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Effectiveness of management
approaches and organisational factors
on nurse staffing sensitive outcomes

Authors: Michael Simon, Jane Ball, Jonathan Drennan, Jeremy Jones, Alejandra Recio-Saucedo, Peter Griffiths.

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Abbreviations & Glossary

AUKUH	Association of UK University Hospitals
AUS	Australia
BA	Before and after study without control
CAN	Canada
CBA	Controlled before and after study
CS	Cross-sectional study
ITS	Interrupted time series
Magnet	'Magnet' organisations are recognized for nursing excellence by the American Nurses Credentialing Center
Management approach	An explicit and defined management measure, intervention or practice as opposed to passive characteristics like leadership styles.
Nurse staffing	The size and skill mix of the nursing team on hospital wards, relative to the number of patients cared for expressed as nursing hours per patient day, patients per nurse or an equivalent measure
Nursing team	The group of workers delivering 'hands on' nursing care on wards (including 'basic' care to meet patients fundamental needs and technical care, including aspects of care generally undertaken only by registered staff, such as medication administration).
NWI	Nursing Work Index
PES	Practice Environment Scale
RAFAELA	A patient classification system owned by the Association of Finnish Local and Regional Authorities
Skill mix	The composition of the nursing team in terms of qualification and experience.
UK	United Kingdom
US	United States

Executive Summary

Introduction

The National Institute for Health and Care Excellence (NICE) has been asked by the Department of Health and NHS England to develop an evidence-based guideline on safe and efficient staffing in acute adult inpatient wards. This review investigates the effectiveness of management approaches and organisational factors to provide safe nurse and healthcare assistant staffing in acute care hospitals.

This review is the second of two reviews to inform the safe staffing guideline. The first review investigated three broad questions 1) which patient safety outcomes are associated with nurse and healthcare assistant staffing levels and skill mix 2) how the ward environment, including physical layout and diversity of clinical disciplines, affect safe staffing requirements and 3) what patient factors affect nurse and healthcare assistant staffing requirements at different times during the day.

The second review aims to explore evidence to inform guidance related to the following two sets of questions, as set out in the scope (NICE, 2013).

1. What management approaches affect nurse and healthcare assistant staffing requirements?
 - a. What nursing staff supervisory approaches and/or team management approaches are required? As supervisory approaches the following are considered:
 - i. Supervisory ward staff
 - ii. Leadership approaches
 - iii. Systems of organising nursing work
 - b. What approaches for identifying required nurse staffing levels and skills mix are effective, and how frequently should they be used?
2. What organisational factors influence staffing at a ward level? This includes:
 - a. Management structures and approaches
 - b. Organisational culture

- c. Organisational policies and procedures, including staff training

Methods

We used the same search strategy as for review 1 (Griffiths et al., 2014) where the association of nurse and healthcare assistant staffing from 1993 to present were investigated.

We aimed to identify relevant primary research and economic analyses. For both questions we considered research testing the effectiveness of managerial approaches or organisational factors on either staffing requirements or a pre-defined set of patient and nurse outcomes. We conducted an extensive search of a wide range of databases identifying 12146 items to screen. To this we added potentially relevant literature from existing reviews and personal libraries in the topic area from the research team.

In total 19 primary studies that met the inclusion criteria were identified. No economic analysis was identified. Studies were critically appraised using an adapted version of the NICE quality appraisal checklist for quantitative intervention studies (NICE, 2012). For each criteria a rating of ++ (indicating that the method was likely to minimise bias) + (indicating a lack of clarity or a method that may not address all potential bias) or – (where significant sources of bias may arise) was assigned. Ratings were summarised to give an overall rating of ++ (most criteria fulfilled / conclusions very unlikely to alter) + (some criteria fulfilled, conclusions unlikely to alter) – (few criteria fulfilled, conclusions likely to alter). Studies were rated for internal / external validity separately. Results were narratively synthesised.

Results

1. What management approaches affect nurse and healthcare assistant staffing requirements?

1.a) nursing staff supervisory approaches and/or team management approaches

Two studies were identified that explored the association between the introduction of a new supervisory post (Bender et al., 2012 [ITS, -/-, US], Burritt et al., 2007 [BA, -/-, US]) and patient and staff outcomes. The introduction of a new supervisory post was associated with improved patient satisfaction with nursing care (Bender et al. 2012, $r = .63$, $p = 0.02$), a

reduction in falls (Burritt et al., 2007, -20%, ns) pressure ulcers (Burritt et al., 2007, -38%, $p=0.02$) and increased job satisfaction of staff (Burritt et al., 2007, +5.5%, ns).

Two studies that explored models of nursing care delivery (Barkell et al., 2002 [BA, -/-, US], Wells et al., 2011 [BA, -/-, CAN]) that changed from a team nursing model (where a team of nurses with different skill levels care for a group of patients) to one that incorporated a total patient care model (where a group of patients is assigned to a nurse who delivers all necessary care) found no significant differences in patient satisfaction, urinary tract infections, pneumonia or levels of job satisfaction.

Two studies explored a change from a total patient care model to a team based approach (Fairbrother et al., 2010 [CBA, -/-, AUS], Tran et al., 2010 [CBA, -/-, AUS]). Fairbrother et al. (2010 [CBA, -/-, AUS]) reported significantly higher levels of extrinsic job satisfaction of the team based approach to care over a total patient care approach ($F 5.4$, $p<0.005$); however Tran et al. (2010 [CBA, -/-, AUS]) reported no statistically significant difference between a team based approach to the delivery of nursing care and job satisfaction.

One study (Dubois et al., 2013 [CS, -/+, CAN]), found that the risk of experiencing any event with consequences (medication administration errors, falls, pneumonia, urinary tract infection, unjustified restraints and pressure ulcers) was significantly lower (OR=0.477, 95%-CI 0.25-0.91) in clinical areas with professional models of care characterised by higher nurse skill levels and staffing levels to those with functional models.

One study (Kovner et al., 1994 [CBA, -/+, US]) that explored mixed interventions (reorganisations, case management, shared governance, computerisation, education) on the delivery of care, reported that the interventions, taken as a whole, improved the job satisfaction with professional interaction ($p<0.05$) but not other aspects of job satisfaction.

1.b) effectiveness of approaches for identifying required nurse staffing levels and skills mix

One study (Twigg et al., 2011 [BA, -/+, AUS]) demonstrated that the introduction of a nursing hours per patient day staffing method reduced some adverse patient outcomes (CNS complications on surgical wards RR 0.46 (95%-CI: 0.23, 0.92), pneumonia on surgical wards RR 0.83 (95%-CI: 0.70, 0.99), gastrointestinal bleeds on surgical wards RR 0.63 (95%-

CI: 0.43, 0.92), and mortality). There is no evidence on how frequently the method should be used. We found no evidence about the effectiveness of other methods.

2.) What organizational factors influence staffing at a ward level?

2.a & b) Management structures/procedures and organisational culture

Three of four studies (Aiken et al., 2008 [BA, -/- , UK], $p=0.008$, Kelly et al., 2011 [CS, -/++ , US], $p<0.05$, Lacey et al., 2007 [CS, -/+, US], $p<0.001$) found nurses were more satisfied with their job in Magnet hospitals, which are recognised for nursing excellence and innovations in professional practice, while one study (Hess et al., 2011 [CS, -/-, US]) did not confirm this difference.

Two studies (Kelly et al., 2011 [CS, -/++ , US], $p<0.05$, Lacey et al., 2007 [CS, -/+, US], $p<0.001$) found lower nurse burnout in Magnet hospitals than in Non-Magnet organisations, but this was not confirmed by the study of Aiken et al. (2008 [BA, -/-, UK]) which found no association. The same three studies found nurses were less likely to intend to leave their jobs in Magnet hospitals than non-recognised hospitals. Of these studies, only one (Kelly et al., 2011 [CS, -/++ , US],) presented an analysis that controlled for the possible confounding effect of overall staffing levels.

We found three studies comparing Magnet vs. Non-Magnet hospitals and nurse sensitive patient care outcomes and controlling for staffing levels. Lake et al. (2010 [CS, -/++ , US]) found lower rates of falls ($p<0.01$), Goode et al. (2011 [CS, -/+, US]) found lower rates of pressure ulcers ($p<0.10$), and Kalisch and Lee (2012 [CS, -/+, US]) found lower amounts of nurse reported missed care ($p<0.05$) in Magnet hospitals.

However, Goode et al. (2011 [CS, -/+, US]) also found no significant differences for heart failure mortality and failure to rescue, and higher rates of postoperative sepsis and metabolic derangement ($p<0.05$) in Magnet hospitals.

2.c) Organisational policies and procedures, including staff training

One study (Kooker and Kamikawa, 2011 [ITS, -/-, US]) that assessed the effect of a staff training intervention focused on nurse retention and found improved staff retention (no test of significance) and job satisfaction (no test of significance) after the introduction of the programme.

McGillis Hall et al. (2008 [BA, -/+, CAN]) tested a workplace change programme to improve resource availability only finding improved nurse ratings for the quality of work ($p=0.02$), but not for four patient reported outcomes including patient perceived hospital quality and five nurse-reported outcomes including job satisfaction.

Kalisch et al. (2013 [BA, -/-, US]) investigated crew resource management training and found decreased nurse reported missed care ($p=0.029$) and improved teamwork ($p= 0.001$).

Discussion

The introduction of supervisory roles showed positive results for staff and patients in two studies (Bender et al., 2012 [ITS, -/-, US], Burritt et al., 2007 [BA, -/-, US]). However both studies were weak in terms of their internal and external validity and therefore stronger evidence is needed. Future research should address these areas to improve the strength of the evidence: in order to assess the effect of additional supervisory staff a more comprehensive assessment of the ward management is required including the model of care and the staffing structure including the skill mix. In order to assess the effect of a ward level measure like supervisory staff, multi-site research is needed.

Results on different models of nursing care organisation were inconclusive, some showing positive effects for staff and patients (Dubois et al., 2013 [CS, -/+, CAN], Tran et al., 2010 [CBA, -/-, AUS]), while other not supporting an improvement in staff satisfaction (Fairbrother et al., 2010 [CBA, -/-, AUS]). Again the validity of the research is weak making it problematic to draw conclusions, and requires additional research to understand the impact on patients and staff.

At the heart of the consideration of safe nurse and healthcare assistant staffing should be research about the effectiveness of staffing methods, which is very rare. We found one Australian study investigating the effectiveness of a staffing method (Twigg et al., 2011 [BA,

-/+ , AUS]) which showed benefits from the NHPPD method. There is no evidence for the effect on nurse sensitive patient or staff outcomes by other approaches to determining nursing staff requirements. Future research should target the development and testing of effective staffing methods.

We identified several studies on the effectiveness of management structures and organisational culture in the context of the assessment of the ANCC Magnet programme. The underlying organisational principles of transformational leadership, structural empowerment, exemplary professional practice, new knowledge, innovations, and improvements are not exclusive to the organisation of nursing care. However, the evidence suggests that these are important elements to create supportive work environments for nurses, which are also associated with improved patient outcomes. The experience of Rochdale Infirmary (Aiken et al., 2008 [BA, -/- , UK]) shows that acute care trusts can apply Magnet principles, however more research is needed to transfer these principles and specific practices associated with 'Magnet' to the NHS.

Finally we identified a few studies that used different training programmes (e.g. crew resource training) to improve patient and/or staff outcomes (Kalisch et al., 2013 [BA, -/-, US], Kooker and Kamikawa, 2011 [ITS, -/-, US]). The studies were weak in terms of internal and external validity and therefore the full assessment of the value of these programmes need further research. However, these studies do show potential for improving nursing services.

We identified no studies evaluating 'Lean' type approaches (for example the 'Productive Ward') to improve the efficiency of nursing practice through the systematic analysis and elimination of non-productive care activities in order to 'release time to care'. A recent systematic review of this topic confirms this. While evidence of improvements in proportion of time in direct care, nurse sensitive indicators including falls and missed care is widely cited, the quality of the evidence base can be best described as 'anecdotal' with little if any formal research / evaluation of programme outcomes (Wright and McSherry, 2013).

Conclusions & recommendations

The evidence identified in this review does not provide a 'silver bullet' to support nurse staffing decisions in acute care hospitals. There is some evidence supporting additional

supervisory roles, organisational practices that are recognised by the Magnet programme (including active involvement in nurse sensitive outcome benchmarking, active programmes of quality assurance and structures to actively promote the involvement of clinical nurses in the setting of hospital policies and governance) as well as staff training. However more research is needed to gain more certainty over the effects of these measures. This should include:

- Research targeting the effectiveness of staffing methodology
- Research on the implementation of staffing methodologies as well as any other measures to support safe staffing
- Research in the complex intervention framework to support reproducibility of interventions

Introduction

Context of this review

Identifying safe approaches to nurse staffing in hospital wards is a key challenge for health service providers. Recent inquiries, including the Keogh review into the quality of care and treatment provided by 14 hospital trusts in England and the inquiries into the Mid Staffordshire NHS Trust have highlighted the role of poor staffing levels on wards in deficits in care leading to excess mortality rates and poor patient experience (Keogh, 2013, The Mid Staffordshire NHS Foundation Trust Inquiry and Chaired by Robert Francis QC, 2010, The Mid Staffordshire NHS Foundation Trust Public Inquiry Chaired by Robert Francis QC, 2013). Safe nurse staffing requires that there are sufficient nurses available to meet patient needs, that the nurses have the required skills and are organised, managed and led in order to enable them to deliver the highest quality care possible.

