal/study (Table S1a):

- **Good=Yes, determined 9 times or more**
- **Fair= Yes, determined 6 to 8 times**
- **Poor=Yes, determined less than 6 times**

Table 3. Description of the studies in the review.

Authors (publication year), country, study design	Intervention	Setting, participants and response rates	Instruments and data collection with evaluation periods and data analyses	Outcomes
Choma & McKeever (2015), USA Pre- and posttest CEU evaluation	Web-based designed continuing educational (CEU) Internet intervention developed by the researchers targeted to HPV infection and cervical cancer screening among adolescents and implementation of ACOG Cervical Cytology Screening guidelines, available 5 weeks, Power point presentations	Members of New Jersey State Nurses Association 78 advanced practice nurses (APN) completed the contact hour program, 61% (n=48) participated in both the program and post program survey.	Questionnaire developed by the author for assessment of knowledge levels related to guidelines and to evaluate the course objectives, the presenter, the experiences with the program, 3 weeks after closing the program Descriptive statistics, SPSS version 19.0, paired –sample t-test.	APNs knowledge level increased statistically significantly from the pretest to posttest. Participants rated the objectives, presenter and use of eLearning method as good to excellent. The program either improved or validated the participants' clinical practice.
Hargraves (2014), USA Study design not mentioned in the paper. Identified by the authors as a quasi-experimental design with before and after tests	Revision the outdated insulin infusion protocol (IIP) according to the guideline of Society of Critical Care Medicine: Guidelines for the Use of an Insulin Infusion for the Management of Hyperglycemia in Critically Ill Patients by a multi-professional team and implementation of the protocol. Educational intervention developed by the multi-professional team with power point presentation: titration of an insulin infusion, blood glucose monitoring during insulin therapy and instructions for insulin infusion. CNS was available during clinical rounds and by e-mail or phone to answer questions.	Cardiac surgery, 29 critical care nurses, Pretest n=29, posttest n=27.	Tests designed for this study to measure nurses' knowledge of glycemic control. Retrospective review of electronic health records using a self-developed tool on 76 patients. Two months before (n=48 patients) and two months after the intervention (n=28 patients). Descriptive and inferential statistics, A 1-tailed test (knowledge), 2-tailed t test to compare patients' age, Chi square test to compare history of diabetes.	A significant increase in nurses' knowledge after education. The incidence of hypoglycemia was significantly reduced after the intervention. The percentage of blood glucose levels less than 180 mg/dl was 88 % (a goal according to the guideline).
Duff et al (2013), Australia A prospective, uncontrolled, before-and-after intervention study with process evaluation using pre- and post-intervention clinical audits and self-administered surveys	The educational outreach visits (EOV) protocol was developed by a multidisciplinary group of healthcare professionals with expertise in mechanical VTE prophylaxis, clinical education, healthcare improvement science and research to improve the implementation of VTE risk assessment tool based on national guidelines. A registered nurse with expertise in VTE was recruited and educated (a 2-day intensive workshop with research team) to the role of EOV facilitator. She conducted face-to-face educational visits to a health	Medical units of Magnet-designated private hospital Out of the 85 nurses who participated in the intervention, 76 (89 %) returned the post-intervention participant survey. The 192 patients who met the criteria were audited before (n = 98) and after (n = 94) the EOV intervention period (2 months)	Participant survey developed for this study, eight questions: effectiveness of the EOV on participants' knowledge and clinical practice, addressing their concerns about VTE prophylaxis and the acceptability of the course. Before tested audit tool based on national VTE prevention guidelines: the proportion of inpatients with a documented VTE risk assessment and receiving appropriate prophylaxis. The facilitator completed a post- intervention survey appraising each participant's perceived level of interest, participation, and comprehension, how the	97 % nurses felt that the EOV was effective or extremely effective at increasing their knowledge and addressing their concerns about VTE prophylaxis. The EOV facilitator reported that 95 % of the participants had a high or very high level of interest and participation, and 86 % of them had a high or very high level of comprehension. No measurable improvement in the proportion of patients with a documented VTE risk assessment after the intervention period, and no

