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Effectiveness of organisational infrastructures to promote evidence-based nursing practice.

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Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

Flodgren G, Rojas-Reyes MX, Cole N, Foxcroft DR

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### Table of Contents

1. **HEADER** .............................. 1
2. **ABSTRACT** .......................... 1
3. **PLAIN LANGUAGE SUMMARY** ........ 2
4. **SUMMARY OF FINDINGS FOR THE MAIN COMPARISON** .......................... 2
5. **BACKGROUND** ......................... 3
6. **OBJECTIVES** ......................... 5
7. **METHODS** ............................ 5
8. **RESULTS** ............................. 7
9. **DISCUSSION** .......................... 9
10. **AUTHORS' CONCLUSIONS** ............ 9
11. **ACKNOWLEDGEMENTS** ............... 10
12. **REFERENCES** ......................... 10
13. **CHARACTERISTICS OF STUDIES** .... 13
14. **DATA AND ANALYSES** ............... 18
15. **ADDITIONAL TABLES** ............... 18
16. **APPENDICES** ......................... 20
17. **WHAT'S NEW** ......................... 45
18. **HISTORY** ............................. 45
19. **CONTRIBUTIONS OF AUTHORS** ...... 45
20. **DECLARATIONS OF INTEREST** ...... 45
21. **SOURCES OF SUPPORT** ............. 46
22. **INDEX TERMS** ........................ 46
**Effectiveness of organisational infrastructures to promote evidence-based nursing practice**

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**ABSTRACT**

**Background**

Nurses and midwives form the bulk of the clinical health workforce and play a central role in all health service delivery. There is potential to improve health care quality if nurses routinely use the best available evidence in their clinical practice. Since many of the factors perceived by nurses as barriers to the implementation of evidence-based practice (EBP) lie at the organisational level, it is of interest to devise and assess the effectiveness of organisational infrastructures designed to promote EBP among nurses.

**Objectives**

To assess the effectiveness of organisational infrastructures in promoting evidence-based nursing.

**Search methods**

We searched the Cochrane Effective Practice and Organisation of Care (EPOC) Group Specialised Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, CINAHL, LILACS, BIREME, IBECs, NHS Economic Evaluations Database, Social Science Citation Index, Science Citation Index and Conference Proceedings Citation Indexes up to 9 March 2011.

We developed a new search strategy for this update as the strategy published in 2003 omitted key terms. Additional search methods included: screening reference lists of relevant studies, contacting authors of relevant papers regarding any further published or unpublished work, and searching websites of selected research groups and organisations.

**Selection criteria**

We considered randomised controlled trials, controlled clinical trials, interrupted times series (ITSs) and controlled before and after studies of an entire or identified component of an organisational infrastructure intervention aimed at promoting EBP in nursing. The participants were all healthcare organisations comprising nurses, midwives and health visitors.

**Data collection and analysis**

Two authors independently extracted data and assessed risk of bias. For the ITS analysis, we reported the change in the slopes of the regression lines, and the change in the level effect of the outcome at 3, 6, 12 and 24 months follow-up.
Main results

We included one study from the USA (re-analysed as an ITS) involving one hospital and an unknown number of nurses and patients. The study evaluated the effects of a standardised evidence-based nursing procedure on nursing care for patients at risk of developing healthcare-acquired pressure ulcers (HAPUs). If a patient's admission Braden score was below or equal to 18 (i.e. indicating a high risk of developing pressure ulcers), nurses were authorised to initiate a pressure ulcer prevention bundle (i.e. a set of evidence-based clinical interventions) without waiting for a physician order. Re-analysis of data as a time series showed that against a background trend of decreasing HAPU rates, if that trend was assumed to be real, there was no evidence of an intervention effect at three months (mean rate per quarter 0.7%; 95% confidence interval (CI) 1.7 to 3.3; P = 0.457). Given the small percentages post intervention it was not statistically possible to extrapolate effects beyond three months.

Authors' conclusions

Despite extensive searching of published and unpublished research we identified only one low-quality study; we excluded many studies due to non-eligible study design. If policy-makers and healthcare organisations wish to promote evidence-based nursing successfully at an organisational level, they must ensure the funding and conduct of well-designed studies to generate evidence to guide policy.

PLAIN LANGUAGE SUMMARY

Can organisational infrastructures be effective in promoting evidence-based nursing practice?

Nurses and midwives form the bulk of the clinical health workforce, and play a central role in all health service delivery. There is potential to improve health care quality if nurses routinely use the best available evidence in their clinical practice. Since many of the factors perceived by nurses as barriers to the implementation of evidence-based practice (EBP) lie at the organisational level, it is of interest to devise and assess the effectiveness of models to change healthcare organisations in order to promote the use of EBP among nurses successfully.

We defined organisational infrastructures as being "the underlying foundation or basic framework through which clinical care is delivered and supported", which include for example: organisational policies, nurse development units and other types of organisational developments such as organisations developing and implementing evidence-based nursing procedures, standards or guidelines for clinical practice.

We searched the literature for robust evaluations of the effectiveness of organisational interventions in promoting EBP in nursing. We included one study from the USA which involved one hospital and for which the number of nurses was not reported. The study evaluated the effects of a standardised evidence-based nursing procedure on improved nursing care for patients at risk of developing healthcare-acquired pressure ulcers (HAPUs), as measured by the HAPU rate. If a patient's admission Braden score was lower than or equal to 18, nurses were authorised to initiate a prevention pressure ulcer care bundle, without a physician order. The Braden scale is a tool used to assess a patient's risk of developing pressure ulcers. An adult with a score below or equal to 18 is considered to have a high risk for developing a pressure ulcer.

Re-analysis of the HAPU data, as an interrupted time series, was suggestive of a trend in rates prior to intervention and, if that trend was assumed to be real, there was no evidence of an intervention effect at three months (mean rate per quarter 0.7%; 95% confidence interval (CI) 1.7 to 3.3; P = 0.457). Given the small percentages post intervention it was not statistically possible to extrapolate effects beyond three months.

Considering the importance placed on organisational change in promoting EBP in nursing, it is surprising that eight years after the previous empty Cochrane review was published, appropriately evaluated organisational infrastructure interventions are still lacking. If policy-makers and healthcare organisations wish to promote evidence-based nursing at an organisational level successfully, they must ensure the funding and conduct of well-designed studies to generate evidence to guide policy.
**SUMMARY OF FINDINGS FOR THE MAIN COMPARISON**

Evidence-based standardised nursing procedure to improve care of patients at risk of developing hospital-acquired pressure ulcers (HAPUs)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Change in level effect (mean rate per quarter) (95% CI)*</th>
<th>No of participants (studies)</th>
<th>Quality of the evidence (GRADE)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAPU rate</td>
<td>At 3 months: 0.7% (95% CI -1.7 to 3.3), P = 0.465 One hospital (1)</td>
<td>⚫⚫⚫⚫ very low quality*</td>
<td>Before the intervention there was a statistically significant (P = 0.046) decrease in mean HAPU rate by 1.1% per quarter. Given the small percentages post intervention it was not possible to extrapolate effects beyond 3 months</td>
<td></td>
</tr>
</tbody>
</table>

* We downgraded the evidence on the basis of imprecision and the downward trend in HAPU rate found already in the pre-intervention period.

**BACKGROUND**

Nurses, like other health professionals, do not always use the best available evidence in their clinical practice and hence patients do not always receive the best possible care (Grol 2003; Schuster 1998; Seddon 2001). Several large studies, investigating barriers to the implementation of evidence-based practice (EBP), emphasise the importance of changes in the infrastructures of healthcare organisations (e.g. policy and procedure changes) in order to achieve successful promotion of EBP in nursing (Atkinson 2008; Funk 1991; Horsley 1978; Pravikoff 2005). There is interest among healthcare providers and policy-makers in knowing how best to support evidence-based nursing at an organisational level, in order to improve the effectiveness and quality of care.

**Definitions**

We define organisational infrastructures as “the underlying foundation or basic framework through which clinical care is delivered and supported” (Foxcroft 2003). Organisational infrastructures can take many forms. They include, for example: organisational policies, management frameworks (e.g. shared governance), skill mix (e.g. the proportion of different nursing grades, and levels of qualification, expertise and experience), nurse development...
Description of the condition

Most nurses do not routinely implement EBP (Pravikoff 2005), even though there is evidence that EBP improves patient outcomes (Heater 1988; Melnyk 2005). The reasons why nurses do not always use the best evidence in their clinical practice are manifold and lie at different levels. Twenty years ago, Funk carried out a large study that involved the development and application of a tool for assessing barriers to nurses adopting EBP (Funk 1991). Drawing upon ideas by Rogers on innovation diffusion (Rogers 2003), he clustered barriers to research utilisation into four major themes: characteristics of the adopter; characteristics of the innovation; characteristics of the communication; and characteristics of the organisation. The results of Funk's study highlighted two main barriers: nurses had insufficient authority to change patient care procedures, and there was a general lack of awareness of relevant research. The work by Funk, and the importance it places on organisational factors, complements an earlier American initiative, the ‘Conduct and Utilization of Research in Nursing’ (CURN) project (Horsley 1983), which focused specifically on the responsibility of the nursing department for the activities involved in making research-based practice changes. In taking an organisational view of the processes involved in practice change, the authors made it clear that they were not negating the positive impact of individual nurses (Horsley 1983). Indeed, they recognised that developments such as policy and procedure changes are of paramount importance and are ‘generally beyond the control of individuals per se’ (Horsley 1983, p22). Recent studies agree with previous results, i.e. that organisational factors, such as insufficient authority to change practice, time constraints, lack of support for implementation of research findings (Atkinson 2008; Hutchison 2004; Fineout-Overholt 2005) and the ‘presence of other goals with higher priority’ (Pravikoff 2005) are perceived by nurses as the greatest barriers to the implementation of EBP.