This review focuses on management approaches and organisational factors that affect nurse and healthcare assistant staffing requirements. Unlike review 1 which investigated the association of nurse staffing and patient outcomes based on observational research, this evidence review assesses the available evidence on the effectiveness of measures to support safe staffing. Such measures include supervisory and leadership approaches, systems to organise nursing work like team or primary nursing and approaches to identify required staffing levels, such as the AUKUH or RAFAELA patient classification tools. The second part of the review summarizes the available evidence on the effectiveness of organisational factors like management structures and approaches, organisational culture or organisational policies, practices and staff training to influence staffing at the ward level.

Management approaches and organisational factors are particularly of interest since they are considered to be one of the mechanisms to provide safe staffing levels either by reducing the demand of staff or to provide necessary health services more efficiently. Ideally one would hope to find studies that directly assess the impact of the suggested managerial approaches as well as organisational factors on nurse staffing requirements. This type of research is rare at best. We therefore will also review studies reporting the effect of these measures and factors on patient and staff outcomes that we identified as associated with nurse and healthcare assistant staffing in review 1.

As with review 1 certain considerations also apply for the managerial or organisational approaches to nurse and healthcare assistant staffing. The determination of safe staffing levels requires that all factors that impact upon staffing requirements are considered. This evidence review also focuses on nurse staffing in general medical and surgical settings in acute care hospitals. However, such settings are unlikely to have uniform demands for nursing care. Patients vary in the nature, extent and the urgency of their need for nursing care. In addition, non-patient factors may significantly impact upon the workload of nurses including the number of admissions and discharges and the physical layout of the ward.

The National Institute for Health and Care Excellence (NICE) has been asked by the Department of Health and NHS England to develop an evidence-based guideline on safe and efficient staffing in acute adult inpatient wards. The Francis report on Mid Staffordshire and the Berwick report on improving the safety of patients in England both identified NICE as a lead organisation in developing advice on NHS staffing levels. The Berwick report stated:

- ‘NICE should interrogate the available evidence for establishing what all types of NHS services require in terms of staff numbers and skill mix to ensure safe, high quality care for patients’ (Berwick, 2013).

Overall, this review is intended to identify the evidence that will help determine the most effective and efficient balance of nursing and support staff to achieve patient safety outcomes.

Aims and objectives of the review

This review is the second of two to inform the safer staffing guideline for acute adult inpatient wards. It aims to explore evidence to inform guidance related to the following two groups of questions, set out in the scope.

1. What management approaches affect nurse and healthcare assistant staffing requirements?
 - a. What nursing staff supervisory approaches and/or team management approaches are required? As supervisory approaches the following are considered:

- i. Supervisory ward staff
 - ii. Leadership approaches
 - iii. Systems of organising nursing work
 - b. What approaches for identifying required nurse staffing levels and skills mix are effective, and how frequently should they be used?
2. What organisational factors influence staffing at a ward level? This includes:
- a. Management structures and approaches
 - b. Organisational culture
 - c. Organisational policies and procedures, including staff training

Operational definitions

Below we outline our operational definitions of the terms ‘management approach’, ‘nurse staffing’, ‘nursing team’ and ‘skill mix’.

Management approach: an explicit and defined management measure, intervention or practice as opposed to passive characteristics like leadership styles. This does not preclude active changes to leadership styles, but these are rarely considered in empirical research

Nurse staffing: the size and skill mix of the nursing team on hospital wards, relative to the number of patients cared for expressed as nursing hours per patient day, patients per nurse or an equivalent measure.

Nursing team: the group of workers delivering ‘hands on’ nursing care on wards (including ‘basic’ care to meet patients’ fundamental needs and technical care, including aspects of care generally undertaken only by registered staff, such as medication administration). This would include all necessary administrative assessment and planning work (e.g. documentation, discharge planning). Members of the nursing team may include both registered nurses and unregistered support workers or assistants, regardless of job titles.

Skill mix: the composition of the nursing team in terms of qualification and experience. This is typically expressed as a ratio of registered to unregistered staff but may encompass other measures of skill mix.

Identification of possible equality and equity issues

Underlying all questions about the delivery of health care are possible questions about equity and equality in terms of access to services, differential outcomes and representation within the research base. Once patients are admitted to hospital these issues are likely to manifest themselves on a micro level – in the interactions between staff or patients. It is clear that some patient groups, for example older people and those with cognitive impairment, may be significantly more vulnerable than others if determination of safe staffing is not based upon objective assessment of need. The nature of the service being evaluated – ward-based nursing care – which is universally accessed by patients admitted to hospital, limits our ability to explore these issues. By focussing on care delivered to all patients in general care settings, including those delivering care to older people and identifying the factors influencing safe staffing, this review aims to provide an overview of all the available evidence, but cannot compensate for omissions in that evidence.

Methodology

Because of the compressed time frame and the large and diverse evidence base we agreed a number of strategies with NICE for this review. We used the same single, broad search for evidence used for review 1, as the main source for this review. The search strategy is based on the comprehensive searching undertaken for Kane's (2007) systematic review of nurse staffing to identify primary studies of the effectiveness of management approaches and organisational factors.

To organise the literature in this broad area, which is replete with descriptive research and research describing associations at a hospital level, we agreed with NICE to focus the review on studies assessing the effectiveness of the following outcomes established as potentially sensitive to ward nursing in review 1 (falls, infections, pressure ulcers, medication errors, missed care and patient experiences of nursing) or which are directly measured on ward nursing staff (e.g. satisfaction):

1. Staff supervisory approaches (ward level),
2. Systems of organising work at a ward level
3. Explicit organisational practices or interventions designed to change organisational culture organisational policies and procedures, including staff training
4. Approaches to determine staffing levels and skill mix at a ward level

Literature search and abstract appraisal

The review considered studies from 1993 and onwards. We aimed to identify relevant review papers, primary research and economic analyses. Two different search approaches were taken.

For the time period before 2006 we screened the 96 primary research studies included in the systematic review by Kane et al. (2007), which conducted a comprehensive search of relevant primary studies until 2006 and applied broader inclusion criteria than ours.

For the period from 2006 to the end of January 2014 we searched all of the following databases to identify more recent primary research, reviews and economic studies.

- CEA registry
- CDSR
- CENTRAL
- CINAHL
- DARE
- Econlit
- Embase
- HTA database
- Medline including In-Process
- NHS EED
- HEED

In addition, we searched the Cochrane databases (CDSR, Central, DARE, HTA database) from 1993-2006 to identify other relevant reviews and additional primary research not considered by Kane et al. and undertook hand-searching of volumes of Medical Care,

Journal of Nursing Administration and the International Journal of Nursing Studies (2010-present). See Appendix A for search strategies.

These searches resulted in a total of 12146 items to screen after removing duplicates, including 9268¹ from database searches from 2006 onwards, 966 from Cochrane database searches pre 2006 and 2162 references from journals to be hand searched. These were exported into an EndNote database for further processing.

Additional potentially relevant sources (primary studies, reviews and economic studies) were also identified from the following:

1. Search of existing project databases held by team members
2. Potentially relevant references supplied by the NICE team
3. Backwards and forwards citation searching on key included studies (no unique material identified)
4. Contact with topic experts from Belgium, England, USA, Australia and Canada studies (no unique material identified)

These yielded an additional 69 potential sources that were merged into the database after initial (title / abstract) screening along with the 96 primary studies from the Kane review.

Screening – title and abstracts

Three reviewers screened the project database for potentially relevant references. Patently irrelevant material was excluded rapidly, leaving 388 items for more detailed consideration (Figure 1). These items were subjected to a more detailed second stage screen using a checklist covering the following major inclusion / exclusion criteria that could be readily verified against title / abstract:

- Studies of the effectiveness of management approaches or organisational factors on patient outcomes sensitive to nurse staffing (falls, infections, pressure ulcers,

¹ Figure after removing duplicates across databases

medication errors, missed care and patient experiences of nursing) or staffing requirements

AND

- General surgical, medical or mixed (medical-surgical) patient settings
- From 1993 onwards

AND (one or more of)

- Randomized or non-randomized controlled trials
 - Prospective or retrospective observational study
 - Before and after studies
 - Cross-sectional or correlational study
 - Interrupted time-series
 - Economic analysis

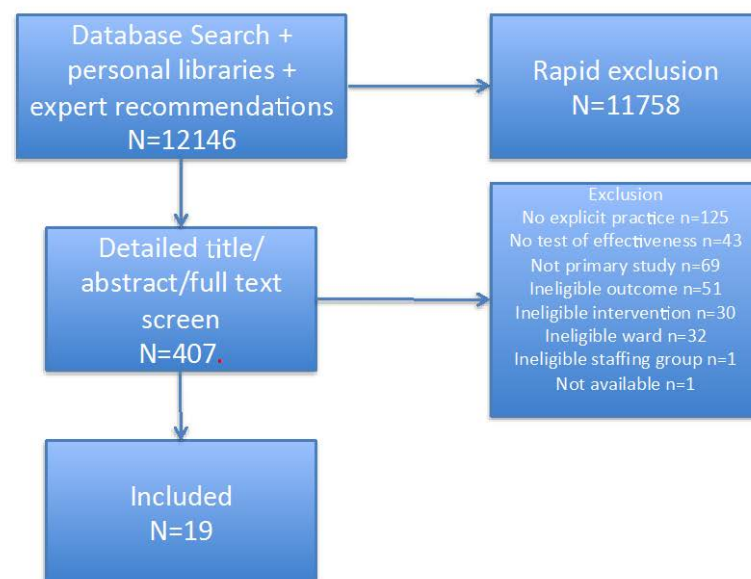
Exclusion criteria:

- Studies exclusively in intensive care, maternity, paediatric or mental health wards; out patients or long-term care
- General discussion / news articles with no empirical data or substantial literature review

At both stages of screening, a second reviewer screened samples of papers in order to check consistency. In case of disagreement the paper was discussed with a third reviewer and processed accordingly.

For all questions both published and unpublished literature, which is publicly available including, papers in press (“academic in confidence”) were considered. Only studies in English were considered. Potentially eligible papers went forward to full paper retrieval / appraisal.

Figure 1 selection of studies



Retrieval of data and full paper appraisal

Full paper appraisal was done by using a checklist based on the detailed inclusion / exclusion criteria. Initially a single reviewer assessed against inclusion / exclusion criteria and abstracted data from included papers. A second reviewer screened all papers independently with no disagreements identified. Subsequently, a second reviewer verified all decisions and checked data extractions. In the event of disagreement, where the first reviewer agreed that the decision was erroneous based on oversight of factual information, the decision was changed. Where disagreement persisted or there was uncertainty a third reviewer was consulted and disagreements were resolved by consensus. See appendix B for included studies and C for excluded (with reasons). In total 19 papers were included (Figure 1).

Selection of studies for inclusion

We applied the following criteria to select studies for all review questions.

Inclusion criteria:

- Randomized or non-randomized controlled trial
- Prospective or retrospective observational study
- Cross-sectional or correlational study
- Interrupted time-series
- Before and after studies
- From 1993 onwards

Exclusion criteria:

- Intensive, maternity, paediatric or mental health wards
- Outpatients and long-term care
- Non-specific (global) nurse reports of care quality

We considered only patient outcomes, which we identified in review 1 as potentially sensitive to and indicative of safe nurse staffing:

- Falls
- Hospital associated infections
- Pressure ulcers
- Medication errors
- Missed care
- Patient experiences of nursing

Additionally the following nurse outcomes were considered:

- Job satisfaction
- Leaving intentions
- Actual leaving
- Well-being/burnout

For question 1 we included 9 primary studies. For question 2 we included 10 primary studies. Although studies on the cost of the different approaches of interest were considered, we did not find studies with a sufficiently detailed cost analysis to consider them as economic studies or that have not been discussed already in review 1 (see Twigg et al., 2013). While studies like Burritt et al. (2007) and Kooker and Kamikawa (2011) briefly discuss costs little information is given to allow for further scrutiny.

Quality assessment

We found two broad categories of studies that were eligible for this review: either before and after studies (question 1) or cross-sectional, correlational studies (question 2). We adapted the NICE quality appraisal checklist for studies of effectiveness for development of NICE public health guidance (NICE, 2012, see appendix D of this report for an example).

We adapted the prompts and major categories to fit the core quality issues relevant to the study questions at hand. To address the limited strength of the evidence of before and after studies without control or cross-sectional, correlational studies, we categorised these studies with low (-) internal validity.

For each criteria, a rating of ++ (indicating that the method was likely to minimise bias) + (indicating a lack of clarity or a method that may not address all potential bias) or – (where significant sources of bias may arise) was assigned. Ratings were summarised to give an overall rating of ++ (most criteria fulfilled / conclusions very unlikely to alter), + (some criteria fulfilled, conclusions unlikely to alter), – (few criteria fulfilled, conclusions likely to alter). Studies were rated for internal / external validity² separately. We used the same checklist to summarise and appraise features of all studies that we included.

Individual reviewers undertook quality assessments with checking by a second reviewer with disagreements resolved by consensus. A 10% sample of bias assessments were undertaken independently with no disagreements identified in overall ratings.

Methods of data extraction

Data was extracted into Excel forms that included the initial screening criteria that were applied to all (full text) papers that were assessed. The content of the form was designed to gather data relevant to bias assessment and evidence tables (methods for development of

² Items to assess internal validity related primarily to the design of the study. If a study is internally valid it is likely that the results and statistical conclusions accurately reflect associations between variables of interest in the observed groups. Items to assess external validity related primarily to the setting and sample and the extent to which there can be confidence that results will generalise to medical and surgical wards more widely.

NICE public health guidance). Evidence tables for each included study are presented in a separate document called 'Evidence Tables'.

Synthesis and presentation

The results of the data extraction and quality assessment for each question are presented in a narrative summary. For questions 1.a and 2.a/b results are combined in a summary table showing the major relationships and overall quality assessments.