	professional in their own clinical setting (2-month intervention period) based on four verbal key messages: consequences of VTE, importance of the assessment, appropriate prophylaxis and monitoring.		EOV was implemented and the degree to which the intervention was implemented as intended (utility) SPSS version 18.0, descriptive statistics, the chi-square test and Mann-Whitney U-test, 95 % confidence intervals	improvement in the proportion of patients who received appropriate mechanical VTE prophylaxis. Removing patients who were at low risk for VTE from the analysis made no difference to this result.
Hanrahan (2013), USA Study design not mentioned in the paper. Identified by the authors as a quasi-experimental design with before and after tests	The guideline <i>Hyaluronidase for Treatment of IV Extravasations</i> was developed systematically using 28 research articles, 34 guidelines, reviews and other publications by a collaborative interdisciplinary process that involved academicians and clinicians. A multiprofessional team used the guideline for updating of the pediatric standard of practice (SOP) for IV extravasations. The SOP included a clinical algorithm, a table of specific agents with evidence-based treatments and quick reference cards. Standardized documentation, treatment and order sets were supported by automated computerized documentation and electronic healthcare record (EHR). Multidisciplinary education for participants.	Academic children's hospital (general unit and NICU) 600 RNs and 600 LIPs (licensed independent providers). A total of 175 staff participated at baseline (return rate 15 %), 100 at 6 months post-implementation (response rate 8 %). Participants were mostly staff nurses 70 % at baseline, 71 % post-imp. Also nurse practitioners, residents and physicians.	An online knowledge survey at baseline and at 6-month post-implementation (4 demographic questions and 10 questions about hyaluronidase from the guideline knowledge test). Incident reports from the electronic medication administration (EMAR): analysis of extravasation incidents, treatment, outcomes by reviewing Patient Safety Net, to determine if treatment resulted in less harm, subjects were collapsed into two groups: those receiving hyaluronidase and those who did not and a retrospective review to capture the use of hyaluronidase 6 month pre- and 6 months post-implementation and 12 months maintenance periods. Time from discovery to treatment as documented in nursing notes in minute. Descriptive statistics were analyzed using Survey and Excel software.	Overall shift toward increased user knowledge, increased incident reporting, statistically significant decrease in the mean of time to treatment administration and increased preparedness to manage an extravasation 6 months after implementation the guideline. There was a trend toward lower scores and a reduction in the percentage of events resulting in harm to patient during the maintenance period. There was an increase in the number of hyaluronidase treatments from the pre-implementation compared with post – implementation period. The rate of hyaluronidase treatment in the maintenance period was sustained and also increased compared with post-implementation period. The time to treatment administration in the maintenance period was not statistically different from post-implementation.
McCaskey (2013), USA A quasi-experimental unmatched pre and post-intervention design.	A multi-pronged educational intervention promoting CLABSI (confirmed bloodstream infection) prevention including electronic educational sessions (available 4 weeks), hands-on demonstration, small group discussion, audit and feedback on the implementation of a central line maintenance care bundle. The electronic learning module was developed by the researchers with the input from practical experts to include the content	Inpatient surgical care units of children' hospital 187 full-time nurses from were invited to participate in the pre and post intervention self-reporting surveys. 56 % (n = 105) completed the pre-intervention survey and 51.8 % completed the post- intervention survey	A 15-question survey designed for this study, seven components of the maintenance care bundle. The audit and feedback on the implementation of a care bundle, the second and fourth Thursday of each month for six months following the intervention. The incidence of CLABSI was recorded during the same 4-month period. Incidence was reported in raw numbers in lieu of the typical infection per 1000 line-day rate.	The mean total compliance score of the post-intervention respondents was significantly higher compared with the pre-intervention respondents. Audit results of the dressing-care integrity and last change day did improve over time. This was possibly related to a Hawthorne effect.