Description of the intervention

The process of knowledge translation is slow, i.e. the translation of research findings into practice (Balas 2000; Rogers 2003) and therefore several nursing models aiming to speed up this process have been developed during the last two decades (see Table 1). The ARCC model (Advancing Research and Clinical Practice through Close Collaboration) (Melnyk 2002), the Clinical Scholar Model (Schultz 2005) and the Iowa model (Titer 2002) are all organisational models. A central concept in the ARCC model is that of an EBP mentor, an advanced nurse with in-depth clinical knowledge and EBP skills, who provides mentorship in EBP implementation and outcomes management projects, thereby improving quality of care and patient outcomes. The Clinical Scholar Model reinforces the intellectual process of EBP; building a cadre of mentors who foster an environment in which staff nurses are encouraged to continuously ask questions, and for whom the Clinical Scholar is a role model (Schultz 2005). The Iowa model suggests a team-based approach in the implementation of EBP (Titer 1994). Other models, e.g. the Rosswurm and Larrabee model (Rosswurm 1999) and the Stetler model (Stetler 2001), may be used both at an individual and an organisational level. However, all these models have yet to be rigorously evaluated.

In addition to the nursing models, specific factors that may be used to speed up the knowledge translation process have been suggested (Melnyk 2002; Melnyk 2004; Omery 1999; Schultz 2005). The factors, which may be used within healthcare organisations as well as within academic or research environments, have been summarised by Fineout-Overholt and colleagues (Fineout-Overholt 2005). These include EBP mentors in healthcare settings, partnerships between clinical and academic settings, EBP champions within the environment, clearly written research support, time and resources, and administrative support. Building on the ARCC model, the authors also suggest some specific strategies for accelerating the use of EBP: development and implementation of EBP rounds, plans for outcomes evaluation, evidence-based journal clubs, a written organisational philosophy, professional advancement systems, as well as awards for successful EBP implementation. These strategies, however, have not yet been evaluated.

Why it is important to do this review

Nurses and midwives form the bulk of the clinical health workforce and play a central role in all health service delivery (WHO 2006). There is therefore potential to improve health care quality if nurses routinely use the best available evidence in their clinical practice. Since many of the factors perceived by nurses as barriers to the implementation of EBP in patient care lie at the organisational level (Atkinson 2008; Funk 1991; Horsley 1978; Pravikoff 2005), it is of great interest to devise and assess the effectiveness of models to change healthcare organisations in order to promote the use of EBP among nurses successfully. Many systematic reviews of the effectiveness of professional interventions on clinical practice have already been undertaken by the Cochrane Effective Practice and Organisation of Care (EPOC) Group. Although this work has included nursing, most of it
has not been specific to nursing (e.g. Flodgren 2010; McGowan 2009). Among nursing-specific studies, one review evaluated the introduction of clinical practice guidelines in professions allied to medicine, but its focus was on professional interventions rather than organisational infrastructures (Thomas 2009). Another review focused on a single aspect of organisational infrastructures, i.e. on nursing record systems (Urquhart 2009). There is, therefore, a need to look more broadly at organisational infrastructures that promote EBP in nursing as a whole, and to summarise the existing evidence base in order to inform healthcare providers and policy-makers of the best ways to promote EBP at an organisational level.

This is an update of a Cochrane review first published in 2003 (Foxcroft 2003), which was empty.

O B J E C T I V E S

To assess the effectiveness of organisational infrastructures in promoting evidence-based nursing.

M E T H O D S

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials (RCTs), controlled clinical trials (CCTs), interrupted time series (ITSs) and controlled before and after studies (CBAs) evaluating the effectiveness of organisational infrastructures in promoting evidence-based nursing practice. We only included interrupted time series if they had a clearly defined point in time when the intervention occurred and three data points before and after the start of the intervention. We only included controlled before and after studies if they had contemporaneous data collection, appropriate choice of control site, and included a minimum of two intervention and two control sites.

We included studies in which the target of the intervention was a healthcare organisation or organisational units comprising of nurses or groups of healthcare professionals including nurses. We excluded professional interventions, which encompass strategies to provide professionals with information or training on appropriate practice.

Types of participants

We included healthcare organisations comprising nurses, midwives and health visitors in hospital and community settings. Studies where the infrastructure development was aimed at other health professional groups as well as nurses were only eligible for inclusion if evidence-based nursing practice outcomes were measured and reported separately.

Types of interventions

We included studies that evaluated an entire or identified component of an organisational infrastructure intervention aimed at promoting EBP in nursing. The organisational infrastructure could be embedded within a geographical unit (hospitals in a province or district), entire hospitals, wards or firms, nursing homes or sub-units, such as nursing teams in homes or hospitals.

We excluded infrastructure developments that were not delivered at an organisational level, for example where the unit of intervention/allocation was at an individual level. We characterised organisational infrastructure interventions according to the following typology:

- Management framework (e.g. shared governance)
- Skill mix (e.g. mix of different nursing grades, levels of qualification, expertise and experience)
- Information strategy (e.g. communication and knowledge policies and systems)
- Nurse development infrastructure (e.g. dedicated nurse development system)
- Research infrastructure (e.g. dedicated research and development support units)
- Quality enhancement systems (e.g. audit and feedback)
- Other (e.g. organisations developing evidence-based nursing procedures, standards or guidelines for clinical practice and implementing these)

Types of outcome measures

We considered studies as eligible for inclusion if they reported objective measures of EBP. Specifically, studies were eligible for inclusion if they reported one or more objective measures of EBP directly indicated by the following:

(a) Increased use, in routine practice, of clinical interventions for which there is evidence of effectiveness.
(b) Other process of care indicators where there is good evidence they relate to implementation of EBP and better health outcomes for patients.
(c) Patient outcome or an accepted surrogate for outcome providing there is good evidence the outcome relates to the implementation of EBP.
(d) Healthcare resource utilisation including: frequency and length of hospital stay, number of re-admissions, prescriptions, tests and investigations ordered, referrals, use of emergency and other health services.
Where any of (a) to (d) was satisfied, outcome (e) could be considered in the review.
(e) Costs of development and delivery of organisational interventions and any associated monetary benefits.

**Search methods for identification of studies**

**Electronic searches**

We developed new search strategies for this update because the strategy published in 2003 (Appendix 1) omitted a number of key concepts. Strategies for English language databases (Appendix 2) were developed by information specialists M Fiander and N Roberts; author MX Rojas developed strategies for Spanish language resources (Appendix 3). We wrote and ran two versions (A and B) of the MEDLINE strategy. For the next update of this review, we will combine strategies A and B into a single strategy in order to improve precision and sensitivity.

Since the search strategies for this update changed significantly from those in the original review, we conducted retrospective searches of MEDLINE and EMBASE (e.g. from 1948 and 1950, respectively). Searches in other databases were limited from 1990 forward. We applied no language limits. We used two methodological search filters to limit retrieval to appropriate study designs in Strategy A: the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE; sensitivity- and precision-maximising version (Cochrane Handbook for Systematic Reviews of Interventions 6.4d (Handbook 2011)) and the Cochrane EPOC Group Methodological Filter version 2.2; Strategy B used only portions of these filters, but the full filters per Strategy A are recommended for future updates.

- The Cochrane EPOC Group Specialised Register (Reference Manager)
- The Cochrane Central Register of Controlled Trials (Wiley) (The Cochrane Library 2011, Issue 4)
  - MEDLINE (OVID) (1948 to present)
  - EMBASE (OVID) (1947 to present)
  - CINAHL: Cumulative Index to Nursing and Allied Health Literature (EBSCOHost) (1980 to present )
  - Science Citation Index Expanded (SCI-EXPANDED) (1945 to present)
  - Social Sciences Citation Index (SSCI) (1956 to present)
  - Arts & Humanities Citation Index (A&HCI) (1975 to present)
  - Conference Proceedings Citation Index - Science (CPCI-S) (1990 to present)
  - Conference Proceedings Citation Index - Social Science & Humanities (CPCI-SSH) (1990 to present)

- Biblioteca Virtual en Salud - BIREME (Virtual Library of Health) (June 2011)
- Literatura Latinoamericana y del Caribe en Ciencias de la Salud - LILACS (Latin American and Caribbean Health Sciences Literature) (June 2011)
- Indice Bibliográfico Español en Ciencias de la Salud - IBECS (Bibliography Spanish index in Health Science) (June 2011)

**Searching other resources**

N Roberts, G Hodgson and MX Rojas conducted a search of grey literature sites, nursing organisational websites, professional bodies and international institutions (see Appendix 3). We searched the reference lists of included studies and contacted authors of relevant papers regarding any further published or unpublished work.

**Data collection and analysis**

**Selection of studies**

We downloaded all titles and abstracts retrieved by the electronic searches into the reference management database EndNote and removed duplicates. One review author screened all titles identified by the main search, excluding all studies which clearly did not meet the inclusion criteria. We produced a long-list of titles and abstracts which clearly did not meet the inclusion criteria. We obtained the full text of potentially relevant papers. We resolved disagreements by discussion between authors or if needed arbitration by a third person.

**Data extraction and management**

Two review authors independently extracted data from included studies using a modified Cochrane EPOC Group data extraction form (EPOC 2009). We resolved disagreements by discussion between review authors or if needed arbitration by a third person. Any study identified as potentially eligible after reviewing it in full text but subsequently excluded is documented in the Characteristics of excluded studies table.

**Assessment of risk of bias in included studies**

Two review authors independently assessed the risk of bias of the included ITS study using the criteria suggested by the Cochrane EPOC Group (EPOC 2009). For the included ITS study we used the following criteria: a) was the intervention independent of other changes; b) was the shape of the intervention effect pre-specified; c) was the intervention unlikely to affect data collection; d) was knowledge of the allocated interventions adequately prevented during the study; e) were incomplete outcome data adequately
addressed; f) was the study free from selective outcome reporting; g) was the study free from other risks of bias? We resolved disagreements by discussion between review authors or if needed arbitration by a third person.