1. What management approaches affect nurse and healthcare assistant staffing requirements?

1.a) nursing staff supervisory approaches and/or team management approaches

Introduction

The following supervisory / team management approaches are considered: supervisory ward staff, leadership approaches, systems of organising nursing work. We found eight eligible studies. Details of these studies are given in the accompanying evidence tables (Appendix E). The studies were categorised according to their principal focus:

1. 5 studies examined models of organising the nursing care delivery team in wards (Barkell et al., 2002, Fairbrother et al., 2010, Tran et al., 2010 [CBA, -/-, AUS], Wells et al., 2011, Dubois et al., 2013) (table 1 – ‘care model’)
2. 2 studies focussed on new supervisory/leadership roles (Bender et al., 2012, Burritt et al., 2007) (table 1 – ‘role’)
3. 1 study examined multiple innovations/changes including care models and new roles (Kovner et al., 1994) (table 1 – ‘multiple’).

Seven of the studies were a form of ‘before and after’, with one of these using an interrupted time series design (Bender et al., 2012). One study (Dubois et al., 2013) used a cross-sectional correlational design. Of the eight studies identified, four included a comparator/control but in none of the studies were the controls carefully matched on potential confounders. Overall, little detail was provided on the comparator units. All studies had significant weakness (rating –) on internal validity, and most of them on external validity except for two studies (Dubois et al., 2013, Kovner et al., 1994)

None of the studies were undertaken in the UK with four from the US, two from Australia and two from Canada (table 1). Whilst all studies were undertaken in what is broadly termed ‘general’ hospital settings, these ranged considerably in size and type from 508 bedded hospital (Barkell et al., 2002) to a 199-bedded academic medical centre (Bender et al., 2012). The majority of the studies were small in scale with the likelihood of being underpowered. Only one study provided power calculations (Dubois et al., 2013). Six of the eight studies were undertaken at single sites.

Table 1. Summary studies of supervisory approaches and/or team management approaches

<i>Study</i>	<i>Intervention</i>	<i>Outcome</i>	<i>Country</i>	<i>Design*</i>	<i>Control</i>	<i>n=</i> <i>(hosp)</i>	<i>n=</i> <i>(units)</i>	<i>Internal</i> <i>validity</i>	<i>External</i> <i>validity</i>
Barkell et al. (2002)	Care model	Pt sat & pt out	US	BA	No	1	1	-	-
Bender et al. (2012)	Role	Pt sat	US	ITS	Yes	1	1	-	-
Burritt et al. (2007)	Role	Pt out & nurse sat	US	BA	No	1	12	-	-
Fairbrother et al. (2010)	Care Model	Nurse sat & vacancy	Aus	CBA	Yes	1	12	-	-
Kovner et al. (1994)	Multiple	Nurse sat	US	CBA	Yes	37	103	-	+
Tran et al. (2010)	Care Model	Nurse sat, stress	Aus	BA	Yes	1	8	-	-
Wells et al. (2011)	Care Model	Nurse sat	Can	BA	No	1	2	-	-
Dubois et al. (2013)	Care model	Pt out	Can	CS	Yes	11	22	-	+

* BA = before and after, CBA = controlled before and after, ITS interrupted time series, CS = cross-sectional

Overview of studies - Role (Supervisory ward staff)

Two US studies assessed the impact of introducing a new role, in effect the introduction of a supervisory ward manager, which aimed to change the model of care delivery.

Bender et al. (2012 [ITS, -/-, US]), using an interrupted time series design with a control, investigated changes following the introduction of two clinical nurses leaders (CNL) to a high acuity unit with the aim of improving care delivery through better coordination and collaboration across the healthcare team. Activities included multiple daily patient rounds and a daily review of patient measures and clinical laboratory results. The control unit was a high-acuity oncology and bone marrow unit, which was similar, but with a lower patient acuity population than the intervention unit.

Patient satisfaction was assessed on both the intervention unit and control unit 10 months prior and 12 months after the intervention was introduced. The introduction of the CNL was found to be correlated with improved patient satisfaction with admission processes (Pearson's $R(r) = +.63$, $p = .02$) and nursing care ($r = +.75$, $p = .004$), including patient perceived skill level of the RN ($r = .83$, $p = .003$) and keeping patients informed ($r = .70$, $p = .003$). There was no significant correlation with patient satisfaction with physician care ($r = .31$, $p = .14$) or discharge processes ($r = .33$, $p = .23$). The control ward showed no significant changes in patient satisfaction measures throughout the study time frame.

Burritt et al. (2007 [BA, -/-, US]) introduced a new role, identified as a 'clinical mentor' on 12 patient care units, including medical-surgical, cardiac care, intensive care, obstetrics, and

emergency services in a single hospital. The new role was introduced to each shift and was responsible for the safety and quality of care delivery and offering 'pro-active oversight' through assessing, monitoring and evaluating care provided by primary nurses, and encouraging reflective practice and role modelling. Clinical mentors were experienced, expert nurses who undertook a week-long education programme to prepare them for their role. In total 34, full-time equivalent posts from a planned 58 were introduced into the 12 units. The plan was for 24 hour per day / 7 day per week coverage but the actual implementation is unclear.

Comparisons were made with outcomes prior to and six months post the intervention. Patient related outcomes measured included falls (per 1,000 patient days), incidence of pressure ulcers, complication rates (% patients who have any complication after admission), length of stay, failure to rescue and economic analysis based on selected outcomes. Nurse related outcomes included job satisfaction. Staffing levels, skill-mix, staffing requirement or workload were not measured or reported.

Before the implementation of the clinical mentor role, actual complication rates were consistently higher (worse) than expected given the acuity of the patient population. After the introduction of the clinical mentors, the rate was lower than expected (change reported as significant at $p < 0.1$). On unadjusted results, a significant reduction in average adverse events occurred post-implementation; it was reported that there was a 20% reduction in falls ($p = 0.06$, 90% CI) and a decrease in pressure ulcers by 38% ($p = 0.02$, 90% CI).

A small improvement on the mean score on each of the subscales and overall composite of the PES-NWI scale, measuring the perceived quality of the nursing practice environment as reported by nurses, was reported (2.89 pre-intervention to 3.05 post-intervention). However, number of cases, sample size and response rates and significance of these results were not reported.

Overview of studies - Systems of Organising Nursing Work

Five studies explored models of organising the nursing care delivery team in wards. These studies explore the effects of differing patterns of assigning patient care to nurses of

different grades and organising / managing the work of nurses in a ward on a shift by shift basis.

Of these, four studies (Barkell et al., 2002 [BA, -/-, US], Fairbrother et al., 2010 [CBA, -/-, AUS], Tran et al., 2010 [CBA, -/-, AUS], Wells et al., 2011 [BA, -/-, CAN]) had significant weaknesses on both internal and external validity. Two studies (Barkell et al., 2002 [BA, -/-, US], Wells et al., 2011 [BA, -/-, CAN]) examined the change from team nursing, where a group of patients are assigned to a group of nurses, to a total patient care model where one nurse is assigned to deliver all the care needs of one patient. Two studies (Barkell et al., 2002 [BA, -/-, US], Wells et al., 2011 [BA, -/-, CAN]), explored a change from individual patient allocation to a team based approach. One study (Dubois et al., 2013 [CS, -/+, CAN]), using a cross-sectional design, explored the association between professional (care delivered by registered nurses) and functional models of nursing care (tasks assigned to grades of staff according to required skill level) and patient outcomes.

Barkell et al. (2002 [BA, -/-, US]) investigated changes following the introduction of a 'total patient care model' in which RNs were responsible for delivering all care to patients. The model of nursing care prior to the intervention involved the RN directing and delegating care activities to a patient care associate (PCA), which is similar to a healthcare assistant. The introduction of the total care model resulted in a change in the role, an increase in the number and proportion of RNs and a decrease in the number of PCAs. Outcome measures included length of stay, the incidence of pneumonia and urinary tract infections (UTIs), patient satisfaction, patients' perceptions of pain, and the frequency of documentation of pain scores.

The introduction of the total patient care model resulted in no significant effect on either patient outcomes (UTIs and pneumonia) or patient satisfaction. Barkell et al. (2002 [BA, -/-, US]) report that the implementation of the model 'did not occur as planned'. The planned increase in numbers (and mix) of registered nurses in the workforce required to deliver the model did not occur because of budgetary constraints. Furthermore the power of the study to detect any change is unclear.

Wells et al. (2011 [BA, -/-, CAN]) implemented a modified total patient care model (with registered nurses co-assigned to licensed practical nurses) and undertook a before and after study comparing outcomes to the previous team nursing approach (details not given). Nurse satisfaction was not significantly different under the total patient care model.

Two studies explored a change of care model in the opposite direction, changing away from individual patient allocation to a team based approach (Fairbrother et al., 2010 [CBA, -/-, AUS], Tran et al., 2010 [CBA, -/-, AUS]).

Fairbrother et al. (2010 [CBA, -/-, AUS]) evaluated a 'new version' of team nursing that divided staff into teams (typically two), but retained principles of patient allocation within the team (each nurse had their own patients but team members had shared responsibility for team progress) in an Australian teaching hospital. An action research approach was used that enabled each ward to modify team nursing to suit the needs of staff in that setting; as a consequence five different models of team nursing were introduced. The structure of the teams and nature of the model (in terms of lines of communication and management within and beyond the team) varied between units and changed during the study as a result of the action research approach used.

Outcome measures included job satisfaction and staff turnover rates. No significant change was found in staff turnover rates. Team nursing wards scored significantly better on 'extrinsic' dimension of job satisfaction compared to total patient care wards (means of 11.3 vs. 12.7, $p=0.005$). Significant improvements in extrinsic job satisfaction before and after the intervention (from 11.3 to 12.4, $p=0.015$) were also identified. There were no significant differences on other two other dimensions of job satisfaction

Tran et al. (2010 [CBA, -/-, AUS]) also assessed the impact of moving from an individual patient allocation model to a team based system, referred to as 'shared care model' and found no significant differences in job satisfaction or stress. Within the shared care (team) group, the only significant difference was a reduction in nurse satisfaction 'with co-workers' following the move to shared care ($p=0.04$), attributed to the challenges associated with new ways of working.

Dubois et al. (2013) explored the relationship between four distinct nursing care organization models (2 professional models and 2 functional models) with six patient safety related outcomes: medication administration errors, falls, pneumonia, urinary tract infection, unjustified restraints, and pressure ulcers in 22 units in six hospitals in Canada. Professional models (innovative professional and basic professional) of nursing were identified as those that employ nurses with high levels of qualifications and provide support for their professional practice. Functional models (adaptive functional and basic functional) were associated with a task allocation approach to the provision of care with registered nurses assigning tasks to less well-educated and less-well qualified members of staff.

Patients' risk of experiencing one adverse event or more or an event with consequence was significantly lower in units with professional models compared to those with functional models. The odds ratios for experiencing at least one event of any severity were lower in units that employed innovative professional (adjusted odds ratio 0.53, 95% CI 0.33–0.84, $p = 0.007$) and basic professional (adjusted odds ratio 0.75 95% CI =0.57–0.99, $p = 0.04$) models when compared to functional models.

Overview of studies - Mixed Innovations

Kovner et al. (1994 [CBA, -/+, US]) aimed to assess the effectiveness of 5 different types of innovation on improving nurse satisfaction in 37 hospitals. Innovations included case management, shared governance, reorganisation of the delivery of care and education. The innovations had been supported by funding across one state in the US with the aim of improving nurse satisfaction in order to help recruitment and retention problems. Although it was a large scale study, the mix of innovations and variety of means of implementation (from single pilot units to hospital wide) and lack of consistent and valid comparators, reduce the confidence in the reliability of the findings. Changes to care delivery models (taken as a whole) were not significantly associated with changes in nurse satisfaction overall but a significant improvement was found on nurse satisfaction with professional interactions ($p < 0.05$).

Summary of studies of supervisory and/or team management approaches

Of the two US studies that assessed the impact of introducing a new role that aimed to change the model of care delivery, one reported improved patient satisfaction following the

implementation of clinical nurse leaders on a high acuity unit (Bender et al., 2012 [ITS, -/-, US]). The other reported a significant reduction in falls and pressure ulcers following the implementation of 34 clinical mentor posts on 12 units (Burritt et al., 2007 [BA, -/-, US]). However, a significant weakness in both studies was the lack of consideration of the effect of the new posts on overall staffing levels.

Of the five studies that explored systems of organising nursing work, in four studies (Barkell et al., 2002 [BA, -/-, US], Fairbrother et al., 2010 [CBA, -/-, AUS], Tran et al., 2010 [CBA, -/-, AUS], Wells et al., 2011 [BA, -/-, CAN]) comparators, where they existed, were not well defined or reported upon. Treatment fidelity was also a recurring weakness in these studies with incomplete or varied implementation of the intervention. There is evidence from one study (Dubois et al., 2013 [CS, -/+, CAN]) that professional models of nursing care are associated with better patient outcomes in relation to medication administration errors, falls, pneumonia, urinary tract infection, unjustified restraints and pressure ulcers.

One complex study reported that the introduction of nurse-related organisational innovations resulted in increased satisfaction in the area of professional satisfaction (Kovner et al., 1994 [CBA, -/+, US]). However, involvement of the researchers in the implementation and evaluation of this study introduces potential bias and also resulted in the intervention units having had regular external input (through discussion groups and interviews) not afforded to the comparator groups, and not present prior to the innovation being studied (which may have had an effect on nurse satisfaction).

Evidence statement - Role (Supervisory ward staff) Work

Two studies were identified that explored the association between the introduction of a new supervisory post (Bender et al., 2012 [ITS, -/-, US], Burritt et al., 2007 [BA, -/-, US]) and patient and staff outcomes. The introduction of a new supervisory post was associated with improved patient satisfaction with nursing care (Bender et al. 2012, $r = .63$, $p = 0.02$), a reduction in falls (Burritt et. al., 2007, -20%, ns) pressure ulcers (Burritt et. al., 2007, -38%, $p = 0.02$) and increased job satisfaction of staff (Burritt et. al., 2007, +5.5%, ns).