	of the bundle: daily discussions of central line necessity, daily assessment of the central line dressing, standardized central line entry procedure, dressing, cap and tubing change procedure.		SPSS version 18.0, descriptive statistics, independent samples t-test, two-way ANOVA and Chi-square for independence.	Two few infections occurred to detect a statistically significant decrease in CLABSI.
Varaai et al (2013), Iran Quasi-experimental study using a before- and –after design.	A 4-days workshop for three groups (6 – 7 members in each): developing a clinical question using the PICO format, searching for evidence, reading and critiquing nursing research, discussing articles, synthesizing evidence, and developing a summary of findings. The researcher was present as a helper in the ward.	Endocrinology ward 19 baccalaureate nurses, (response rate 100 %)	Self-report questionnaire, designed for this study: nurses' knowledge about and attitude to EBN approach and EBN practice. A checklist based on the national and regional clinical guideline for the evaluation of nurses' skills in the performance and assessment of people with diabetes foot ulcer, filled in by a researcher. The performance assessment after intervention was conducted more than once for each nurse within a period of 3 months. SPSS version 11.5, descriptive and inferential statistics.	The mean scores for nurses' knowledge about EBN, attitude to EBN and EBN practice were statistically significantly higher after the intervention. The nurses' performance in caring for patients with diabetes foot ulcer, based on clinical guideline, showed statistically significant improvement after the intervention.
Davis et al (2012), USA Pre-/post-test methodology	Hospital leadership engaged nurses, nurse assistants, managers, physicians and nurse lactation consults and educators as change agents and in the development of the educational intervention according to the requirements of the Baby-Friendly Hospital Initiative. 2-hour class evidence-based knowledge: breastfeeding as a health care issue, the importance of exclusive breastfeeding, skin-to-skin concepts, common questions of mothers and appropriate provider responses, support strategies for parents and common challenges of breastfeeding in the early postpartum period. Changes in hospital policies and procedures.	Maternal Infant Services (MIS) units 32 nurses Pre, n=32, post 1, n=30 and post 2 (after 3 months), n=30	Survey developed by hospital to measure nurses' knowledge, attitudes and practice of breastfeeding, eight-item demographic and 12 multiple choice and true/false questions, Measuring the differences in the scores and correlations, independent t-test	Significant differences in attitudes, knowledge and practice of the MIS between the pretest and the first and second posttest indicating that the change was sustained during the period of time. The percentage of infants exclusively breastfeeding improved to 70.4 beyond the stated goal one year after the change project was completed.
Lucas & Knobel (2012), USA A nonexperimental, pretest/posttest study	The clinical guideline was developed based on a review of literature to incorporates all aspects of neonatal abstinence syndrome (NAS) from etiology to discharge of the patient	Intensive care unit for newborn 68 nurses, Pre, n= 68, post, =68, 10 nurses independently observed a DVD of an infant with NAS and scored the infant, using the FNAST, an interrater	NAS test (58 questions) developed for the study to evaluate knowledge of NAS, care of infant and use of the FNAST SPSS Version 19.0, descriptive statistics, paired samples test	All of the nurses showed some improvement representing increase in knowledge (2 % to 44 %) on the posttest scores. Sixty-one of the participants showed a 10 % or more improvement in scores on the

	Formal classroom component developed by researchers in groups, a DVD of FAS newborn followed by formal didactic education based on the guideline with Power point software and evaluation of newborn with the Finnegan Neonatal Abstinence Scoring Tool (FNASST) and with the help of the experts. Duration not mentioned.	reliability testing one week after the educational offering		posttest, while scores of 7 of the participants (10 %) increased by 10 % or less. All 10 nurses achieved a score of 90 % or more agreement according to the criteria when using the FNASST, four nurses scored 100 % agreement
Policicchio et al (2011), USA A quasi-experimental study using a pre-post design.	Nurse Asthma Care Education (NACE) program modified by a university's centre. Program based on the national guidelines, which focused on the importance of providing treatment consistent with national guidelines, building effective relationships with patients and delivering key messages pertinent to asthma self-management for patients (10 specific techniques and 10 educational messages). A 5-hour seminar, slide presentations, video demonstration, role-play activities, case studies.	Mainly clinic/ambulatory care facility or physician's office caring for both children and adults 34 nurses, post = not mentioned	Questionnaire developed by the creators of NACE program to measure perceived helpfulness and confidence in providing asthma services according to NACE program. Postintervention survey was conducted at the conclusion of the teaching session. SPSS Version 15.0, nonparametric sign test, Mann-Whitney <i>U</i> test.	Significant changes in nurses' perceptions of the helpfulness of the National Asthma Education and Prevention Program Asthma Guidelines and their confidence to use the guidelines.
Salinas & Abdolrasulnia (2011), USA A quasi-experimental design with control group.	Educational certified intervention INROADS developed by university staff Into Pain Management, Optimal Analgesics and Drug Safety including latest findings on the pathophysiological pathways of pain as well as practical and evidence based approaches to the evaluation and management of patient pain, review of pharmacology and therapeutic rationale for major classes of pain medications and multimodal therapy with patient case examples, 10 meetings (workshops) and one satellite symposium.	Hospital and pain clinics 93 nurses of the 527 nurses who participated in the INROADS program 93 nurses with characteristics similar to those of the participants was chosen for a control group.	Survey with case vignettes was designed for this study and survey of barriers for analgesia, 30 days after the intervention SPSS Version 18.0, descriptive statistics, <i>t</i> test, Cohen's <i>d</i> formula	The nurses participating into the INROADS program made their care choices statistically significantly more often based on the guidelines than the control group. Significantly greater number of them than nonparticipants reported that they felt "extremely confident" in their ability to provide optimal pain management to patients. Both groups indicated that the greatest barrier is a lack of adequate education dealing with pain management, followed by fear of contributing to a patient's addiction and lack of familiarity with evidence-based practices.
Ang & Chow (2010), Singapore A pre- and post-audit strategy.	Educational intervention developed by university staff and based on best available evidence for pain assessment, documentation and analgesia administration including results of initial audit (good	Oncology ward in a acute care setting 24 nurses and all patients in the ward	GRIP program to identify gaps and barriers related to pain assessment and documentation, audit data: medical records of 24 patients, repeated 3 months after the implementation of practice change	Compliance increased statistically significantly for all the three criteria: Increase in use of a pain assessment tool for patients with cancer, increase in the number of registered nurses