Measures of treatment effect
For the included ITS study we reported the main outcomes in natural units and two effect sizes: the change in the level of outcome immediately after the introduction of the intervention and the change in the slopes of the regression lines. Both of these estimates are necessary for interpreting the results of each comparison. For example, there could have been no change in the level immediately after the intervention, but there could have been a significant change in slope. We also reported the level effects for six months and yearly post intervention points within the post intervention phase.

Assessment of heterogeneity
Since only one study was found for inclusion in this review, we performed no meta-analysis. If, in future updates, meta-analysis is possible we will explore heterogeneity between studies by comparing descriptions of the study populations, interventions and outcomes. In addition we will visually assess the forest plots and quantify heterogeneity with the I^2 statistic (Egger 1997; Higgins 2008).

Data synthesis
Since only one study was included in this review, we have described the results within the text of this review. The main (only) outcome is presented in Summary of findings for the main comparison. We extracted data for the healthcare-acquired pressure ulcer (HAPU) rate from graphs using MS Paint (Microsoft Windows). We performed the re-analysis of the ITS study using a time series approach that accounts for time features such as seasonality and serial correlation where appropriate, e.g. time series regression. We performed the statistical analysis using Stata 11 Statistical Software (StataCorp).

The ‘Summary of findings’ table includes information regarding the magnitude of the effect of the intervention and the quality of evidence for interventions to prevent the development of HAPUs. In future updates, we will carry out a meta-analysis only if we have a sufficient number of studies that are homogeneous regarding population, interventions, comparisons and outcomes. If we do not find enough studies for a meta-analysis, we will report the review as a descriptive narrative. For studies that are sufficiently homogeneous in terms of setting, design and intervention, we will use a fixed-effect model. Where there is evidence of heterogeneity, we will apply a random-effects model. We will perform data synthesis using Review Manager 5 (RevMan 2008).

Subgroup analysis and investigation of heterogeneity
In future updates, should more eligible studies be found, we will investigate how the pooled intervention effect is affected by the inclusion of RCTs at an unclear or high risk of bias.

Sensitivity analysis
In future updates, should more eligible studies be found for the primary meta-analysis, we will undertake a sensitivity analysis to investigate how the pooled intervention effect is affected by the inclusion of RCTs at an unclear or high risk of bias.

RESULTS

Description of studies
See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification.

Results of the search
The searches of the main electronic databases led to the identification of 11,256 titles, the additional search of the Latin and Ibero-American databases yielded 215 titles, and the manual searches of the home pages of the organisational bodies retrieved 1060 titles. In total we identified 12,531 titles. After the independent examination by the review authors, we retrieved 16 papers that were potentially eligible for the review. After the full-text assessment we found only one study, presented in a conference abstract, that met the Cochrane EPOC Group quality criteria for non-randomised studies and the inclusion criteria of the review. We obtained additional graphical data from this study, in the form of a Powerpoint presentation, through Google. The included study is presented in more detail in the Characteristics of included studies table. A description of full-text studies retrieved and reasons for their exclusion are presented in the Characteristics of excluded studies table.

Included studies

Study design, participants and settings
We found only one low-quality study (re-analysed as an ITS) from the USA for inclusion in this review. The study involved the Washington hospital in Fremont, serving the whole of California. The number of nurses recruited to the study was not reported. No details of hospital or participant characteristics, or the number of patients affected by the study were provided.
Targeted behaviour

The study evaluated the effects of a standardised evidence-based nursing procedure on nursing care provided to patients at risk of healthcare-acquired pressure ulcers (HAPUs), as measured by the HAPU rate. If a patient's admission Braden score (Bergstrom 1987) was equal to or lower than 18 they were judged to be at risk of developing pressure ulcers. The Braden scale is a tool used to assess a patient's risk of developing pressure ulcers by examining six criteria: sensory perception, the degree to which the skin is exposed to moisture, the individual's level of activity, the individual's ability to change positions, nutrition and the exposure to situations that can result in friction and shear to the skin. Each category is rated on a scale of 1 to 4, excluding the 'friction and shear' category which is rated on a 1 to 3 scale. This combines for a possible total of 23 points, with a higher score meaning a lower risk of developing a pressure ulcer. An adult with a score below 18 is considered to have a high risk for developing a pressure ulcer. Nurses were authorised to initiate a pressure ulcer prevention bundle (i.e. a set of three to five evidence-based interventions/practices that when used together may result in significant improvement in patient outcomes), without waiting for a physician order (Shih 2010). Strategies were developed to increase compliance in the implementation of the evidence-based nursing procedures to reduce the HAPU rate.

Outcomes

One outcome was reported by Shih 2010: the quarterly HAPU rate. We contacted the main author twice by e-mail to request additional information, but received no reply.

Data collection

HAPU data were collected by quarterly CALNOC (Collaborative Alliance for Nursing Outcomes) pressure ulcer prevalence study. CALNOC is a nursing quality database which measures patient outcomes to advance standards in patient care (https://www.calnoc.org/globalPages/mainpage.aspx). The main outcome (HAPU rate) was measured from January 2008 to September 2008 (pre-intervention period) and from October 2008 to March 2010 (post intervention period).

Description of the intervention

After reviewing the literature, an evidence-based standardised nursing procedure on nursing care provided to patients at risk of healthcare-acquired pressure ulcers (HAPUs), as measured by the HAPU rate. If a patient's admission Braden score (Bergstrom 1987) was equal to or lower than 18 they were judged to be at risk of developing pressure ulcers. The Braden scale is a tool used to assess a patient's risk of developing pressure ulcers by examining six criteria: sensory perception, the degree to which the skin is exposed to moisture, the individual's level of activity, the individual's ability to change positions, nutrition and the exposure to situations that can result in friction and shear to the skin. Each category is rated on a scale of 1 to 4, excluding the 'friction and shear' category which is rated on a 1 to 3 scale. This combines for a possible total of 23 points, with a higher score meaning a lower risk of developing a pressure ulcer. An adult with a score below 18 is considered to have a high risk for developing a pressure ulcer. Nurses were authorised to initiate a pressure ulcer prevention bundle (i.e. a set of three to five evidence-based interventions/practices that when used together may result in significant improvement in patient outcomes), without waiting for a physician order (Shih 2010). Strategies were developed to increase compliance in the implementation of the evidence-based nursing procedures to reduce the HAPU rate.

Excluded studies

In total, we excluded 15 studies after full copies of papers were obtained and scrutinised (Alexander 2011; Anonymous 2009; Artz 2011; Callaghan 1998; Gracias 2008; Hampton 2005; Johnson 2011; Kavanagh 2006; Lee 2009; Lena 2009; Levin 2011; McKinley 2007; Scheide 2007; White 2010; Whitney 2006). The reasons for exclusion are presented in the Characteristics of excluded studies table.

Risk of bias in included studies

For the one included study (Shih 2010) we judged the risk of bias as ‘unclear’ for most of the criteria due to the absence of information provided in the abstract (see ‘Risk of bias’ table within the Characteristics of included studies table). For one item there was high risk of bias: already before the intervention there was a statistically significant decrease in HAPU rate and therefore the intervention cannot be considered independent of other changes. One item was not applicable: the intervention effect was not pre-specified, since nothing was mentioned about what effect (a step change or change in slope) was expected for the outcome measure (HAPU rate). However, as the study authors did not specify this analysis, and the data were re-analysed by the review authors, this criteria cannot be reasonably applied.

Effects of interventions

See: Summary of findings for the main comparison

Re-analysis of the HAPU data as an interrupted time series showed no statistically significant difference in slopes between the regression lines for the pre-intervention period (January 2008 to September 2008) and the post intervention period (October 2008 to March 2010) (mean rate per quarter 0.73%; 95% confidence interval (CI) -0.37 to 1.84; P = 0.151).

The re-analysis was suggestive of a trend in rates prior to intervention (-1.1%; 95% CI -2.1 to -0.03; P = 0.046) and, if that trend is assumed to be real, there was no evidence of an intervention effect at three months (mean rate 0.7%; 95% CI -1.7 to 3.3; P = 0.465). Given the small percentages post intervention it was not statistically possible to extrapolate effects beyond three months. The results for the HAPU rate are summarised in Summary of findings for the main comparison.
**DISCUSSION**

**Summary of main results**

We performed an extensive search of the literature for studies evaluating the effectiveness of organisational infrastructures to promote evidence-based nursing, including RCTs, ITTs, CBAs and CCTs. However, we found only one study from the USA that met our inclusion criteria (Shih 2010). Shih and colleagues evaluated the effects of introducing an evidence-based standardised nursing procedure at one hospital, aimed at improving the care provided to patients at risk of developing healthcare-acquired pressure ulcers (HAPUs). The results for the one participating hospital showed no evidence of an intervention effect at three months after implementation of the intervention.

Considering the importance placed on organisational change in promoting evidence-based nursing, it is surprising that eight years after the previous empty Cochrane review was published, appropriately evaluated organisational infrastructure interventions are still lacking. If policy-makers and healthcare organisations wish to promote evidence-based nursing at an organisational level successfully, they must ensure the funding and conduct of well-designed studies to generate evidence to guide policy.

**Overall completeness and applicability of evidence**

The evidence is incomplete and of very limited generalisability. With only one included study it is impossible to draw any clear conclusions about the effectiveness of organisational infrastructures in promoting evidence-based nursing. Shih et al reported only one outcome measure, the HAPU rate, when evaluating the effectiveness of the evidence-based standardised nursing procedure (Shih 2010). No outcomes related to processes of care, to healthcare resource utilisation (e.g. length of stay), unintended/adverse effects (e.g. sepsis, mortality) or costs were reported.

A better description of the implementation strategies, the number of participating nurses and patients, as well as hospital and participant characteristics would have been useful not only for the interpretation of results, but to understand how the intervention was implemented.