Evidence statement - Systems of Organising Nursing Work

Two studies that explored models of nursing care delivery (Barkell et al., 2002 [BA, -/-, US], Wells et al., 2011 [BA, -/-, CAN]) that changed from a team nursing model (where a team of nurses with different skill levels care for a group of patients) to one that incorporated a total patient care model (where a group of patients is assigned to a nurse who delivers all necessary care) found no significant differences in patient satisfaction, urinary tract infections, pneumonia or levels of job satisfaction.

Two studies explored a change from a total patient care model to a team based approach (Fairbrother et al., 2010 [CBA, -/-, AUS], Tran et al., 2010 [CBA, -/-, AUS]). Fairbrother et al. (2010 [CBA, -/-, AUS]) reported significantly higher levels of extrinsic job satisfaction of the team based approach to care over a total patient care approach ($F 5.4, p < 0.005$); however Tran et al. (2010 [CBA, -/-, AUS]) reported no statistically significant difference between a team based approach to the delivery of nursing care and job satisfaction.

One study (Dubois et al., 2013 [CS, -/+, CAN]), found that the risk of experiencing any event with consequences (medication administration errors, falls, pneumonia, urinary tract infection, unjustified restraints and pressure ulcers) was significantly lower (OR=0.477, 95%-CI 0.25-0.91) in clinical areas with professional models of care characterised by higher skill levels and staffing levels of those with functional models.

Evidence statement - Mixed Innovations

One study (Kovner et al., 1994 [CBA, -/+, US]) that explored mixed interventions (reorganisations, case management, shared governance, computerisation, education) on the delivery of care, reported that the interventions, taken as a whole, improved the job satisfaction with professional interaction ($p < 0.05$) but not other aspects of job satisfaction.

1.b) effectiveness of approaches for identifying required nurse staffing levels and skills mix.

Introduction

In the first evidence review we undertook to support the development of NICE guidance on safe staffing levels on acute adult inpatient wards³, the identification of required staffing levels and skill mix was focused on factors affecting nurse staffing requirements at different times of the day including the question how patient dependency and patient turnover might influence staffing requirements. To investigate the effectiveness of an approach to identify nurse staffing levels, an interventional study is required which tests if the introduction of an approach (e.g. a workload management system) leads to an improved match of nursing resources and nursing demands, which in turn translates into improved patient outcomes.

While dozens of studies explore workload measurement systems, they are primarily descriptive in nature (Fasoli and Haddock, 2010). This also includes studies on well-known approaches like the AUKUH / Safer Nursing Care tool (Smith et al., 2009), Patient Intensity Nursing Index (Prescott et al., 1991, Prescott et al., 1989, Soeken and Prescott, 1991) or RAFAELA (Rainio and Ohinmaa, 2005, Rauhala and Fagerstrom, 2007), which have been described and tested for their reliability and validity (albeit to a limited extent), but ultimately not for their effect on patient outcomes. In addition to these organizational level tools, a small body of literature exists which explores the effectiveness of governmental initiatives such as mandated staffing ratios in California (e.g. Mark et al., 2013, McHugh et al., 2012, McHugh et al., 2011), which are beyond the scope of this review. An alternative approach, though mandated, is the Nursing Hours per Patient Day (NHPPD) method, which is used to determine safe staffing levels for wards in Western Australia.

³ See: Evidence review 1, “The association between patient safety outcomes and nurse / healthcare assistant skill mix and staffing levels & factors that may influence staffing requirements.”

Overview of studies

A single observational study (Twigg et al., 2011) was identified, which assessed the effectiveness of the Nursing Hours Per Patient Day (NHPPD) method by comparing nursing sensitive outcomes before and after the introduction of the NHPPD method in Western Australia.

The NHPPD method differentiates between 7 different ward types, which are described by patient complexity, intervention levels, the presence of high dependency beds, the emergency/elective patient mix and patient turnover. Depending on the ward type, different nursing hours per patient day are assigned and guidance is provided in developing staffing rotas to achieve this across the day⁴. Twigg et al. (2011) investigated changes to fourteen nursing sensitive outcomes (central nervous system (CNS) complications, wound infections, pulmonary failure, urinary tract infection (UTI), pressure ulcers, pneumonia, deep vein thrombosis, ulcer/gastritis/upper gastrointestinal bleed, sepsis, physiologic/metabolic derangement, shock/cardiac arrest, mortality, failure to rescue, length of stay) two years before and after the introduction of the NHPPD method in three tertiary care hospitals in Western Australia (-,+).

Three nursing sensitive outcomes improved after the introduction of the NHPPD method in surgical wards: CNS complications (rate ratio 0.46, $p < 0.05$), pneumonia (rate ratio 0.83, $p < 0.05$) and ulcer/gastritis/upper gastrointestinal bleeds (rate ratio 0.63, $p < 0.05$). Mortality decreased for medical and surgical patients (rate ratio 0.75, $p < 0.05$). No significant differences were found for wound infections, pulmonary failure, urinary tract infections (UTI), pressure ulcers, deep vein thrombosis, sepsis, physiologic/metabolic derangement, shock/cardiac arrest, failure to rescue and length of stay.

Summary evidence statements

One study (Twigg et al., 2011 [BA, -/+, AUS]) demonstrated that the introduction of a nursing hours per patient day staffing method reduced some adverse patient outcomes (CNS complications on surgical wards RR 0.46 (95%-CI: 0.23, 0.92), pneumonia on surgical

⁴ See http://www.nursing.health.wa.gov.au/planning/workload_man.cfm

wards RR 0.83 (95%-CI: 0.70, 0.99), gastrointestinal bleeds on surgical wards RR 0.63 (95%-CI: 0.43, 0.92), and mortality). There is no evidence on how frequently the method should be used. We found no evidence about the effectiveness of other methods.

2.) What organizational factors influence staffing at a ward level?

Introduction

There is large field of literature describing associations between management structures and procedures, organizational culture and organizational policies, procedures and staff training of acute care hospitals related to the work environment and patient outcomes in general (e.g. Kapinos et al., 2012, West and Lyubovnikova, 2013). Broadly this literature establishes that those organisations with more positive cultures (for example providing a supportive culture for staff and a focus on patient safety) and those which are assessed by staff as having active policies for staff training and appraisal, achieve better outcomes. However, to a large extent this literature is descriptive and explorative, and does not refer to explicit organizational practices or interventions. Outcomes that are able to clearly identify improvements in nursing care delivery are rarely (if ever) considered and little if any of the literature focuses on ward-based hospital nurses. The only exception specifically addressing the work environment of nurses through explicit management structures and processes and enhanced organizational culture is the Magnet program of the American Nurses Credentialing Center (ANCC). Additionally, a small number of studies addresses relevant nurse and patient outcomes by different types of staff training.

2.a & b) Management structures/procedures and organisational culture

Overview of studies

Health care organizations assessed as achieving Magnet status are recognized for their quality patient care, nursing excellence and innovations in professional practice and are evaluated on five elements: transformational leadership; structural empowerment; exemplary professional practice; new knowledge, innovations, and improvements; and empirical outcomes (Lake et al., 2012). Structural and organisational characteristics associated with Magnet recognition include active involvement (at the hospital level) in

nurse sensitive outcome benchmarking, active programmes of quality assurance and structures to actively promote the involvement of clinical nurses in the setting of hospital policies and governance. The recognition process consists of a comprehensive and rigorous assessment and takes about two years. The award is given for a period of four years.

Seven studies investigated the association between ANCC Magnet recognition and nurse and patient outcomes, six in US hospitals (Goode et al., 2011, Hess et al., 2011, Kalisch and Lee, 2012, Kelly et al., 2011, Lacey et al., 2007, Lake et al., 2010) and one in England (Aiken et al., 2008). All studies employed a cross-sectional/correlational design except for the study of Aiken et al. (2008), which used a before and after design. Three studies (Goode et al., 2011, Kelly et al., 2011, Lake et al., 2010) were large, including fifty or more hospitals in the analysis. Four studies based their analysis solely on survey data from nurses (Aiken et al., 2008, Hess et al., 2011, Kelly et al., 2011, Lacey et al., 2007), while Kalisch and Lee (2012) combined survey data with organisational level information requested from each participating hospital. Two studies (Goode et al., 2011, Lake et al., 2010) used data from secondary sources like the National Database of Nursing Quality Indicators (NDNQI).

Five studies were assessed with moderate internal and strong external validity (Goode et al., 2011, Kalisch and Lee, 2012, Kelly et al., 2011, Lacey et al., 2007, Lake et al., 2010, all studies: +,++), while the validity of two studies was judged as weak (-/-) (Aiken et al., 2008, Hess et al., 2011). An overview of the studies is presented in Table 2.

Summary evidence statements

Three of four studies (Aiken et al., 2008 [BA, -/- , UK], $p=0.008$, Kelly et al., 2011 [CS, -/++ , US], $p<0.05$, Lacey et al., 2007 [CS, -/+, US], $p<0.001$) found nurses were more satisfied with their job in Magnet hospitals, which are recognised for nursing excellence and innovations in professional practice, while one study (Hess et al., 2011 [CS, -/-, US]) did not confirm this difference.

Two studies (Kelly et al., 2011 [CS, -/++ , US], $p<0.05$, Lacey et al., 2007 [CS, -/+, US], $p<0.001$) found lower nurse burnout in Magnet hospitals than in non-Magnet organisations, but this was not confirmed by the study of Aiken et al. (2008 [BA, -/-, UK]) which found no association. The same three studies found nurses were less likely to intend to leave in

Magnet hospitals than non-recognised hospitals. Of these studies, only one (Kelly et al., 2011 [CS, -/++, US],) presented an analysis that controlled for the possible confounding effect of overall staffing levels.

We found three studies comparing Magnet vs. Non-Magnet hospitals and nurse sensitive patient care outcomes and controlling for staffing levels. Lake et al. (2010 [CS, -/++, US]) found lower rates of falls ($p < 0.01$), Goode et al. (2011 [CS, -/+, US]) found lower rates of pressure ulcers ($p < .10$), and Kalisch and Lee (2012 [CS, -/+, US]) found lower amounts of nurse reported missed care ($p < 0.05$) in Magnet hospitals.

However, Goode et al. (2011 [CS, -/+, US]) found no significant differences for heart failure mortality and failure to rescue, and higher rates of postoperative sepsis and metabolic derangement ($p < 0.05$) in Magnet hospitals.

Table 2: Overview of included studies on Magnet recognised hospitals

Study	Outcomes	n= (hosp)	n=(units)	n=nurses	n=patients	Internal validity	External validity
Lacey et al. (2007)	Job satisfaction (+) Leaving Intentions (+) Well-being/burnout (+)	15	292	3,337	-	-	+
Aiken et al. (2008)	Job satisfaction (+) Intent to leave (+) Nurse perceived care quality (+) Burnout (ns)	1	-	T1: n=128 T2: n=109	-	-	-
Lake et al. (2010)	Falls (+) Pressure ulcers (+) Failure to rescue (ns) HAI (-)	636	5388	-	-	-	++
Goode et al. (2011)	Postoperative sepsis (-) CHF mortality (ns) MI mortality (ns) Postop. metabolic derangement (-)	54	-	-	-	-	+
Hess et al. (2011)	Job satisfaction (ns)			518		-	-
Kelly et al. (2011)	Job dissatisfaction (+) Burnout (+) Intent to Leave (+)	567		26,276		-	++
Kalisch and Lee (2012)	Missed care (+)	11	124			-	+

+ Statistically significant in favour of Magnet and, - statistically significant in favour of control, ns not significant

2.c) Organisational policies and procedures, including staff training

We did not identify any evidence regarding organizational policies and procedures that explicitly influence staffing at the ward level. Although research exists which shows that general human resource management practices, such as training and appraisal policies are associated with better patient outcomes, such as mortality (e.g. West et al., 2006) we could not find studies addressing ward level nurse staffing or specifically nurse sensitive outcomes. We did identify three studies describing ward level interventions, which did use some method of training to improve relevant patient or nurse outcomes.

Overview of studies

Two studies from the US (Kalisch et al., 2013 [BA, -/-, US], Kooker and Kamikawa, 2011 [ITS, -/-, US]) and one study from Canada (McGillis Hall et al., 2008 [BA, -/+, CAN]) tested ward level teamwork, leadership and training interventions to improve outcomes. All three studies used before and after designs without controls, leading to weak internal validity of the studies (-).

Kooker and Kamikawa (2011 [ITS, -/-, US]) evaluated a retention strategy for an academic medical center in the US with a before and after study design. The retention strategy consists of four elements although it is not fully described in the report. The first element is a new nurse fellowship training over 24 weeks after the first six month of employment. The training aims to support personal, cultural, team and leadership development of newly hired nurses. The second element is a nurse manager academy, which aims to support leadership skills of managers and ward sisters. The third element is a staff exchange programme with a Magnet-accredited hospital for staff nurses and managers in order to learn from an organization with an established history of staff retention. The fourth element consists of several ward level performance improvement projects targeting patient and nurse outcomes. Full details on the content, frequency and provision of the different elements are not reported.

Over a four-year period, the proportion of satisfied patients increased by 3.2%, RN retention increased by 12% and the RN vacancy rate dropped by 9%. RN satisfaction with autonomy increased by 5.8% and satisfaction with decision-making increased by 6.9%. Although the

trends support the notion of a successful training, the reported outcomes are not tested for statistical significance and no information on the distribution is given which make it difficult to judge the level of uncertainty in the results. A high risk of bias from weak internal and external validity (-,-) and failure to account for any planned changes in staffing levels limit the value of the conclusions that can be drawn from study.