	practices and developmental areas), guidance for education to patients and their caregivers and introduction to a formalized pain and pain management assessment tool. Workshop consisting three sessions (5 – 6 persons in each), a replacement of a pain management policy into a flow chart to be inserted into patient’s medical records and briefing given, audit with feedback.		JBI-Paces program, descriptive statistics, Fisher’s exact test	who received education in pain assessment and increase for accuracy in the assessment and documentation of pain.
Anson <i>et al</i> (2010), USA A single-group pretest/posttest design.	The educational program developed by researchers (a 38-minute, web-based tutorial session) presented evidence-based guidelines for venipuncture practices in children: introduction of the importance of the project by a nurse administrator, a short video highlighting concerns raised by the family advisory board, “worst-case” and “best-case” scenario, proper assessment techniques, communication, comfort measures, site elections, insertion techniques, securement, documentation, complications, and staff resources.	Medical-surgical units and clinics at a pediatric Magnet hospital 939 nurses in pre-test and 603 in post-test (4 months after initial data collection)	Survey with also open ended questions specifically developed for the current project, 426 matched pre- and posteducation surveys SPSS Version 12.0, chi-square and <i>t</i> -test analyses, open ended responses were listed and frequencies were reported.	Statistically significant improvements in the ability to grade IV infiltrates, and phlebitis, a greater willingness to allow parents to be present during venipuncture (not statistically significant) and to use topical anesthetic agents before IV placements and the need to limit venipuncture to two attempts before seeking additional support (statistically significant).
Gance-Cleveland <i>et al</i> (2009), USA A quasi-experimental, one-group, pretest/posttest design.	The 4-hour session developed by the workgroup that had formulated the guideline: an overview of the development of the Healthy Eating and Activity Together (HEAT) Guidelines, a summary of the specific recommendations of it, introduction to the role of the nurse practitioners, tools available in the HEAT Resource Kit (documentation guide, parent/patient handouts, and rapid cycle improvement worksheets), a training and demonstration on motivational interviewing and counseling technique. Case studies to role play.	NAPNAP Annual conference participants 35 nurse practitioners, mainly from pediatrics 32 completed both the pre-test and post-test evaluation at the conclusion of the training.	Questionnaire originally developed by Expert Panel on Obesity Prevention in Children and the International Life Sciences Institute was adapted for this study (17 questions), SAS Version 9.1, descriptive statistics, <i>t</i> - and <i>v2</i> tests,	Improvements in addressing the barriers to the prevention of overweight in youth, as well as increased intent to change a practice. Statistically significant improvements in intent to conduct growth assessment, assessment of family history, and physical activity, in knowledge regarding the family health history related to risk for overweight and in confidence to modify behavior and engage the whole family in the discussions and age appropriate recommendations.

Revisions of local procedures and protocols		✓		✓		✓		✓			✓		
Facilitation with feedback		✓	✓					✓			✓		
Audit with feedback			✓	✓	✓	✓					✓		
Support for decision-making				✓									
Multiprofessional collaboration		✓	✓	✓				✓					
Outcomes of the educational interventions and strategies													
Positive changes in nurses' attitudes						X		X	X		X		X
Improvement in nurses' knowledge base	X	X		x		X	X	X					X
Nurses' enhanced confidence in using guidelines and changing practices									X	X			X
Self-reported improvement in nurses' evidence-based decision making and care practices based on guidelines	x			x	X	X		X		X	X	X	X
Improvements in the quality of care		X		X	x			x			X	x	

Included in the intervention (✓), statistically significant improvements (X), improvements, but no statistically significant (x)