Within the excluded studies there are many examples of researchers using inappropriate study designs in their attempts to evaluate the effectiveness of different organisational infrastructure interventions. Either the study includes too few intervention and control groups for it to be judged as eligible, or too few pre-intervention and post-intervention data points to allow for an appropriate time series analysis. Some studies were not eligible due to only reporting self-reported outcomes. Since the previous review was published in 2003, a number of new conceptual nursing models (EBP) have been added to the existing list of non-evaluated nursing models (Di Cenzo 2005; Melnyk 2005; Steetler 2001; Titler 2002). The problem is thus not a lack of nursing models, or lack of studies aiming to evaluate the effects of different organisational interventions based on these models, but that the studies are at a high risk of bias or have not been designed to generate effectiveness data.

**Quality of the evidence**

The little evidence we included in this review is at risk of bias. The re-analysed ITS scored unclear on the ITS risk of bias criteria, in part because the authors never intended it to be analysed as an ITS, but also because of the little information provided in the conference abstract.

**Potential biases in the review process**

The extensive search strategy was carefully scrutinised and adapted to existing terminology by experienced information technologists and we searched a large number of databases and relevant websites for relevant organisational bodies. One author sifted all references identified by the electronic searches, excluding papers that clearly were not eligible, while two review authors assessed all potentially eligible titles and abstracts against the eligibility criteria independently to ensure no important references were missed.

**AUTHORS’ CONCLUSIONS**

**Implications for practice**

We found only one eligible paper for inclusion in the review and therefore the review question remains unanswered. Healthcare organisations considering implementing and evaluating interventions aimed at changing organisational infrastructure should consider using a robust design (e.g. interrupted time series), preferably with at least two intervention and control sites, and at least three data points before and three data points after the intervention (i.e. complying with the Cochrane EPOC group quality criteria).

**Implications for research**

We only identified one eligible study, which was eligible only after the data were re-analysed as a time series. We excluded many studies due to inappropriate study design. If policy-makers and healthcare organisations wish to promote evidence-based nursing at an organisational level successfully, they must ensure that well-designed studies evaluate the effectiveness of these interventions. Below we outline key aspects of study design to be considered.
• Randomised controlled trials (RCTs), the 'gold standard' study design, should be used when possible
• Controlled before and after studies (CBAs) should include at least two intervention and two control sites
• Interrupted time series (ITSs) should have at least three data points before and three data points after the intervention to permit a time series analysis
• ITSs should include at least two intervention sites
• All studies should include objective outcome measures when evaluating the effectiveness of an intervention and not only self reported outcomes. Examples of key outcomes include: nosocomial infection rates, hospital length of stay, sepsis, mortality and costs.

ACKNOWLEDGEMENTS

REFERENCES

References to studies included in this review

Shih 2010 (published data only)

References to studies excluded from this review

Alexander 2011 (published data only)

Anonymous 2009 (published data only)
Anonymous. Evaluating nurse behaviour change in NSW acute stroke units following implementation of an intervention to promote the uptake of evidence-based practice. Nursing Monograph 2009;11.

Artz 2011 (published data only)

Callaghan 1998 (published data only)

For the present review update we wish to acknowledge Nia Roberts and Michelle Fiander for revising and running the electronic searches. We also wish to acknowledge Adriana Buitrago for her assistance with sifting the search results from the Latin and Ibero-American databases and Ly-Mee Yu for re-analysing the data from the included study. This update was funded by a National Institute for Health Research (NIHR) Cochrane Programme Grant ‘Effective Practice and Organisation of Care in the NHS’.

For the previous version of the review the acknowledgements were as follows:

Particular thanks go to colleagues who have commented on protocols and draft reports and have provided additional information and resources: Carole Estabrooks (University of Alberta), Paul Fulbrook (University of Bournemouth), John Gabbay (University of Southampton), Linda Johnson (University of Melbourne) and Heather Waterman (University of Manchester). We are also grateful for the helpful comments from referees: Alba DiCenso, Peter Griffiths and Merrick Zwarenstein.

REFERENCES

Dufault 1995 (published data only)

Fitch 1992 (published data only)

Gracias 2008 (published data only)

Greenwood 1998 (published data only)

Hampton 2005 (published data only)

Johnson 2011 (published data only)
Kavanagh 2006 (published data only)

Lee 2009 (published data only)

Lenz 2009 (published data only)

Levin 2011 (published data only)

Martin 1994 (published data only)

McKinley 2007 (published data only)

Robinson 1997 (published data only)

Rutledge 1995 (published data only)

Scheide 2007 (published data only)

Sperhac 1994 (published data only)

White 2010 (published data only)

Whitney 2006 (published data only)

References to studies awaiting assessment

Farmer 2011 (published data only)

Additional references

Atkinson 2008

Balas 2000

Bergstrom 1987

Burrows 1995

Di Censo 2005

Egger 1997

EPOC 2009

Fineout-Overholt 2005

Flodgren 2010
Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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Funk 1989

Funk 1991

Goode 1992

Grol 2003

Handbook 2011

Heater 1988

Higgins 2008

Horsley 1978

Horsley 1983

Hutchison 2004

Jack 1997

Kitson 1996

McCowan 2009

Melnyk 2002

Melnyk 2004

Melnyk 2005

Omery 1999

Pravikoff 2005

RevMan 2008

Rogers 2003

Rosswurm 1999

Sackett 2000

Schultz 2005

Schuster 1998

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Seddon ME, Marshall MN, Campbell SM, Roland MO. Systematic review of studies of quality of clinical care in...
general practice in the UK, Australia and New Zealand. 

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Stetler CB. Refinement of the Stetler/Marram model for 
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to facilitate evidence-based practice. Nursing Outlook 2001; 

Thomas 2009
Thomas L, Callum NA, McColl E, Rousseau N, Soutter 
J, Steen N. Guidelines in professions allied to medicine. 
Cochrane Database of Systematic Reviews 1999, Issue 1. 
[DOI: 10.1002/14651858.CD000349]

Titler 1994
Titler MG, Kleiber C, Steelman V, Goode C, Rakel B, 
Barry-Walker J, et al. Infusing research into practice to 

Titler 2002
Titler M. Use of research in practice. In: LaBiondo G, 
Haber J ednin(s). Nursing Research, Methods, Critical 

Urquhart 2009
Urquhart C, Carroll R, Grant MJ, Hardiker NR. Nursing 
record systems: effects on nursing practice and healthcare 
outcomes. Cochrane Database of Systematic Reviews 2009, 
Issue 1. [DOI: 10.1002/14651858.CD002099.pub2]

WHO 2006
World Health Organization. Strengthening nursing and 
midwifery. World Health Organization resolution WHA 
59.27 2006.

References to other published versions of this review

Foxcroft 2003
Foxcroft DR, Cole N. Organisational infrastructures 
to promote evidence based nursing practice. Cochrane 
Database of Systematic Reviews 2003, Issue 4. [DOI: 
10.1002/14651858.CD002212]

* Indicates the major publication for the study
### Characteristics of included studies  
*ordered by study ID*

**Shih 2010**

<table>
<thead>
<tr>
<th>Methods</th>
<th>Study design:</th>
<th>ITS (an uncontrolled before and after study that we re-analysed as an interrupted time series)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data:</td>
<td>data on HAPU rate between January 2008 and March 2010 were collected by quarterly CALNOC (Collaborative Alliance for Nursing Outcomes) pressure ulcer prevalence study. CALNOC is a nursing quality database which measures patient outcomes to advance patient care excellence (<a href="https://www.calnoc.org/globalPages/mainpage.aspx">https://www.calnoc.org/globalPages/mainpage.aspx</a>)</td>
</tr>
<tr>
<td></td>
<td>Statistical methods:</td>
<td>not described</td>
</tr>
</tbody>
</table>

| Participants     | Participants: | (i) All nurses at one medical-surgical unit (number of participating nurses unknown) |
|                  |              | (ii) All nurses at one hospital (number of participating nurses unknown) |
|                  |              | (iii) Patients at risk of developing HAPUs (number of participating patients unknown) |
|                  | Country:     | US |
|                  | Targeted behaviour: | preventive care of patients at risk of developing HAPUs (with an admission Braden score ≤18) |

| Interventions    | Description of the intervention: | - After literature synthesis an evidence-based standardised nursing procedure (including a pressure ulcer prevention bundle) was developed and implemented |
|                  |                                   | - Strategies used to improve the implementation of the intervention consisted of staff education through posters, one to one peer teaching, elevator speech and documentation audits |
|                  |                                   | - If the patient’s admission Braden score was ≤18, a prevention bundle could be initiated: nurses were authorised to initiate these preventive actions without waiting for a physician order |
|                  |                                   | The Braden scale is a tool used to assess a patient’s risk of developing pressure ulcers by examining 6 criteria: sensory perception, the degree to which the skin is exposed to moisture, the individual’s level of activity, the individual’s ability to change positions, nutrition and the exposure to situations that can result in friction and shear to the skin. Each category is rated on a scale of 1 to 4, excluding the ‘friction and shear’ category which is rated on a 1 to 3 scale. This combines for a possible total of 23 points, with a higher score meaning a lower risk of developing a pressure ulcer and vice versa. An adult with a score below 18 is considered to have a high risk for developing a pressure ulcer. The pressure ulcer prevention bundle consisted of: (i) turning every 2 hours, (ii) utilising an air mattress overlay, (iii) assessing the patient’s pre-albumin level, (iv) initiating a wound care referral and/or a dietitian referral, and (v) ordering heel pressure relief devices and/or wheelchair cushion |

| Outcomes         | Quarterly data on HAPU rate were retrieved from graphs included in a Powerpoint presentation found on the Internet (http://www.beaconcollaborative.org/assets/files/2010%20Annual%20Exchange/0410 Everything You Always Wanted to Know About HAPU Prevention Garcia Shih(2).pdf), see Table 2 and Table 3 |
|                  | The results for the HAPU data are summarised in the Summary of findings for the main comparison |
According to the authors the HAPU rate was significantly decreased on the medical-surgical unit from an average 6.07% pre-intervention to 0.62% a year later. Re-analysis of the data retrieved from the graph was, however, not possible.

### Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors' judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>Unclear risk</td>
<td>Not stated in the abstract</td>
</tr>
<tr>
<td>All outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other bias</td>
<td>Low risk</td>
<td>No evidence of other risk of bias</td>
</tr>
<tr>
<td>Was the intervention independent of other changes?</td>
<td>High risk</td>
<td>Already before the intervention there was a statistically significant ($P = 0.046$) decrease in HAPU rate of 11 cases per 1000 patients per quarter, and therefore the intervention cannot be considered independent of other changes</td>
</tr>
<tr>
<td>Was the shape of the intervention effect pre-specified?</td>
<td>Low risk</td>
<td>The data was re-analysed by the review authors and therefore the risk for this item must be considered low</td>
</tr>
<tr>
<td>Was the intervention unlikely to affect data collection?</td>
<td>Unclear risk</td>
<td>Not stated in the paper</td>
</tr>
<tr>
<td>Was knowledge of the allocated interventions adequately prevented in the study?</td>
<td>Unclear risk</td>
<td>Not specified in the paper</td>
</tr>
<tr>
<td>Were incomplete outcome data adequately addressed?</td>
<td>Unclear risk</td>
<td>Not specified in the paper</td>
</tr>
</tbody>
</table>

CALNOC: Collaborative Alliance for Nursing Outcomes
HAPU: healthcare-acquired pressure ulcer
ITS: interrupted time series
### Characteristics of excluded studies  
*ordered by study ID*

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander 2011</td>
<td>Uncontrolled BA study, not re-analysable as a time series (no graph)</td>
</tr>
<tr>
<td>Anonymous 2009</td>
<td>Could not be found</td>
</tr>
<tr>
<td>Arzt 2011</td>
<td>Descriptive reliability study</td>
</tr>
<tr>
<td>Callaghan 1998</td>
<td>CBA study with only 1 intervention and 1 control site. Not re-analysable as a time series</td>
</tr>
<tr>
<td>Dufault 1995</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>Fitch 1992</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>Gracias 2008</td>
<td>Uncontrolled BA study that could not be re-analysed as a time series</td>
</tr>
<tr>
<td>Greenwood 1998</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>Hampton 2005</td>
<td>Uncontrolled BA study. Not re-analysable as a time series (bundle intervention)</td>
</tr>
<tr>
<td>Johnson 2011</td>
<td>Descriptive study</td>
</tr>
<tr>
<td>Kavanagh 2006</td>
<td>Uncontrolled BA study that could not be re-analysed as a time series</td>
</tr>
<tr>
<td>Lee 2009</td>
<td>Diagnosis not treatment was the focus of this RCT study. No reference to the evidence-based features of the tool</td>
</tr>
<tr>
<td>Lenz 2009</td>
<td>Uncontrolled BA study that could not be re-analysed as a time series</td>
</tr>
<tr>
<td>Levin 2011</td>
<td>Only self reported outcomes in this RCT study</td>
</tr>
<tr>
<td>Martin 1994</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>McKinley 2007</td>
<td>Nurses were not targeted separately and could not be separated from the rest of the staff</td>
</tr>
<tr>
<td>Robinson 1997</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>Rutledge 1995</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>Scheide 2007</td>
<td>Uncontrolled BA study that could not be re-analysed as a time series</td>
</tr>
<tr>
<td>Sperhac 1994</td>
<td>Poor design: retrospective case study with no controls or comparison group</td>
</tr>
<tr>
<td>White 2010</td>
<td>Only self reported outcomes were reported in this RCT study</td>
</tr>
<tr>
<td>Whitney 2006</td>
<td>Could not be found</td>
</tr>
</tbody>
</table>
RCT: randomised controlled trial
BA: before and after study

**Characteristics of studies awaiting assessment**  
*ordered by study ID*

Farmer 2011

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methods</strong></td>
<td>Unclear</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Unclear</td>
</tr>
<tr>
<td><strong>Interventions</strong></td>
<td>Use of nursing practice reviews</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Unclear</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td></td>
</tr>
</tbody>
</table>
DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. Conceptual models, simplified (-> is a process step indicated in the model)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horsley 1978</td>
<td>Identify clinical problem -&gt; Find and appraise research evidence -&gt; Evaluate relevance of evidence for local context -&gt; Design practice innovation and devise implementation plan -&gt; Clinical trial (evaluation) of the innovation -&gt; Review evidence from evaluation -&gt; If innovation is positive then devise plan to extend and disseminate to other areas</td>
</tr>
<tr>
<td>Funk 1989</td>
<td>Find and appraise literature -&gt; Effective communication -&gt; Effective facilitation of utilisation</td>
</tr>
<tr>
<td>Goode 1992</td>
<td>Organisational commitment -&gt; Change agents -&gt; Planned change process -&gt; Outcome (research-based practice)</td>
</tr>
<tr>
<td>Burrows 1995</td>
<td>Review current practice -&gt; Motivation to change -&gt; Identify relevant evidence and appraise -&gt; Implement in practice</td>
</tr>
<tr>
<td>Kitson 1996</td>
<td>Evidence -&gt; Context -&gt; Successful implementation -&gt; Facilitation</td>
</tr>
<tr>
<td>Jack 1997</td>
<td>Facilitation/education -&gt; Quality assurance/audit -&gt; Conducting research -&gt; Guidelines -&gt; Evidence-based practice -&gt; Dissemination</td>
</tr>
<tr>
<td>Rosswurm 1999</td>
<td>The Rosswurm and Larrabee Model: assess needs of stakeholders -&gt; Build relationships and make connection between nursing intervention and outcome -&gt; Synthesise the gathered evidence -&gt; Plan for the evidence-based change in practice -&gt; Implement the plan and evaluate the implementation -&gt; Maintain the change</td>
</tr>
<tr>
<td>Stetler 2001</td>
<td>The Stetler Model (replaces the previous Stetler Model (Stetler 1994)) Preparation (gather evidence, look for confounding influences) -&gt; Validation (appraise and synthesise evidence) -&gt; Comparative evaluation/Decision-making (determine the ability of evidence to answer the question) -&gt; Translation/application (if there is sufficient evidence, implement it either formally or informally) -&gt; Evaluation (evaluate whether evidence implementation sufficiently addressed the given issue)</td>
</tr>
<tr>
<td>Melnyk 2002</td>
<td>The ARCC Model (Advancing Research and Clinical Practice through Close Collaboration): the central concept in the ARCC model is that of an evidence-based practice (EBP) mentor, an advanced nurse with in-depth EBP and clinical knowledge and skills who provides mentorship in EBP and facilitates improvement in clinical care and patient outcomes through EBP implementation and outcomes management projects Promoting EBP among both advanced practice and staff nurses locally and nationally -&gt; Establishing a cadre of EBP mentors to facilitate EBP in healthcare organisations -&gt; Disseminating and facilitating use of the best evidence from well-designed studies to advance an evidence-based approach to clinical care -&gt; Conducting an annual EBP conference -&gt; Conducting studies to evaluate the effectiveness of the ARCC model on the process and outcomes of clinical care and -&gt; Conducting studies to evaluate the effectiveness of the EBP implementation strategies</td>
</tr>
<tr>
<td>Titler 2002</td>
<td>The Iowa model (Titler 2002) replaces the previous model (Titler 1994): Generate the question from either a problem or new knowledge -&gt; Determine relevance to organisational priorities -&gt; Develop a team to gather and appraise evidence -&gt; Determine if the evidence answers the question -&gt; If there is sufficient evidence, pilot the...</td>
</tr>
</tbody>
</table>
Table 1. Conceptual models, simplified (→ is a process step indicated in the model) (Continued)

<table>
<thead>
<tr>
<th>Model</th>
<th>Process Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Di Censo 2005</td>
<td>Asking the question → Compiling the evidence → Planning a change → Integrating skills and experience</td>
</tr>
<tr>
<td>Schultz 2005</td>
<td>The Clinical Scholar Model: this model reinforces the intellectual process of EBP, building a cadre of mentors who foster an environment in which staff nurses are encouraged to continuously ask questions. Clinical scholars are bedside clinicians who challenge nurses practices through inquiry, observation, analysis and synthesis of internal data and published evidence, application of synthesised evidence, and evaluation of subsequent outcomes. Clinical scholars serve as role models in the ownership of their clinical practice. Inherent in the model is the final step, dissemination of findings from the projects and research accomplished by the clinic scholar team to team members and the healthcare public. Intrinsic to the model are collaboration, consultation and mentorship by a nurse scientist through every step of the educational and application processes</td>
</tr>
</tbody>
</table>

Table 2. Quarterly HAPU rate at a 40-bed medical-surgical ward

<table>
<thead>
<tr>
<th>Time periods</th>
<th>Quarterly reported HAPU rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 2008</td>
<td>7.56</td>
</tr>
<tr>
<td>Q2 2008</td>
<td>3.93</td>
</tr>
<tr>
<td>Q3 2008</td>
<td>4.53</td>
</tr>
<tr>
<td>Q4 2008 (intervention)</td>
<td>0</td>
</tr>
<tr>
<td>Q1 2009</td>
<td>1.89</td>
</tr>
<tr>
<td>Q2 2009</td>
<td>0</td>
</tr>
<tr>
<td>Q3 2009</td>
<td>0</td>
</tr>
<tr>
<td>Q4 2009</td>
<td>0</td>
</tr>
<tr>
<td>Q1 2010</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3. Quarterly reported HAPU rate at Washington hospital

<table>
<thead>
<tr>
<th>Time periods</th>
<th>Quarterly reported HAPU rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 2008</td>
<td>4.92</td>
</tr>
<tr>
<td>Q2 2008</td>
<td>3.08</td>
</tr>
<tr>
<td>Q3 2008</td>
<td>2.76</td>
</tr>
</tbody>
</table>
Table 3. Quarterly reported HAPU rate at Washington hospital  (Continued)