McGillis Hall et al. (2008 [BA, -/+, CAN]) evaluated the effect of a workplace change program to improve resource availability with a before and after study design. The training programme is based on a quality improvement framework with three dimensions: identification and choice of key factors influencing nurses' working life, analysis of the process influencing those key factors and identification and mobilisation of the change intervention. This process was supported by a trained facilitator (bachelor prepared nurse) over a six-month period. Examples of interventions were: improving linen supply, enhancing documentation activities of Licensed Practical Nurses, increasing medication stock supply, improving communication related to patient transfers and identification of basic equipment needs. The four patient outcomes and five out of six nurse outcomes showed no change 6 months past the intervention. Only nurse perceived work quality increased (no effect estimate provided, $p=0.02$). Risk of bias assessment identified high risk of bias from internal validity and moderate risk of bias regarding the external validity (internal / external validity -/+).

Kalisch et al. (2013 [BA, -/-, US]) tested the impact of a crew resource management approach (CRM) on nurse reported outcomes including missed care with a before and after study design. The CRM approach consisted of several training elements: a short 10-minute podcast explaining core elements of nursing teamwork, provision of scenarios including role playing (simulation), debriefing, and discussions of the scenarios. 3x one-hour sessions with 2-3 scenarios to discuss eight nursing teamwork behaviours in a period over 4-6 weeks were held. Feedback was provided by trainers, who were themselves given 2-days training. Class sizes ranged between 3-6 staff members. Overall teamwork (0.13, $p=0.001$), missed care (-0.09, $p=0.029$), satisfaction with teamwork (0.24, $p=0.002$), and knowledge (0.40, $p=0.005$) improved. Risk of bias assessment identified low internal validity and moderate external validity (-/+).

Summary evidence statements

One study (Kooker and Kamikawa, 2011 [ITS, -/-, US]) that assessed the effect of a staff training intervention focused on nurse retention and found improved staff retention (no test of significance) and job satisfaction (no test of significance) after the introduction of the programme.

McGillis Hall et al. (2008 [BA, -/+, CAN]) tested a workplace change programme to improve resource availability and only found improved nurse ratings for the quality of work ($p=0.02$), but not for four patient reported outcomes including patient perceived hospital quality and five nurse reported outcomes, including job satisfaction.

Kalisch et al. (2013 [BA, -/-, US]) investigating crew resource management training found decreased nurse reported missed care ($p=0.029$) and improved teamwork ($p=0.001$).

Discussion

The introduction of supervisory roles showed positive results for staff and patients in two studies (Bender et al., 2012 [ITS, -/-, US], Burritt et al., 2007 [BA, -/-, US]). However both studies were weak in terms of their internal and external validity and therefore stronger evidence is needed. Future research should address these areas to improve the strength of the evidence: in order to assess the effect of additional supervisory staff a more comprehensive assessment of the ward management is required including the model of care and the staffing structure including the skill mix. In order to assess the effect of a ward level measure like supervisory staff, multi-site research is needed.

Results on different models of nursing care organisation were inconclusive, some showing positive effects for staff and patients (Dubois et al., 2013 [CS, -/+, CAN], Tran et al., 2010 [CBA, -/-, AUS]), while other did not support an improvement in staff satisfaction (Fairbrother et al., 2010 [CBA, -/-, AUS]). Again the validity of the research is weak making it problematic to draw conclusions and requires additional research to understand the impact on patients and staff.

At the heart of the consideration of safe nurse and healthcare assistant staffing should be research about the effectiveness of staffing methods, which is very rare. We found one

Australian study investigating the effectiveness of a staffing method (Twigg et al., 2011 [BA, -/+, AUS]) which showed benefits from the NHPPD method. There is no evidence for the effect on nurse sensitive patient or staff outcomes by other approaches to determining nursing staff requirements. Future research should target the development and testing of effective staffing methods.

We identified several studies on the effectiveness of management structures and organisational culture in the context of the assessment of the ANCC Magnet programme. The underlying organisational principles of transformational leadership, structural empowerment, exemplary professional practice, new knowledge, innovations, and improvements are not exclusive to the organisation of nursing care. However, the evidence suggests that these are important elements to create supportive work environments for nurses, which are also associated with improved patient outcomes. The experience of Rochdale Infirmary (Aiken et al., 2008 [BA, -/- , UK]) shows that acute care trusts can apply Magnet principles, however more research is needed to transfer these principles and specific practices associated with 'Magnet' to the NHS.

Finally we identified a few studies that used different training programmes (e.g. crew resource training) to improve patient and/or staff outcomes (Kalisch et al., 2013 [BA, -/-, US], Kooker and Kamikawa, 2011 [ITS, -/-, US]). The studies were weak in terms of internal and external validity and therefore the full assessment of the value of these programmes need further research. However, these studies do show potential for improving nursing services.

We identified no studies evaluating 'Lean' type approaches (for example the 'Productive Ward') to improve the efficiency of nursing practice through the systematic analysis and elimination of non-productive care activities in order to 'release time to care'. A recent systematic review of this topic confirms this. While evidence of improvements in proportion of time in direct care, nurse sensitive indicators including falls and missed care is widely cited, the quality of the evidence base can be best described as 'anecdotal' with little if any formal research / evaluation of programme outcomes (Wright and McSherry, 2013).

Conclusions & recommendations

The evidence identified in this review does not provide a 'silver bullet' to support nurse staffing decisions in acute care hospitals. There is some evidence supporting additional supervisory roles, organisational practices that are recognised by the Magnet programme (including active involvement in nurse sensitive outcome benchmarking, active programmes of quality assurance and structures to actively promote the involvement of clinical nurses in the setting of hospital policies and governance) as well as staff training. However more research is needed to gain more certainty over the effects of these measures. This should include

- Research targeting the effectiveness of staffing methodology
- Research on the implementation of staffing methodologies as well as any other measures to support safe staffing
- Research in the complex intervention framework to support reproducibility of interventions

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Management structures and approaches, staffing levels & nurse and patient outcomes.

Michael Simon, Jane Ball, Jonathan Drennan, Liz James, Jeremy Jones, Alejandra Recio-Saucedo, Peter Griffiths.

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What nursing staff supervisory approaches and/or team management approaches are required?

Supervisory approaches

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments															
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes																
Burritt et al. (2007)	US (California)	Introduced a new role ‘clinical mentor’ to be present on each shift, responsible for the safety and quality of care delivery and offering ‘pro-active oversight’ (assessing, monitoring and evaluating care provided by primary nurses, and encouraging reflective practice and role modelling). 34 FTE (planned number 58) posts created (funded by the anticipated cost savings – although, to provide 24/7 coverage on 12 patient care units. Mentors (experienced expert nurses from within the hospital) undertook week long preparation course within the hospital. Back-fill replacement costs = \$2,315,040.	Patients: - Falls (per 1,000 patient days) - Pressure ulcers - Complication rates (% patients who have any complication after admission) - length of stay - failure to rescue - Excess charges and LOS attributable to injuries from adverse events Nurses: - Job satisfaction (as measured by the Practice Environment Scale) Outcomes assessed monthly 6 months before and after implementation. Staffing levels, skill-mix, staffing requirement or workload not measured/reported.	Pre implementation, adverse events rates were consistently worse than expected. Over the 6 months post-implementation they fell to at, or slightly below the expected level based on patient acuity/risk. (Eg. Fall rates from 4.16 to 3.3 per 1000 patient days) On unadjusted results, a significant reduction in average adverse events reported post-implementation Falls – 20% reduction (p = 0.06) Pressure ulcers (decrease by 38% (p=0.02). Assessment of annualised impact of clinical mentors on excess LOS and charges attributable to injuries from adverse events: <table><tr><td>Outcome</td><td>Excess Days</td><td>Excess Charges</td></tr><tr><td>PU</td><td>199</td><td>\$542,250</td></tr><tr><td>FTR</td><td>309</td><td>\$1,819,068</td></tr><tr><td>LOS</td><td>550</td><td>\$452,100</td></tr><tr><td>Total</td><td>3,192</td><td>\$2,813,418</td></tr></table>	Outcome	Excess Days	Excess Charges	PU	199	\$542,250	FTR	309	\$1,819,068	LOS	550	\$452,100	Total	3,192	\$2,813,418	Intervention involved an overall increase of 34 WTE nursing posts across 12 units (approx 3 nurses per unit), which was not controlled for in the study design.
Outcome	Excess Days	Excess Charges																		
PU	199	\$542,250																		
FTR	309	\$1,819,068																		
LOS	550	\$452,100																		
Total	3,192	\$2,813,418																		
Study Aim	Setting	What was the comparison?																		
Assess the impact that proactive oversight provided by introducing clinical mentors on every shift has on patient outcomes and nurse satisfaction	In patient acute care units/wards	None (expected outcomes compared with predicted, using regression model)																		
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes																
Before and after study	372 bedded acute care facility	1	Regression model used to analyse observed relative to expected outcomes (based on patient acuity and other risk factors).	Reported a small improvement on the mean score on each of the subscales and overall composite of the PES-NWI scale (eg. composite form 2.89 to 3.05). But number of cases (or sample size and response rates) not reported, and no significance tests.																
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment																	
-	Unit sample - not described (likely to be convenience). No details of nurse sample	12 units: Medical, surgical, cardiac, intensive care, obstetrics, emergency.	None																	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘ hospitals’)																	
-		Patients: 6,307. Nurses: not provided	NA																	

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Bender et al. (2012)	US (California)	CNL is a Master’s prepared registered nurse, educated to improve care delivery through better coordination and collaboration across the healthcare team (by developing supportive inter and intra disciplinary pathways for lateral integration of care). Activity included multiple daily patient rounds and daily review of patient measures and lab results. Two CNLs were introduced to the unit. Working Mon-Fri 7am – 3:30 pm. Each were responsible for 13 patients. Intervention occurred on the high acuity progressive care unit (with staffing ratio 1:3 – 1:5, depending on acuity). Patient satisfaction assessed on both the intervention unit and control unit 10 months prior and 12 month after intervention introduced.	Patients: • Patient satisfaction with nursing care Measured monthly using Press Ganey survey instrument (items related to satisfaction with admission, discharge, nursing, physician). Typical staffing ratios (based on mandated minimums) for the intervention unit and control unit presented as background (not measured as part of the study). Nurses: none	CNL implementation correlated with improved patient satisfaction with admission processes (Pearson’s R (r) = + .63, p = .02) and nursing care (r = + .75, p = .004), including skill level (r = .83, p = .003) and keeping patients informed (r = .70, p= .003). There was no significant correlation with improved patient satisfaction with physician care (r = .31, p = .14) or discharge processes (r = .33, p = .23) post-implementation. Control data showed no significant changes in patient satisfaction measures throughout the study time frame.	Authors note small sample size (single unit) and low response rates to patient satisfaction survey and conclude “no causal inferences can be made regarding the CNL role and improved outcomes related to this study”. The intervention involved introducing 2 FTE CNL posts. It is unclear if these were additional to existing staff or were replacing two existing posts – ie. had there been a net increase in staffing resulting from the intervention (that was not applied to the control?)
Study Aim	Setting	What was the comparison?			
Assess the impact of introducing a Clinical Nurse Leadership (CNL) role on patient satisfaction with care quality	Two high acuity units in urban academic medical centre	Control was a high-acuity oncology and bone marrow unit. Acuity similar but lower. (Staffing ratio typically 1:4.)			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Interrupted time series, with control	119 bedded urban academic medical centre with state mandated staffing ratios in place	1	None	NA	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unit - convenience sample (single intervention unit and a similar control). Patients – sampling, selection, how/when data collected and response rates not described.	2	NA		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘hospitals’)		
-		Patients – each month approx 26 (19 – 33) patient surveys responses.	NA		