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 4 2008</td>
<td>2.46</td>
</tr>
<tr>
<td>(intervention)</td>
<td></td>
</tr>
<tr>
<td>Q 1 2009</td>
<td>2.24</td>
</tr>
<tr>
<td>Q 2 2009</td>
<td>0.70</td>
</tr>
<tr>
<td>Q 3 2009</td>
<td>0.74</td>
</tr>
<tr>
<td>Q 4 2009</td>
<td>1.30</td>
</tr>
<tr>
<td>Q 1 2010</td>
<td>0.60</td>
</tr>
</tbody>
</table>

**APPENDICES**

Appendix 1. MEDLINE strategy (used in original review)

1. randomized controlled trial.pt.
2. randomized controlled trials.sh.
3. controlled clinical trial.pt.
4. random allocation.sh.
5. double blind method.sh.
6. single blind method.sh.
7. clinical trial.pt.
8. exp clinical trials/
9. (clin$ adj3 trial$).ti,ab.
10. ((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).ti,ab.
11. random$.ti,ab.
12. quasi?experiment$.ti,ab.
13. research design.sh.
15. cross-over studies.sh.
16. matched-pair analysis.sh.
17. meta-analysis.pt.
18. meta-analysis.sh.
19. meta?anal$.ti,ab.
20. (systematic adj (overview$ or review$)).ti,ab.
21. evaluation studies.sh.
22. program evaluation.sh.
23. efficiency, organizational.sh.
24. longitudinal studies.sh.
25. follow up studies.sh.
26. prospective studies.sh.
27. (control$ or prospectiv$ or volunteer$).ti,ab.
Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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Appendix 2. Search strategies for 2011 update

MEDLINE Strategy A

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1948 to Present>

Search Strategy:

1 Evidence-Based Nursing/ (772)
2 ((evidence or evidence-based or EBM or EBN or EBP) adj2 (nursing or nurse or nurses)).ti,ab. (834)
3 or/1-2 [EBN--combine with Filters] (1527)

4 Evidence-based practice/ or Evidence-Based Medicine/ or Evidence-Based Emergency Medicine/ (42687)
5 (evidence-base? or evidence informed).ti,ab. (40991)
6 ((EBM or EBN or EBP) adj2 (care or healthcare or nursing or patient care or practice? or practitioner?!)).ti,ab. (581)
7 (evidence adj3 (adopt$ or application or apply$ or diffusion or implement$ or practice or uptake or utilization or utili?e? or utili?ing)).ab. (8823)
8 (knowledge adj2 (adopt$ or application or apply$ or DIFFUSION or implement$ or uptake or transfer$ or translat$ or utilization or utili?e? or utili?ing)).ti,ab. (3802)
9 (BEST PRACTICE or BEST PRACTICES).ti,ab. (6400)
10 (research adj3 (implement$ or TRANSLATIONAL or uptake or utilization or utili?e? or utili?ing)).ti,ab. (6495)
11 research.hw . and diffusion.ti,ab. (45751)
12 (research adj3 (implement$ or TRANSLATIONAL or uptake or utilization or utili?e? or utili?ing)).ti,ab. (6495)
13 research adj2 practice).ti,ab. (9218)
14 (PRACTICE and MODEL).ti. or (PRACTICE adj3 MODEL?).ab. (3553)
15 or/4-14 [Evidence Based Practice & Synonyms] (139449)
16 evidence.ti,ab. (885713)
17 (quality adj2 (care or healthcare or improv$ or initiat$ or program? or programme?!)).ti,ab. (72027)
18 Quality Improvement/ (137)
19 "Quality of Health Care"/ (47348)
20 "Quality assurance, health care"/ (42627)
21 Benchmarking/ (8178)
22 Quality Indicators, health care/ (7117)
23 or/16-22 [Quality Terms] (1025910)
24 Nursing/ or exp Specialties, Nursing/ or Nursing, Practical/ (166775)
25 Nursing Staff/ or Nursing Staff, Hospital/ (48837)
26 Nursing services/ or Nursing services, hospital/ (15052)
27 Nurses/ or Nurse Administrators/ or Nurse Anesthetists/ or Nurse Clinicians/ or Nurse Midwives/ or Nurse Midwives/ or Nurses, Male/ (50856)
28 Nurse's Role/ (28393)
29 Models, Nursing/ (10099)
30 (nursing or nurse or nurses).ti. (183067)
31 (midwif$ or midwives or health visitor$).ti,ab. (14876)
32 ((nurse or nurses or nursing) adj2 (acute care or administrator? or administrative or an?esthetist? or clinical or clinician? or emergency or hospital or IMPLEMENT$ or manager? or practical or practitioner? or primary care or specialist? or triage)).ab. or (nurse-led or nurse driven).ti,ab. (20321)
33 or/24-32 [Nurses/Nursing/Nursing Staff] (3553263)
34 nursing research/ or clinical nursing research/ or nursing administration research/ or nursing education research/ or nursing evaluation research/ or nursing methodology research/ (41589)
35 ((nurse or nurses or nursing) adj2 research).ti,ab. (7588)
36 or/34-35 [Nursing Research] (45121)
37 Health Services Administration/ or "Organization and Administration"/ or Hospital administration/ or health facility administration/ (45008)

Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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78 exp animals/ not humans.sh. (3548210)
79 "comment on".cm. or systematic review.ti. or literature review.ti. or editorial.pt. or meta-analysis.pt. or news.pt. or review.pt. (2359589)
80 77 not (or/78-79) [EPOC Trial Filter 1.0] (1389348)
81 intervention?.ti. or (intervention? adj (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailor$ or target$ or team$ or usual care)).ab. (110614)
82 (hospital$ or patient?).hw . and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (605229)
83 demonstration project?.ti,ab. (1677)
84 (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab. (46438)
85 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (424)
86 (pre-train$ or post-train$ or pre-intervention or post-intervention).ti,ab. [Added] (5901)
87 (before adj10 (after or during)).ti,ab. (293554)
88 ("quasi-experiment$" or quasiexperimen$ or quasi random$ or quasirandom$ or quasi control$ or quasi-control$ or ((quasi$ or experimental) adj3 method$ or study or trial or design$)).ti,ab,hw. [ML] (80239)
89 ("time series" adj2 interrupt$).ti,ab,hw. [ML] (564)
90 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or "more than").ti,ab. (5895)
91 pilot.ti,ab. [added AB] (65669)
92 Pilot projects/ [ML] (64176)
93 action research.ti,ab. [Added] (1641)
94 "comment on".cm. or review.ti,pt. or randomized controlled trial.pt. [ML] (2407427)
95 (animal model? or animal experiment? or animal study? or animal trial? or canine or feline or bovine or cow or cows or mice or dog or dogs or cat or cats or rabbit? or rat or rats or veterinarian$).ti,hw. (2907425)
96 exp animals/ not humans.sh. [ML] (3548210)
97 *experimental design/ or *pilot study/ or quasi experimental study/ [EM] (16229)
98 ("quasi-experiment$" or quasiexperimen$ or quasi random$ or quasirandom$ or quasi control$ or quasi-control$ or ((quasi$ or experimental) adj3 method$ or study or trial or design$)).ti,ab, [EM] (80239)
99 ("time series" adj2 interrupt$).ti,ab. [EM] (564)
100 (animal model? or animal experiment? or animal study? or animal trial? or canine or feline or bovine or cow or cows or mice or dog or dogs or cat or cats or rabbit? or rat or rats or veterinarian$).ti,hw. [EM extended title words to hw] (3063545)
101 (editorial or letter or note or "review" or trade or survey).pt. [EM] (2568022)
102 meta-analysis/ or systematic review/ or "literature review".ti. or "systematic review".ti. or (meta-analy$ or metaanalyt$).ti. [EM] (54003)
103 (1990* or 1991* or 1992* or 1993* or 1994* or 1995*).dp. (2590636)
104 (1996* or 1997* or 1998* or 1999*).dp. (2637530)
Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)
Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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63 exp hospitals/ or exp Hospitalization/ or exp Patients/ or exp Nurses/ or exp Nursing/) and (study.ti. or evaluation st udies as topic/
(30807)
64 demonstration project:.ti.ab. (1675)
65 (pre-post or "pre test" or pretest$ or posttest$ or "post test" or (pre adj5 post)).ti,ab. (46337)
66 (preimplement$ or pre-implement$ or post-implement$ or postimplement$).ti,ab. (531)
67 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (422)
68 trial.ti. or ((study adj3 aim?) or "our study").ab. (430840)
69 (before adj10 (after or during)).ti,ab. (293343)
70 ("quasi-experiment" or quasiexperiment$ or "quasi random" or quasirandom$ or "quasi control" or quasicontrol$ or ((quasi or experimental) adj3 (method$ or study or trial or design$))).ti,ab,hw. [ML] (80157)
71 ("time series" adj2 interrupt$).ti,ab,hw. [ML] (560)
72 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab. (5889)
73 pilot.ti. (28385)
74 Pilot projects/ [ML] (64052)
75 (clinical trial or multicenter study).pt. [ML removed RCT--redundant v2.0] (541931)
76 (multicentre or multicenter or multi-centre or multi-center).ti. (21490)
77 random$.ti,ab. or controlled.ti. (574025)
78 (control adj3 (area or cohort? or compar? or condition or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. [ML remove DESIGN changed truncation on Compare] (253049)
79 "comment on".cm. or systematic review.ti. or literature review.ti. or editorial.pt. or letter.pt. or meta-analysis.pt. or news.pt. or review.pt. or Case study.ti. [to exclude irrelevant publication types] (2810896)
80 exp animals/ not humans.sh. [ML] (3545906)
81 "experimental design/ or *pilot study/ or quasi experimental study/ [EM] (16209)
82 ("quasi-experiment" or quasiexperiment$ or "quasi random" or quasirandom$ or "quasi control" or quasicontrol$ or ((quasi or experimental) adj3 (method$ or study or trial or design$))).ti,ab. [EM] (80157)
83 ("time series" adj2 interrupt$).ti,ab. [EM] (560)
84 (animal model? or animal experiment? or animal study? or animal trial? or canine or feline or bovine or cow or cows or mice or dog? or cat or cats or rabbit? or rat or rats or veterinari$).ti. or (animal or veterinary).hw. [EM] (1519719)
85 (editorial or letter or note or "review" or trade or survey).pt. [EM] (2565983)
86 meta-analysis/ or systematic review/ or "literature review".ti. or "systematic review".ti. or (meta-analy$ or metaanalyt$).ti. [EM] (53863)
87 (or/61-69,72-73,76-77,81-83) not (or/84-86) [EPOC Methods Filter EM 2.2] (1236202)
88 (or/61-78) not (or/79-80) [EPOC Methods Filter ML 2.2] (1531060)
89 Deleted Line
90 14 and (or/42,47) and 60 [Nursing & Org/Admin/Personnel/Evidence & RCT] (2137)
91 14 and (or/42,47) and 56 and 88 [Nursing & Org/Admin/Personnel & EB& EPOC] (852)
92 17 and 56 and (or/42,47) and (or/60,88) [Nursing Research & EBN & Org/Admin/HR & Filters] (520)
93 4 and (or/60,88) [EBN & Filters] (811)
94 or/90-93 [Results ML1.4 Strategy] (3339)
95 (2002$ or 2003$ or 2004$ or 2005$ or 2006$ or 2007$ or 2008$ or 2009$ or 2010$ or 2011$).ep,ed,yr. [Entry Date/ E-Pub/ Year 2002 forward] (7467051)
96 (1990$ or 1991$ or 1992$ or 1993$ or 1994$ or 1995$ or 1996$ or 1997$ or 1998$ or 1999$ or 2000$ or 2001$).ep,ed,yr. [Entry Date/ E-Pub/Year 1990-2001] (5721902)
98 94 and 95 [Results ML1.4 Strategy 2002-2011] (2337)
99 not 98 [Results ML1.4 1948 to 2001] (1002)
Note for future searches: ML Strategy B saved in OVID Medline as version 1.4.

EMBASE Strategy A

EMBASE Classic<EMBASE <1947 to 2011 March 14>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1948 to Present>

Note: Deleted lines represent search terms not used in the final results set

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CINAHL strategy

(Ebscohost 1980 to current)

S84 S79 or S80 or S81 or S82
S83 S79 or S80 or S81 or S82
S82 S13 and (S40 or S44) and S53 and S78
S81 S13 and S16 and (S40 or S44) and S53 and S78
S80 S13 and (S40 or S44 or S53) and (S57 or S73 or S74 or S75)
S79 S4 and S78
S78 S54 or S55 or S56 or S57 or S58 or S59 or S60 or S61 or S62 or S63 or S64 or S65 or S66 or S67 or S68 or S69 or S70 or S71 or S72 or S73 or S74 or S75 or S76 or S77
S77 TI ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 "more than") or AB ((time points n3 over) or (time points n3 multiple) or (time points n3))
S76 TI ((control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study) ) or AB ((control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study))
S75 TI ( multicentre or multicenter or multi-centre or multi-center ) or AB random*
S74 TI random* OR controlled
S73 TI ( trial or (study n3 aim) or “our study” ) or AB ((study n3 aim) or “our study”)
S72 TI (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop) ) or AB (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop) )

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S18 (MH “Shared Services, Health Care” or MH “Hospital Restructuring”)
S17 (MH “Health Services Administration” or MH “Health Facility Administration”)
S16 S14 or S15
S15 (MH “Nursing Research” or MH “Research, Nursing”)
S14 S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12
S12 (MH “Nurse Practitioner” or MH “Nurse” or “Primary Care” or MH “Specialist” or MH “Triage” or MH “Nurse-led” or MH “Nurse-driven” or TI nurse-led or TI nurse-driven or AB nurse-led or AB nurse driven or AB nurse led or TI nurse led
S11 (MH “Nurse” or “Midwife” or “Health Visitor”)
S10 (MH “Evidence-Based”) or MH “Medical Practice, Evidence-Based” or MH “Physical Therapy Practice, Evidence-Based”
S9 (MH “Nursing Practice, Evidence-Based”) or MH “Medical Practice, Research-Based”
S8 (MH “Nursing Models, Theoretical+”)
S7 (MH “Nursing”)
S6 (MH “Nurse-Midwifery Service”) OR (MH “Nursing Service”)
S5 (MH “Nurses”)
S4 S1 or S2 or S3
S3 (MH “Evidence-Based”) or (MH “Medical Practice, Evidence-Based”)
S2 (MH “Nurse Practice, Evidence-Based”)
S1 (MH “Nurse” or “Midwife” or “Health Visitor”)

Citation indexes strategy

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BIREMÉ strategy

We used combinations of text words and DeCS/Mesh terms that included:


Appendix 3. Additional resources searched

Sources of grey literature:

  - Searched 21 April 2011 by Information Specialist N Roberts
  - Exact phrase = evidence based nursing OR All of these words = evidence based nursing

- UK Clinical Research Network Portfolio Database (UKCRN) - http://public.ukcrn.org.uk/search/
  - Searched 21 August 2011 by Information Specialist N Roberts
  - Title = nursing OR nurse OR nurses OR Research summary = “evidence based nursing”

- OpenSIGLE - http://www.greynet.org/opensiglerepository.html
  - Searched 21 April 2011 by Information Specialist N Roberts
  - Title = “evidence based nursing”
  - Keyword = “evidence based nursing”

Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)

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The following organisational and institutional websites were searched in June 2011 by using the phrase "evidence based nursing" and/or browsed using the individual website navigation facility.

1. Rev@enf (http://www.revenf.bvs.br/)
2. Escuela Universitaria de enfermería, Fisioterapia y Podología - ENFISPO (University College of Nursing, Physiotherapy and Podology) (http://www.ucm.es/centros/webs/euenfer/)
3. Universidad Complutense de Madrid (http://www.ucm.es/) (any available)
4. EBN online - Edición Española Evidence based Nursing (http://www.enfermeria21.com/publicaciones/ebn)
5. The Nursing and Midwifery Office (WHO) (http://www.who.int/hrh/nursing_midwifery/en/)
8. International Catholic Committee of Nurses and Medico-social Assistants (http://www.ciciams.org/)
9. International Confederation of Midwives (ICM) (http://www.internationalmidwives.org/)
10. International Council of Nurses (ICN) (http://www.icn.ch/)
11. International Federation of Red Cross and Red Crescent Societies (http://www.ifrc.org/)
12. International Society of Nurses in Cancer Care (http://www.isncc.org/)
13. Sigma Theta Tau International Honour Society of Nursing (http://www.nursingsociety.org/default.aspx)
14. Royal College of Nursing (www.rcn.org.uk)
15. Cochrane nursing field (http://cnf.cochrane.org)
16. Nursing and Midwifery Council (http://www.nmc-uk.org/)
17. WHO (http://www.who.int/topics/nursing/en/)
18. Pan American Health Organization - PAHO (http://new.paho.org/)
22. University of Granada Nursing in Spain (http://www.ugr.es/pages/estudios/titulaciones/enfermeria)
23. Fundación Santa Fe Hospital in Colombia (http://www.fsfb.org.co/node/315)
24. Colombian Nursing Association (http://www.anec.org.co/)

Appendix 4. Data extraction form

Cochrane Effective Practice and Organisation of Care Group (EPOC)[1]
Modified EPOC Group Data Abstraction Form

Effectiveness of organisational infrastructure change to promote evidence based nursing practice

Data collection

Name of review author:
Date:
Study reference:

Quick eligibility screening questions:

i) Does the intervention target the healthcare organisation (including nurses, midwives or health visitors)?
ii) Is the aim of the intervention to change an entire or identified component of an organisational infrastructure and thereby improve evidence-based nursing practice?

iii) Are the assessed outcomes objective measures of evidence-based practice or other processes of care, patient outcomes or health resource utilisation?

If not - EXCLUDE!

1. **Inclusion criteria**

   1.1 **Study design**

   1.1.1 **RCT designs**

   1.1.2 **CCT designs**

   1.1.3 **CBA designs**
   a) Contemporaneous data collection
   b) Appropriate choice of control site/activity
   c) At least two intervention and two control sites

   1.1.4 **ITS designs**
   a) Clearly defined point in time when the intervention occurred
   b) At least 3 data points before and 3 after the intervention

   1.2 **Methodological inclusion criteria**
   a) The objective measurement of performance/provider behaviour or health/patient outcomes
   b) Relevant and interpretable data presented or obtainable

   **N.B.** A study must meet the minimum criteria for EPOC scope, design and methodology for inclusion in EPOC reviews. If it does not, COLLECT NO FURTHER DATA.