Systems of nursing work

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	Staffing model “did not occur as planned” – change in balance between RN and PCAs was achieved by overall reduction in care givers, (due to budgetary constraints). No conclusions can be drawn as intervention proposed not happened.
Barkell et al. (2002)	USA	Planned intervention (in Sept 1999) was to introduce a ‘total patient care model’ in which RN’s were responsible for delivering all care to patients. Before: Jan-June 1999 After: Jan – June 2000 Anticipated (budgeted) features: • A change in the role of RNs • Increased number of RNs (and decrease in PCAs) • Increased proportion of RNs	Patients: • Patient satisfaction • UTI • Pneumonia (cost, length of stay, post-op pain scores) Nurses: none Staffing requirement/workload: not assessed	No significant difference in patient satisfaction scores (p= 0.468). No UTIs occurred in either group. Pneumonia occurred in 5.1% (3 patients) in group A and none in group B, so no statistical test conducted.	
Study Aim	Setting	What was the comparison?			
To explore the effect of a change in nurse staffing model on post-operative outcomes of bowel procedure patients.	33 bed in-patient surgical unit (in community-based teaching hospital).	Previous model was’ team nursing’; patient care associates (PCAs) assisted RNs in delivering care – with RNs directing and overseeing care delivered. Actual staffing change: • Actual total staffing fell (from 38.75 FTE to 30.36) • RNs not increased • PCAs decreased			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Retrospective descriptive comparison (before and after)	508 bedded community-based teaching hospital. Study targeted patients receiving bowel procedures	1	Gender, race, co-morbidities and primary diagnosis reported for both groups of patients (pre and post change), but not controlled for in the analysis. Statistical differences between groups not reported. Observed differences: Caucasian – 88% group A 95% group B Co-morbidities - group A (59%) group B (76%)	NA	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unit – selected by convenience.	1	Unclear (unit’s staffing model adjusted)		
External Validity	Patient inclusion criteria: 18-85 years; DRGs 148 & 149; Entire LOS within the unit (ie excluded patients transferred to ITU)	Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘ hospitals’)		
-		59 patients in model A, 37 in model B	Unclear from extraction		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Wells et al. (2011).	Canada	Modified total patient care model: - Allocation of patients to specific nurses - Patient care coordinators provide leadership and guidance)8:00 – 16:00 (liaison between steering committee and nursing staff) - Charge nurse carried out PCC role between 16:00 – 8:00 - Written shift report (not audio taped as previously) - Plan for client care when nurse on breaks	Patients: none Nurses: Job satisfaction (Index of Work Satisfaction, Stamps 1997) The nursing staff-to-patient ratios typically on the unit at day and night were reported (1:4, and 1:5 respectively).		
Study Aim	Setting	What was the comparison?			
Assess the impact of implementing ‘total patient care’ model on nurse job satisfaction	Acute nursing care units at a regional health care facility	Team nursing was previously used.			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Before and after, no control	Unclear	1	None	No significant change in job satisfaction was observed.	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unclear	2	None		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘ hospitals’)		
-		Potential nurses’ sample 118. Response rates reported: 32%, 31%, and 27% to pre, 3 month and 6 month surveys. Respondents at 6 months n=21 (excluded LPN, and pool nurses, due to low response rate: casual/float RN at pre-implementation (n = 5) and 3 months (n = 2), and no responses from LPN.)	None		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	There was considerable variation in the way in which ‘Team Nursing’ was applied, which would make replication of the model difficult, as the action research design was integral to the implementation process.
Fairbrother et al. (2010)	Australia	‘Team nursing’ (TN) was introduced. The ‘new version’ of TN divided staff into teams (typically two), but retained principles of patient allocation within the team (each nurse had own patients but team members had shared responsibility for team progress). The structure of the teams and nature of the model (in terms of lines of communication and management within and beyond the team) varied between units and changed during the study as a result of the action research approach used. 5 different models of team nursing evolved and are described.	Patients: None Nurses: - Job satisfaction (measured using Nursing Workplace Satisfaction Questionnaire, developed by authors, at baseline and 12 months after first survey) - Staff turnover (FTE vacancies, and vacancy rates at two points in time – baseline, and 12 months later)		
Study Aim	Setting	What was the comparison?	Focus groups, interviews with nurse unit managers and regular ‘group work’ and facilitated redesign workshops held with intervention wards (but not with comparators). No description of staffing levels, skill-mix staffing requirements, or other workload measure.	Nurse Outcomes	
To assess the impact of team nursing in nurse job satisfaction and retention	Acute Hospital (Sydney)	Individual Patient Allocation Each nurse has own patients allocated, and then reports to either a ‘nurse in charge of the shift’ (who then reports to the nurse unit manager) or directly to the nurse unit manager.		Staff turnover: Vacancy rates were higher in the intervention group at baseline (32% vs 23%). They improved in both with the rate in the intervention group falling below that of the comparator wards (8% vs. 13%), but the difference was not significant (p=0.2).	
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Satisfaction: Equivalent satisfaction at baseline between control and intervention groups.	
<i>Controlled before and after study</i>	16 Medical and surgical wards/units	1	None		
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	Significant (p=0.005) difference in ‘extrinsic’ dimension of job satisfaction between intervention wards and comparison wards (means of 11.3 vs 12.7, f 5.4, p<0.005), but not significant on the other two dimensions.	
-	Convenience sample (volunteer wards from 16) Excluded: - Critical care (not suitable for TN due to high staffing requirement) -small units	12 (6 control, 6 intervention) 3 medical 2 surgical 1 older person/rehab	Unclear		
External Validity	Allocation to intervention/control group was self-selection (nurse unit manager’s choice).	Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘ hospitals’)	Also significant difference in extrinsic job satisfaction before and after (from 12.4 to 11.3, p=0.015), but not on the other two dimensions.	
-		Nurse survey responses Intervention: 92 (79%) pre, 99 (72%) post. Control: 80 (78%) pre, 79 (71%) post	Unclear		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments	
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	The SCN and PA groups were similar at baseline across all variables: job satisfaction, stress at work, job tension and perceptions about the nurses’ role. Within-group analysis	
Tran et al. (2010)	Australia	Shared Care Model: comprises teamwork, leadership and professional development. Tenets of the teamwork model described (12 C’s framework including principles such as commitment, collaboration) but organisational practice changed to implement are not clear. Leadership ‘skills enhanced’ but unclear how. Professional development consisted of attendance at courses, and one author provided regular input during implementation.	Patients: None Nurses: • Job satisfaction (measured using the Job Descriptive Index) • Stress (measured using the Stress in General scale, with 2 subscales: pressure at work, and work-related threat) Staff to patient ratios and patient characteristics considered ‘similar’ on the selected wards (not formally recorded).			
Study Aim	Setting	What was the comparison?		Nurse outcomes		
Assess the impact on nurse outcomes of a Shared Care in Nursing (SCN) and Patient Allocation (PA) models of care delivery.	Medical and surgical hospital wards	Patient allocation		The SCN and PA groups were similar at baseline across all variables: job satisfaction, stress at work, job tension and perceptions about the nurses’ role. Within-group analysis showed no differences in the outcomes between baseline and follow-up in each group, except for a trend in the ‘satisfaction with co-worker’ domain that decreased from 41.8 to 37.4 (p = 0.044) in the intervention group. Between-group comparisons also found no differences between the two groups.		
Study design	Source Population	Sample size (Hospitals)	Nurse level adjustment			
‘Quasi experimental design’ Before and after study with comparison group	400 bed urban teaching acute hospital in New South Wales	1	Most nurse characteristics similar at baseline; intervention group slightly younger (31% under 30 vs 11%, p=0.09) and larger proportion of ENs (28% vs 15%, p=0.07). No adjustments made.			
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment			
-	Convenience sample – nurse unit managers invited to take part. 4 wards assigned to each group (allocation procedure not clear)	8 (4 medical, 4 surgical)	None			
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘hospitals’)			
-		150 eligible nurses. 125 (83%) responses at baseline – 51 PA, 74 SCN. Follow up: 14 PA, 39 SCN.	None			

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Dubois et al. (2013).	Canada	Analysis of discharge data from 11 hospitals in Quebec to identify adverse events and establish associations with nurse organisational model	Patients: - Falls - Pressure ulcers - Medication errors - Pneumonia - UTI - Unjustified restraints How was staffing requirement measured? Nursing care hours per patient day	Results of regression model after controlling for patient characteristics. Odds ratios for experiencing at least one event of any severity. Innovative professional model: Adjusted odds ratio 0.525, 0.33-0.84 (p= 0.007, 95% CI). Basic professional model: OR= 0.752, 0.57-0.99 (p=0.04, 95% CI) Odds ratio for experiencing at least one event with consequences Innovative professional model OR=0.477, 0.25-0.91 (p=0.026, 95% CI) Basic professional: OR=0.623, 0.42-0.93 (p=0.020, 95% CI) Basic functional: OR=0.601, 0.38-0.95 (p=0.029, 95% CI)	Two composite outcomes were constructed: binary variable indicating occurrence of any six-event with/without consequences and a second indicating whether the patient experienced any event with consequences.) CCI= age-adjusted Charlson Comorbidity Index In addition to number of risk factors, CCI and length of stay, odds ratios were also adjusted for sex and number of diagnoses at admission (not statistically significant. *P> 0.05.) Professional models: characterised by a higher proportion of care hours provided by RN and by nurses' perception of greater support for professional practice.
Study Aim	Setting	What was the comparison?			
Assess the association between nursing care organisational models and six patient safety-related events	Twenty-two acute medical units in 11 hospitals in Quebec	Comparison of patient adverse events between four nursing care organisational models: 2 professional and 2 functional through analysis of discharge and nurse survey data.			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Cross sectional correlational	Pool that hospitals / wards come from. E.G. "Hospitals contributing to the NDNQI database"	11	Age-adjusted Charlson Comorbidity Index (CCI), number of risk factors, length of stay and number of diagnoses at admission		
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Based on pre-defined criteria and informed by a survey sent to all hospitals in Quebec (50% response rate).Hospitals were selected based on adjustment criteria. Patients were selected based on: -at least 24h hospitalisation; -<18 years old;	22	Unclear from extraction		
External Validity		Sample size (Patients & or nurses)	Hospital: Teaching status, size, location, nursing workforce profile, and work reorganisation track records.		
+	admission diagnosis cared for in medical units; hospitalisation during a nurse survey regarding nursing care delivery models on the unit.	2,699 patients (117 to 128 per unit)	Yes		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Kovner et al. (1994)	USA	State initiative to provide funding to support innovations in hospitals aimed at improving nurse recruitment and retention (by improving nurse satisfaction). Innovations included (number of units doing each): - Case management (19) - Shared governance (4) - Care delivery (37) - Education (13) - Computer systems (40) The timing, extent (eg. single or multiple pilot units, or hospital wide), or pace of the innovations implemented were not controlled or standardised. Most hospitals implemented more than one type of initiative.	Patients: none Nurses: • Job satisfaction (measured at baseline and after a year using the Stamps and Piedmonte Work Satisfaction Index, including 6 scales: pay, autonomy, task requirements, organisational policies, interaction, professional status) Staff per admission used as a control variable used in regression (at unit level, with average nurse satisfaction per unit)		
Study Aim	Setting	What was the comparison?		Nurse outcomes	
Assess the relative effects of different interventions aimed at improving nurse satisfaction	37 New Jersey Hospitals	Comparison units were selected in most (35) hospitals (no project implemented).		Taken together the innovations improved satisfaction with one of the 6 subscales – professional interactions (adjusted b = 0.15, p<0.05). Nurses on units implementing care delivery reorganisations (p<0.1), computer (p<0.1) or educational systems (p<0.05), also had improved satisfaction with task requirements.	
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment		
<i>Before and after study, with control</i>	New Jersey hospitals	37	Mean scores weighted according to number of nurses on the unit		
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unclear (retrospective convenience sample – selection of units that had implemented an initiative)	103 units: 68 pilot units 35 comparison units	• Average length of stay • Occupancy • Staff per admission • Hosp size (beds) • Unit size (beds)		
External Validity		Sample size (nurses)	Control for clustering of outcomes in units (wards 'hospitals')		
+		All nursing staff on the units surveyed. Response rate approx 60% pre, and 50% post.	None	Educational initiatives were associated with improved overall satisfaction (p<0.05), and increased satisfaction on 5 out of the 6 subscales (only task requirements and interactions at the <p<0.05 level significance).	

Effective approaches for identifying required nurse staffing levels and skills mix

Study Details	Population and setting	Intervention	Outcomes and control variables	Results
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes
Twigg et al. (2011)	Australia	NHPPD staffing method ordered by the Australian Industrial Relations Commission (AIRC). Approach classifies wards into seven categories based on patient complexity, intervention levels, the presence of high dependency beds, the emergency/elective patient mix and patient turnover. After implementation of the order productive hours of permanent nursing staff increased by 3.7%	Patients: - Central nervous system (CNS) complications - Wound infections - Pulmonary failure - Urinary tract infection (UTI) - Pressure ulcer - Pneumonia - Deep vein thrombosis - Ulcer/gastritis/upper gastrointestinal bleed - Sepsis - Physiologic/metabolic derangement - Shock/cardiac arrest - Mortality - Failure to rescue - Length of stay Derived from patient discharge abstracts. Staff data were sourced from Department of Health Human Resource Data Warehouse. All nursing hours (total hours of nursing care) by category of nurse in an associated cost centre by registered and licensed practical.	Rate ratios comparing phase 0 (before) and phase 2 (after implementation). CNS complication All patients: ns Medical: ns Surgical: 0.46 (p<0.05) Pneumonia All patients: ns Medical: ns Surgical: 0.83 (p<0.05) Ulcer/gastritis/upper gastrointestinal bleed All patients: ns Medical: ns Surgical: 0.63 (p<0.05) Mortality All patients: 0.75 (p<0.001) Medical: 0.76 (p<0.01) Surgical: 0.75 (p<0.05) No significant results for: Wound infections Pulmonary failure Urinary tract infection (UTI) Pressure ulcer Deep vein thrombosis Sepsis Physiologic/metabolic derangement Shock/cardiac arrest Failure to rescue Length of stay
Study Aim	Setting	What was the comparison?		
To assess the impact of implementing the NHPPD staffing method in Western Australia on 14 nursing-sensitive outcomes including: wound infections, urinary tract infection, pressure ulcers, sepsis, mortality, failure to rescue and length of stay.	Three tertiary teaching hospitals with 1449 beds with a range of services like trauma, emergency (except obstetrics), critical care, neurosurgery, interventional neuroradiology, cardiac, lung and liver transplants, orthopaedics, general medicine, general surgery, cardiac care, cancer services, hyperbaric services and rehabilitation services.	Before implementation of NHPPD staffing method.		
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes
Before and after study without control	All multi-day patients of the three hospitals between 2000-2004.	3	No adjustment	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	
-	Major Diagnostic Categories (MCD) for maternity, paediatric and substance abuse as well as stays longer than 90 days were excluded	16	No adjustment	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ' hospitals')	
+		236,454	Yes, GEE	