2. **Interventions**

   2.1 **Type of intervention**
   (State all interventions for each comparison/study group)

   Group 1:
   Group 2:
   Group 3:

   2.2 **Control(s)**

3. **Type of targeted behaviour** (state more than one where appropriate)

4. **Participants**

   4.1 **Characteristics of participating providers**

   4.1.1 **Profession**

   4.1.2 **Level of training**

   4.1.3 **Clinical specialty**

   4.1.4 **Age**
4.1.5 Time since graduation (or years in practice)

4.2 Characteristics of participating patients

4.2.1 Clinical problem

4.2.2 Other patient characteristics
   a) Age
   b) Gender
   c) Ethnicity
   d) Other (specify)

4.2.3 Number of patients included in the study
   a) Episodes of care
   b) Patients
   c) Providers
   d) Practices
   e) Hospitals
   f) Communities or regions

5. Setting

5.1 Reimbursement system

5.2 Location of care

5.3 Academic status

5.4 Country

5.5 Proportion of eligible providers (or allocation units)

6. Methods

6.1 Unit of allocation

6.2 Unit of analysis

6.3 Power calculation

6.4 'Risk of bias' assessment
   (If the trial is an ITS go directly to 6.4.2 for the 'Risk of bias' assessment)

6.4.1 Risk of bias assessment for randomised controlled trials (RCTs), controlled clinical trials (CCTs) and controlled before and after studies (CBAs)
   a) Was the allocation sequence adequately generated? (cut and paste from the paper verbatim)
<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If a random component in the sequence generation process is described (e.g. referring to a random numbers table)</td>
</tr>
<tr>
<td>NO</td>
<td>If a non-random method is used (e.g. performed by date of submission)</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
</tr>
</tbody>
</table>

b) Was the allocation adequately concealed?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If the unit of allocation was by institution, team or professional and allocation was performed at all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some kind of centralised randomisation scheme; an on-site computer system or if sealed opaque envelopes were used</td>
</tr>
<tr>
<td>NO</td>
<td>If none of the above mentioned methods were used (or if a CBA)</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
</tr>
</tbody>
</table>

c) Were baseline outcome measurements similar?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups</td>
</tr>
<tr>
<td>NO</td>
<td>If important differences were present and not adjusted for in analysis**</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If RCTs have no baseline measure of outcome**</td>
</tr>
</tbody>
</table>

d) Were baseline characteristics similar?
<table>
<thead>
<tr>
<th>Score</th>
<th>If baseline characteristics of the study and control providers are reported and similar</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>If there is no report of characteristics in the text or tables or if there are differences between control and intervention providers</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If it is not clear in the paper (e.g. characteristics are mentioned in the text but no data were presented)</td>
</tr>
</tbody>
</table>

e) Were incomplete outcome data adequately addressed?

<table>
<thead>
<tr>
<th>Score</th>
<th>If missing outcome variables were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and the control group, or the proportion of missing data was less than the effect size, i.e. unlikely to overturn the study results)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>If missing data were likely to bias the results</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper (do not assume 100% follow-up unless stated explicitly)</td>
</tr>
</tbody>
</table>

f) Was knowledge of the allocated interventions adequately addressed?*

<table>
<thead>
<tr>
<th>Score</th>
<th>If the authors state explicitly that primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>If the outcomes were not assessed blindly</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
</tr>
</tbody>
</table>

g) Was the study adequately protected against contamination?

---

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<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If allocation was by community, institution or practice and it is unlikely that the control group received the intervention</td>
</tr>
<tr>
<td>NO</td>
<td>If it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised)</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians within practices were allocated to intervention or control)</td>
</tr>
</tbody>
</table>

**h) Was the study free from selective outcome reporting?**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section)</td>
</tr>
<tr>
<td>NO</td>
<td>If some important outcomes are subsequently omitted from the results</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
</tr>
</tbody>
</table>

**i) Was the study free from other risks of bias?**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If no evidence of other risks of bias</td>
</tr>
<tr>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>UNCLEAR</td>
<td></td>
</tr>
</tbody>
</table>

* If some primary outcomes were imbalanced at baseline, assessed blindly or affected by missing data and others were not, each primary outcome can be scored separately.

**If 'UNCLEAR' or 'No', but there are sufficient data in the paper to do an adjusted analysis (e.g. baseline adjustment analysis or intention-to-treat analysis) the criteria should be re-scored to 'Yes'.

6.4.2 Risk of bias assessment for interrupted time series (ITS) designs
Note: If the ITS study has ignored secular (trend) changes and performed a simple t-test of the pre versus post intervention periods without further justification, the study should not be included in the review unless reanalysis is possible.

a) Was the intervention independent of other changes? (cut and paste from the paper verbatim)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If there are compelling arguments that the intervention occurred independently of other changes over time and the outcome was not influenced by other confounding variables/historic events during study period</td>
</tr>
<tr>
<td>NO</td>
<td>If reported that intervention was not independent of other changes in time</td>
</tr>
<tr>
<td>NO</td>
<td>If events/variables identified, note what they are</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
</tr>
</tbody>
</table>

b) Was the shape of the intervention effects pre-specified?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If point of analysis is the point of intervention OR a rational explanation for the shape of intervention effect was given by the author(s). Where appropriate, this should include an explanation if the point of analysis is NOT the point of intervention</td>
</tr>
<tr>
<td>NO</td>
<td>If it is clear that the condition above is not met</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
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</tbody>
</table>

c) Was the intervention unlikely to affect data collection?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>If reported that intervention itself was unlikely to affect data collection (for example, sources and methods of data collection were the same before and after the intervention)</td>
</tr>
<tr>
<td>NO</td>
<td>If the intervention itself was likely to affect data collection (for example, any change in source or method of data collection reported)</td>
</tr>
</tbody>
</table>
(Continued)

<table>
<thead>
<tr>
<th>Score</th>
<th>If not stated in the paper</th>
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<td>UNCLEAR</td>
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**d) Was knowledge of the allocated interventions adequately prevented during the study?***

<table>
<thead>
<tr>
<th>Score</th>
<th>If not stated in the paper</th>
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<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors</td>
</tr>
<tr>
<td>NO</td>
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<tr>
<td></td>
<td>If the outcomes were not assessed blindly</td>
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<tr>
<td>UNCLEAR</td>
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<td>If not specified in the paper</td>
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</tbody>
</table>

**e) Were incomplete outcome data adequately addressed?***

<table>
<thead>
<tr>
<th>Score</th>
<th>If not stated in the paper</th>
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<tbody>
<tr>
<td>YES</td>
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<tr>
<td></td>
<td>If missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the pre- and post-intervention periods or the proportion of missing data was less than the effect size, i.e. unlikely to overturn the study result)</td>
</tr>
<tr>
<td>NO</td>
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<tr>
<td></td>
<td>If missing data were likely to bias the results</td>
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<tr>
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<td>If not specified in the paper (do not assume 100% follow-up unless stated explicitly)</td>
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</table>

**f) Was the study free from selective outcome reporting?**

---

*Effectiveness of organisational infrastructures to promote evidence-based nursing practice (Review)*

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<table>
<thead>
<tr>
<th>Score</th>
<th>If there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
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<tr>
<td>NO</td>
<td>If some important outcomes are subsequently omitted from the results</td>
</tr>
<tr>
<td>UNCLEAR</td>
<td>If not specified in the paper</td>
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**g) Was the study free from other risks of bias?**

<table>
<thead>
<tr>
<th>Score</th>
<th>If no evidence of other risks of bias, e.g. should consider if seasonality is an issue (i.e. if January to June comprises the pre-intervention period and July to December the post, could the 'seasons' have caused a spurious effect)</th>
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<tbody>
<tr>
<td>YES</td>
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<tr>
<td>NO</td>
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</table>

*** If some primary outcomes were assessed blindly or affected by missing data and others were not, each primary outcome can be scored separately.

6.5 Consumer involvement
6.6 Funding
6.7 Conflict of interest

7. **Prospective identification by investigators of barriers to change**

8. **Intervention**

8.1 **Description of the intervention** (cut and paste from paper verbatim):

8.2 **Recipient**

8.3 **Timing**
   a) Frequency/number of events
   b) Duration of the intervention

9. **Outcomes**

9.1 **Description of the main outcome measure(s).**
a) Healthcare organisational change (e.g. organisational performance)
b) Health professional behaviour
c) Patient outcomes-
c) Economic variables (only if reported)
- Costs of the intervention

- Changes in direct healthcare costs as a result of the intervention

- Changes in non-healthcare costs as a result of the intervention

- Costs associated with the intervention are linked with provider or patient outcomes in an economic evaluation

9.2 **Length of post intervention follow-up period**

9.3 **Identify a possible ceiling effect**

a) Identified by investigator
b) Identified by review author

10. **Results** (use extra page if necessary)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention</th>
<th>Control</th>
<th>Diff (%)</th>
<th>P value</th>
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Cochrane Effective Practice and Organisation of Care Group
Institute of Population Health, University of Ottawa
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Ottawa, Ontario K1N 6N5
Tel: +1 613 562 5800 x2361
Fax: +1 613 562 5659
Email: al.mayhew@uottawa.ca
**WHAT'S NEW**

Last assessed as up-to-date: 7 March 2011.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 January 2012</td>
<td>New citation required but conclusions have not changed</td>
<td>New authors, other revisions as described above.</td>
</tr>
<tr>
<td>6 October 2011</td>
<td>New search has been performed</td>
<td>A new search strategy was developed. We used revised methods of the Cochrane Effective Practice and Organisation of Care (EPOC) Group to assess the risk of bias of included studies. We expanded the search to include Latin and Ibero-American databases</td>
</tr>
</tbody>
</table>

**HISTORY**


Review first published: Issue 4, 2003

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
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<tbody>
<tr>
<td>20 October 2008</td>
<td>Amended</td>
<td>Converted to new review format.</td>
</tr>
<tr>
<td>25 August 2003</td>
<td>New citation required and conclusions have changed</td>
<td>Substantive amendment.</td>
</tr>
</tbody>
</table>

**CONTRIBUTIONS OF AUTHORS**

For the present review update the contributions of authors were as follows:

GF sifted the titles and abstracts from the main electronic database search; GF and SS applied the eligibility criteria on selected titles. MR and AB sifted and assessed the titles identified by the searches of the Latin and Ibero-American databases. GF and MR extracted data and assessed the risk of bias of included studies. GF drafted the review and all review authors read and commented on drafts and the final version.

For the previous version of the review the contributions of authors were as follows:

DF had the initial idea and obtained funding from the National Health Service (NHS) Research and Development programme. DF and NC conducted the review and co-wrote the final report and Cochrane review using Review Manager software.
DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources
- Oxford Brookes University, UK.
- Portsmouth NHS R&D Consortium, UK.
- Oxford NHS R&D Consortium, UK.

External sources
- NHS Executive, UK.
- NIHR Cochrane EPOC Programme Grant, UK.

INDEX TERMS

Medical Subject Headings (MeSH)
*Efficiency, Organizational; Evidence-Based Nursing [*methods]; Nursing Care [*standards]; Outcome and Process Assessment (Health Care) [standards]; Pressure Ulcer [prevention & control]

MeSH check words
Humans