Organizational factors that influence staffing at ward level

Management structures/procedures and organisational culture

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Aiken et al. (2008)	UK	Implement Magnet principles in a hospital in the UK. Data from pre-post intervention was provided by surveys of nurses in the intervention hospital at two time points (2000 and 2002), compared with nurses from a national sample of acute Health Service Trusts. All full time nurses in NHS clinical grades D–F (to include most registered nurses) completed a self-administered survey (Nursing Work Environment (NWI)). Lists of nurses were provided by payroll officers at Rochdale.	Nurses: • Job satisfaction • Intent to leave • Assessment of quality of patient care How was staffing requirement measured? Patient to nurse ratios.	Nurse outcomes Nurses workload: No significant change between Rochdale two surveys and compared to National study. Average 10.01 to 10.02 patients per nurse. Results of t-test comparing Rochdale waves 1 and 2 Significant improvements in nurse work environment for: Administrative and career support (p <0.001) Administrative: 12.41 ± 3.65 14.61 ± 3.37 13.61 ± 3.38. Career: 20.66 ± 4.51 23.98 ± 5.82 21.92 ± 4.89 Job satisfaction Rochdale moderately or very dissatisfied: baseline-47.2%. Declined significantly by 2002 to 32.1%. (p= 0.008) National average: 36.9% Burnout, no significant differences Intent to leave Rochdale: baseline- 38.9%; 2002: significantly decreased to 27.5% (p= 0.03). National average similar at baseline Quality of care Rochdale: baseline-22.8%; 2002- 39.6% significant (higher than national average-20.1%) (p <0.01) Patients’ prepare to self-care at discharge Rochdale: baseline-62.6%; 2002-78.5% (higher than national average-59.7) (p<0.001)	Rochdale Infirmary, (first recognised Magnet hospital in the UK and outside the US Relevant to hospital selection. (Aiken LH, Clarke SP & Sloane DM (2002a) Hospital staffing, organisational support and quality of care: cross-national findings. International Journal for Quality in Health Care 14, 5–13.) No data were provided on the percentage of the nurses who responded to both surveys. Samples described as ‘broadly similar’.
Study Aim	Setting	What was the comparison?			
-To assess the impact of the implementation of Magnet principles on the improvement of nurses’ outcomes and quality of care. -To examine whether the ANCC Magnet Recognition programme was feasible to implement outside the US.	General medical and surgical in-patient settings at Rochdale NHS Hospital	Large national survey (including nurses from 30 NHS Trusts) is reported in Rafferty et al. 2001, 2007			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment		
Before and after study	Rochdale Infirmary	1 Hospital (intervention); 30 NHS Trusts (national survey used in the comparison with Rochdale data)	Unclear		
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unclear as how Rochdale was selected.	NA	Unclear		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘ hospitals’)		
-		Rochdale: 2000: n=128; 2002: n=109 National survey: 3,984 nurses (response rate 49.4% approximately n=1,968)	Unclear from extraction		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Kelly et al. (2011)	US	Secondary analysis of a home survey sent to RN in California, Florida, Pennsylvania, and New Jersey (US) between 2006 and 2007, to identify differences in nurse outcomes and work environments of RN.	Patients: - None Nurses: - Job satisfaction - Well-being/burnout Patient-to-nurse ratio (calculated from number of patients cared for in last shift (self-reported) averaged across all units reported.		Magnet hospitals had more highly educated nurses ($t = -2.27, P < .001$). Associated with lower levels of nurse job dissatisfaction and burnout, Magnet hospitals showed significantly better work environments compared to non-Magnet institutions. Number of patients per nurse lower in Magnet hospitals when data from California hospitals (where legislation for staffing ratios are in place) were excluded ($t = -5.29, p < 0.001$) Work environment measured with the 31-item Practice Environment Scale of the Nursing Workforce Index. Job-related burnout measured with the emotional exhaustion subscale of the Maslach Burnout Inventory Human Services Survey (MBI-HSS)
Study Aim	Setting	What was the comparison?			
Determine whether work environments, staffing, and nurse outcomes differ between Magnet and non-Magnet hospitals.	Acute Magnet accredited and non-Magnet hospitals	Acute care Magnet and non-Magnet hospitals			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Cross-sectional, secondary analysis	Nurses who responded to a home-mailed population-based survey	567 acute care hospitals (46 ANCC Magnet)	Nurse: gender, age, years of experience, educational level, specialty certification, and place where degree was received.	In a model adjusted for individual nurse, hospital, and hospital-level nursing characteristics:	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	Magnet hospital nurses were less likely to perceive job dissatisfaction by 18% ($p < 0.05$) or to report burnout by 13% ($p < 0.05$) Work environments were better in Magnet hospitals ($t = -5.29, p < 0.001$).	
-	Hospitals were not selected. RN who responded to the population-based survey provided employer's name and other information. Data collected was aggregated by hospital.				
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards 'hospitals')		
++		26,276 nurses (4,562 nurses working in Magnet and 21,714 in non-Magnet)	Unclear from extraction (most likely No)		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments																			
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	Magnet has been defined as an organisation with a professional work environment that has demonstrated excellence in (1) the delivery of nursing care to patients, (2) the development of support systems for nursing professionals, (3) the conduct and dissemination of research to share best practices, and (4) enhanced patient outcomes. In-process: organisations that have initiated the process to receive Magnet accreditation																			
Lacey et al. (2007)	US	Comparison of staff satisfaction and workload between Magnet, in-process, and non-Magnet hospitals. Secondary analysis of Individual Workload Perception Scale (IWPS) data. Nurses were invited to participate and directed to a secure Web site to take the survey.	Patients: - None Nurses: - Job satisfaction - Leaving intentions - Well-being/burnout How was staffing requirement measured?																					
Study Aim	Setting	What was the comparison?																						
Assessment of differences between nurses' scores on organizational support, workload, satisfaction, and intent to stay between Magnet, Magnet-aspiring, and non-Magnet hospitals.	Inclusion criteria for this secondary analysis was limited to 3,337 registered nurses from 15 institutions, 11 states, and 292 nursing units (these were the figures when Magnet variable was included in the IWP data).	Magnet, in-process and non-Magnet hospitals.																						
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes																				
Cross sectional, secondary analysis	Hospitals contributing to the Individual Workload Perception Scale data collection (reported as ongoing at the time of the study, 2007, and begun in 2003)	15 (2 Magnet, 10 Magnet-aspiring, and 3 non-Magnet) 6 are paediatric hospitals and 44% of the nurse sample worked primarily in a paediatric unit	Nurse staff demographic characteristics analysed: Experience, education level, employment status, gender	All subscales of the IWPS were significantly better for the Magnet hospitals. <table><tr><th>Subscale</th><th>Magnet</th><th>In-process</th><th>Non-Magnet</th><th>P value</th></tr><tr><td>Workload</td><td>3.86 (0.028)</td><td>3.56 (0.015)</td><td>3.42 (0.034)</td><td>.000</td></tr><tr><td>Intent to stay</td><td>3.92 (0.039)</td><td>3.72 (0.019)</td><td>3.64 (0.052)</td><td>.000</td></tr><tr><td>Nurse satisfaction</td><td>3.86 (0.024)</td><td>3.69 (0.012)</td><td>3.52 (0.028)</td><td>.000</td></tr></table> Values are given as mean (SD).	Subscale	Magnet	In-process	Non-Magnet	P value	Workload	3.86 (0.028)	3.56 (0.015)	3.42 (0.034)	.000	Intent to stay	3.92 (0.039)	3.72 (0.019)	3.64 (0.052)	.000	Nurse satisfaction	3.86 (0.024)	3.69 (0.012)	3.52 (0.028)	.000
Subscale	Magnet	In-process	Non-Magnet	P value																				
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Intent to stay	3.92 (0.039)	3.72 (0.019)	3.64 (0.052)	.000																				
Nurse satisfaction	3.86 (0.024)	3.69 (0.012)	3.52 (0.028)	.000																				
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment																					
-	Unclear	292	Magnet status, type of institution (location, hospital type to control for paediatric organisation), bed size																					
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ' hospitals')																					
+		3,337 Nurses	Unclear from extraction																					

Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes
Hess et al. (2011)	US	A comparison of RN perceptions of 'being a nurse' in different types hospitals (based on accreditation status). A survey mailed to a random sample of RN drawn from the National Survey of Registered Nurses maintained by the Gannett Healthcare Group. The survey took place between May and August 2010	Patients: - None Nurses: - Nurses' perception of job satisfaction - Also, (not main interest) nursing shortage, work environment, opportunities to influence the workplace, and professional relationships. - Aspects of well-being (back or other musculoskeletal injuries; episodes of physical violence in the workplace) classified in the survey as perceptions of the workplace. How was staffing requirement measured? Not measured	
Study Aim	Setting	What was the comparison?		
Comparing perceptions of RNs employed in Magnet, non-Magnet or in-process of accreditation hospitals	RN working in hospitals that were classified (as per survey response) as hospital that had earned ANCC designation as Magnet or Pathway to Excellence, No accreditation or in the process of applying for one.	Magnet, non-Magnet and in-process.		
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes
Cross sectional	Pool that hospitals / wards come from. E.G. "Hospitals contributing to the NDNQI database"		Nurses: sex, ethnicity, race, marital status, and highest degree.	Job satisfaction The three groups reported similar high levels of job satisfaction (91% of nurses from aspiring-hospitals, 89% Magnet, and 83% non-Magnet). Not statistically significant differences between the groups were reported for survey items related to workplace conditions (eg experience of verbal abuse, discrimination and harassment). However, nurses in Magnet hospitals reported significantly more back or musculoskeletal injuries (39%) than non-Magnet nurses (30%) (p< 0.05).
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	Nurse outcomes
-	Hospitals and units were not selected. A random sample of nurses were sent a survey and they reported the type of hospital they worked in.	Not relevant to study	None reported	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ' hospitals')	
-		1,500 RNs. 518 nurses responded to the type of hospital where they were employed: 151 (29%) worked in a Magnet. 69 (13%) worked in in-process and 298 (58%) in non-Magnet.	No	

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Lake et al. (2010)	US	Comparison of fall counts in Magnet and non-Magnet hospitals	Patients: • Falls	5% lower rate of falls in Magnet hospitals (IRR=0.95) An additional 3% RN hppd was associated with a 3% lower fall rate in ICUs An additional licensed practical nurse (LPN) or nursing assistant (NA) hour was associated with a 2–4% higher fall rate in non-ICUs. all types of nursing staff hours were significantly associated with patient falls, but in different directions; the directions were consistent with their bivariate patterns	Independent variables: nurse staffing, RN staff composition, and hospital Magnet status. Dependent variable: fall count
Study Aim	Setting	What was the comparison?	Nurses: None How was staffing requirement measured? HPPD		
Examine the relationships between hospital Magnet status, nursing unit staffing, and patient falls	Participating hospitals identified units by type of patient population and primary service. Units included: intensive care, step- down, medical, surgical, medical-surgical, and rehabilitation.	Magnet and non-Magnet institutions			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Cross sectional	Hospitals contributing to the NDNQI database in 2004	636	Nurse: educational level, national specialty certification, and proportion of hours supplied by agency employee nurses Patient: Age and gender		
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Unclear	5388	Ownership, bed size, teaching status, region (Northeast, Midwest, West, South)		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards 'hospitals')		
++			Yes		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	How was the intervention developed?	Outcomes	Patient outcomes	Staffing included RN, LPNs and CNAs Data of original study: Hickey P, Gauvreau K, Connor J, Sporing E, Jenkins K. The relationship of nurse staffing, skill mix, and Magnet recognition to institutional volume and mortality for congenital heart surgery. JNurs Adm. 2010;40(5):226-232. Aimed at examining the association of nurse staffing, skill mix, and Magnet recognition with mortality at children’s hospitals.
Goode et al. (2011)	US	Comparison on administrative data	Patients: - Hospital acquired infections (HAI) - Pressure ulcers How was staffing requirement measured? THPPD (all nursing hours divided by patient days of care in each unit).	Magnet hospitals had poorer outcomes (significant associations in bold). non-Magnet hospitals had lower than expected rates of infections and sepsis (post surgery). Negative associations between Magnet and HAPU. Results multiple regression: <u>Staffing on adult ICU</u> THPPD: - 0.022 HAPU (Hospital Acquired Pressure Ulcers) significant (p <.10); 0.003 HAI not significant; 0.035 Sepsis not significant RN%: -0.011 HAPU; -0.002 HAI; -0.033 (P < 0.05) Sepsis Magnet: -0.112 HAPU; 0.234 HAI; 0.576 (p < 0.05) Sepsis <u>Staffing on adult general units</u> THPPD: -0.037 HAPU 0.020 HAI - 0.045 Sepsis RN%: -0.007 HAPU; 0.003 HAI; - 0.006 Sepsis Magnet: -0.132 HAPU; 0.253 HAI; 0.612 (p <.10) Sepsis	
Study Aim	Setting	How was the intervention delivered?			
Comparison of patient outcomes and staffing between Magnet and non-Magnet hospitals.	Magnet and non-Magnet hospitals, ICUs and general units of adult wards in eligible teaching hospitals.	Patient outcomes in Magnet and non-Magnet institutions			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes <td rowspan="5"></td>	
Cross sectional	Hospitals contributing to the 2005 University Health Systems Consortium (UHC) operational and clinical databases.	54 (19 Magnet and 35 non-Magnet)	Risk adjusted adverse outcome rates (as per patient safety and inpatient quality indicators from the AHRQ) at hospital level	None reported	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Data collected from previous study of paediatric hospitals. The data source were University HealthSystems Consortium (UHC) which collects all hospital data and so it was possible to use those data in the study.		From extraction		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘hospitals’)		
+			Yes		

Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	Findings from authors: Missed nursing care showed significant differences according to Magnet status. Separate analysis showed no staffing-level difference between Magnet and non-Magnet hospitals CONCLUSIONS: The authors concluded the benefits of promoting efficient operations, work environment, and culture which characterise Magnet hospitals.
Kalisch and Lee (2012)	US	Survey that took place over a period of 4 weeks between December 2008 and April 2009. 2 phases: (1) surveying the nursing staff on patient-care Units with the MISSCARE Survey and (2) the collection of staffing and acuity (CMI) data by patient-care unit. Survey was distributed in sealed envelopes and left in the staff mailboxes. Responses were left in sealed boxes of participating units.	Patients: • Missed care Nurses: • None How was staffing requirement measured? HPPD Independent variables: missed nursing care, reasons for missed nursing care, nurse staffing(ie, HPPD, RN HPPD, and skill mix), and unit characteristics.	Staff on patient care units reported significantly less overall missed nursing care in Magnet than in non-Magnet hospitals (t = 2.20, p =0.03). Ten out of 24 specific elements of nursing care were missed significantly more in non-Magnet hospitals than in Magnet-designated facilities. All these however are not organisational factors related (eg bathing, feeding, patient teaching, mouth care, ambulation)	
Study Aim	Setting	What was the comparison?			
Examine missed nursing care between Magnet and non-Magnet hospitals	Medical-surgical, intermediate, intensive care, and rehabilitation units in hospitals located in the Midwest and Western regions of the United States	Missed care, as perceived by nursing staff (self-reported) between Magnet and non-Magnet hospitals.			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Cross-sectional	Pool that hospitals / wards come from. E.G. “Hospitals contributing to the NDNQI database”	11 hospitals (4 Magnet, 7 non-Magnet)			
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	Nurse outcomes	
-	Units included met the criteria of: patients were over 18 years old and an average patient length of stay (LOS) was higher or equal to 2 days	124	From extraction		
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘hospitals’)		
-			Unclear from extraction		

Organisational policies and procedures, including staff training

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	No details on the different measures, the sample characteristics or the distribution are given.
Kooker and Kamikawa (2011)	US, Hawaii	New nurse fellowship training for all new nurses after the first six months of employment. Training included 24 weeks of personal, cultural, team and leadership development. Nurse manager academy for all nurse managers to improve leadership skills. Staff exchange with magnet accredited facility Ward level performance improvement projects focussed on patient and nurse outcomes.	Patients: - Pressure ulcers (ICU only) - Patient satisfaction with nurses Nurses: - RN satisfaction autonomy - RN satisfaction decision making - RN retention rate - RN vacancy rate	From 2005 to 2009: Patient satisfaction with nurses increased from 84.6 to 87.8 Pressure ulcer rate decreased from 15.3 to 6.7 (only on ICU measured)	
Study Aim	Setting	What was the comparison?			
Evaluation of a nurse retention initiative.	Academic medical center	None			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Time series without control	Single site	1	No	RN retention increased from 55.97 to 68.2	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	RN vacancy rate decreased from 11.26 to 2.19	
-	Not reported	Unclear	No	RN satisfaction – autonomy increased from 43.55 to 49.29 RN satisfaction – decision making increased from 41.13 to 47.97	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ‘hospitals’)		
-		Unclear	No		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
McGillis Hall et al. (2008)	Canada	Workplace change to improve resource availability. Based on quality improvement framework with three dimensions: identification and choice of key factors influencing nurses' working life, analysis of the process influencing that factor and identification and mobilisation of the change intervention. This process was supported by a trained facilitator (bachelor prepared nurse) over a six month period. Example of interventions were: improving linen supply, enhancing documentation activities of LPNs, increasing medication stock supply, improving communication related to patient transfers and identification of basic equipment needs.	Patients: - Index of Activities of Daily Living (ADL), - Therapeutic self-care - Perceived Health Benefit from Nursing Care - Patient Judgment of Hospital Quality Questionnaire Cronbach alphas ranging from 0.78-0.90 Nurses: - McCloskey-Mueller satisfaction scale - Work quality index - Perceived effectiveness of care questionnaire - Perceptions of nursing leadership - Role tension index - Stress in general scale Cronbach alphas ranging from 0.82-0.97	Overall four patient outcomes (Patient Judgments of Hospital Quality, Perceived Health Benefit, Therapeutic Self-care, Activities of Daily Living) were assessed before and six month after the intervention. No significant differences were found.	
Study Aim	Setting	What was the comparison?			
Examine the impact of interventions designed to improve the nursing work environment on patient and nurse outcomes.	Public hospitals representing all settings in Ontario, CA.	None			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Before and after study without control group	All public hospitals in Ontario, CA	8	Yes, not described.	Overall six nurse (Work Quality, Job Satisfaction, Nursing Leadership, Role	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment	Tension, Quality of Care, Job Stress) outcomes were assessed before and six month after the intervention.	
-	Hospitals were randomly selected. Not described for nurse managers, nurses and patients. Same nurses and managers were assessed during study period. Patients were recruited for each time point.	16	Medical vs. surgical Care delivery model % part-time RNs	Only work quality increased statistically significant (p= 0.0214, no effect estimate given)	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ' hospitals')		
+		1137 patients 296 nurses	Yes, hierarchical linear model		

Study Details	Population and setting	Intervention	Outcomes and control variables	Results	Notes / comments
Author (Year)	Country	What was the intervention?	Outcomes	Patient outcomes	
Kalisch et al. (2013)	US	Crew resource management approach including TeamSTEPPS. Training consisted of several elements: short 10-minute podcast, scenarios including role playing (simulation), debriefing, and discussion. 3x one hour sessions with 2-3 scenarios to discuss eight nursing teamwork behaviours in a period over 4-6 weeks. Feedback was provided by trainers, which were trained with a 2-day training. Class sizes between 3-6 staff members.	Nurses: - Nursing Teamwork (measured with Nursing Teamwork Survey) - Missed Care (measured with MISSCARE Survey) - Satisfaction with teamwork - Knowledge of Teamwork	None	
Study Aim	Setting	What was the comparison?			
Assess the impact of a train-the-trainer teamwork/missed care intervention on teamwork, missed nursing care, satisfaction with teamwork, and knowledge of teamwork.	Three medical/surgical units in three acute care hospitals (academic medical center, specialty hospital, and a large teaching hospital).	None			
Study design	Source Population	Sample size (Hospitals)	Patient (nurse) level adjustment	Nurse outcomes	
Before and after study without control	All members of the nursing team including nurse managers.	3		Before vs. delayed post-test Overall teamwork 0.13, p= 0.001 Missed Care -0.09, p=0.029	
Internal Validity	Selection procedure	Sample size (units)	Unit / hospital level adjustment		
-	Convenience sample, no further description	3		Sat. w. teamwork 0.24, p=0.002	
External Validity		Sample size (Patients & or nurses)	Control for clustering of outcomes in units (wards ' hospitals')		
-		242 nurses		Knowledge 0.40, p=0.005	

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Appendices

A) Base search strategy

Database, Host, Date Searched, Year Searched Added Keywords	Search Strategy	Results
Ovid MEDLINE(R) 1996 to January Week 4 2014 Searched on 30/01/201 4 Search Limited to 2006- current Keywords Added: QUESTION	1 exp Nurses/ (39956) 2 Nursing Staff, Hospital/ (19990) 3 (nurse or nurses or nursing).tw. (166343) 4 (RN or "RNs" or "RN's").tw. (6068) 5 Nurses' Aides/ (1986) 6 ("healthcare assistant*" or "health care assistant*").tw. (296) 7 Nursing Administration Research/ (1905) 8 Nursing Audit/ (1798) 9 Models Nursing/ (8353) 10 Nursing Service Hospital/ (1383) 11 or/1-10 (196456) 12 exp Hospitals/ (96922) 13 exp Hospital Units/ (46926)	4233

1 2006 TO CURRENT SEARCH MEDLINE	14 hospital*.tw. (495376) 15 (acute adj3 (ward* or unit*)).tw. (3146) 16 (acute adj3 care).tw. (12476) 17 (medical adj3 (unit* or ward*)).tw. (6786) 18 (surgical adj3 (unit* or ward*)).tw. (5932) 19 Inpatients/ (9872) 20 (inpatient* or "in-patient*").tw. (755198) 21 (patient* adj3 surgical).tw. (38159) 22 ("medical-surgical" or "surgical-medical").tw. (3180) 23 (postsurgical or "post surgical").tw. (8691) 24 or/12-23 (1241211) 25 (skill* adj1 mix*).tw. (486) 26 skillmix*.tw. (5) 27 (staffmix* or "staff mix*").tw. (67) 28 staffing.tw. (5679) 29 understaff*.tw. (263) 30 "under staff*".tw. (29) 31 "Personnel Staffing and Scheduling"/ (9217) 32 (staff* adj3 (level* or ratio* or resourc* or model* or number* or mix* or rota* or rosta* or roster* or schedul* or overtime or supervision or supervisory)).tw. (4977) 33 (staff* adj3 (sufficient* or sufficiency or adequate* or adequac* or target* or insufficient* or insufficienc* or inadequate* or inadequac* or short or shortage or efficient* or efficienc* or inefficien*)).ti. (129)	
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34	Health Manpower/ (3311)	
35	manpower.tw,fs. (29821)	
36	(workload* or workforce* or shift or shiftwork* or shifts or overtime or capacity).tw. (331806)	
37	Workload/ (12895)	
38	or/25-37 (376700)	
39	11 and 24 and 38 (7620)	
40	(nursing and hours and patient and day).tw. (270)	
41	NHPPD.tw. (5)	
42	(nurs* and hours and care).tw. (2716)	
43	(nurs* and work* and hours).tw. (1458)	
44	(nurs* adj3 "patient* ratio*").tw. (221)	
45	"nurse-patient-ratio".tw. (39)	
46	(nurs* adj3 "patient* number*").tw. (2)	
47	(nurs* adj staffing).tw. (778)	
48	(nurs* and staffing and hospital*).tw. (1126)	
49	(nurs* and staffing and ward*).tw. (150)	
50	(nurs* and staffing and unit*).tw. (746)	
51	(nurs* and safe* and staffing).tw. (350)	
52	(nurs* and adequate* and staff*).tw. (953)	
53	(nurs* and inadequate* and staff*).tw. (530)	
54	(nurs* and understaff*).tw. (121)	
55	(nurs* and "under staff*").tw. (13)	
56	("nurs* unit*" and (organi?ation or characteristic* or	

	outcome* or level*)).tw. (314)	
57	(nurs* and staffing and outcome*).tw. (701)	
58	(nurs* and staff* and burnout).tw. (307)	
59	(nurs* and staff* and stress).tw. (821)	
60	(nurs* and staff* and fatigue).tw. (121)	
61	(nurs* and staffing and practice).tw. (484)	
62	"care left undone".tw. (3)	
63	("missed care" or "missing care").tw. (29)	
64	(nurs* and skillmix*).tw. (2)	
65	(nurs* and "skill* mix*").tw. (308)	
66	(nurs* and (staffmix or "staff mix")).tw. (45)	
67	(nurs* and magnet and staff*).tw. (133)	
68	or/40-67 (7836)	
69	39 or 68 (13127)	
70	(MAU or "assessment unit*" or maternal or maternity or obstetric* or "accident and emergency" or "A&E" or "emergency room* or HIV or burns").tw. (142436)	
71	Emergency Medical Services/ or Emergency Service, Hospital/ (50883)	
72	Maternal Health Services/ or Hospitals, Maternity/ or Obstetrics/ (12168)	
73	Community Mental Health Services/ or Mental Health Services/ or "United States Substance Abuse and Mental Health Services Administration"/ (23572)	
74	Psychiatric Department, Hospital/ or Emergency Services, Psychiatric/ or Hospitals, Psychiatric/ or Psychiatric Nursing/	

	(14909) 75 (mental or mentally or psychiatry or psychiatric).tw. (193845) 76 exp Intensive Care Units/ or Burns Units/ or Burns/ or HIV Infections/ or Acquired Immunodeficiency Syndrome/ (181726) 77 (ICU or "intensive care unit*").tw. (56971) 78 exp "Homes for the Aged"/ (5969) 79 ("nursing home*" or "care home*" or "medical home*").tw. (15340) 80 exp residential facilities/ or exp nursing homes/ or Outpatients/ (28500) 81 or/70-80 (626705) 82 or/15-18,21-23 (72277) 83 69 not (81 not 82) (8881) 84 limit 83 to yr="2006 -Current" (4965) 85 (editorial or comment or letter).pt. (825651) 86 84 not 85 (4899) 87 limit 86 to english language (4520) 88 exp child/ or exp infant/ (918546) 89 (child* or infant* or schoolchild* or preschool* or "pre- school*" or pediatric* or paediatric* or toddler* or newborn* or neonatal or baby or babies).tw. (750873) 90 88 or 89 (1112615) 91 exp adult/ (3079078) 92 adult*1.tw. (485370)	
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	93 91 or 92 (3291089)	
	94 87 not (90 not 93) (4233)	
Ovid MEDLINE(R) In- Process & Other Non- Indexed Citations January 30, 2014 (MEIP) Searched on 30/01/201 4 Search Limited to 2006- current Keywords Added: QUESTION 1 2006 TO CURRENT SEARCH MEDLINE	As per Medline using free text terms	561

EMBASE Ovid 1974 to 2014 January 30 Search Limited to 2006- current Searched on 31/01/2014 Keywords Added: QUESTION 1 2006 TO CURRENT SEARCH EMBASE	1 Nurses/ (71662) 2 Nursing staff/ (54918) 3 Nursing/ (195177) 4 (nurse or nurses or nursing).tw. (363049) 5 (RN or "RNs" or "RN's").tw. (11585) 6 Nursing Assistant/ (3662) 7 ("healthcare assistant*" or "health care assistant*").tw. (434) 8 or/1-7 (505465) 9 Hospital/ or Teaching Hospital/ or Magnet Hospital/ or General Hospital/ or Teaching Hospital/ (276321) 10 Hospital Patient/ (73168) 11 hospital*.tw. (1132017) 12 (inpatient* or "in-patient*").tw. (1625587) 13 Inpatient/ (73168) 14 or/9-13 (2621563) 15 (patient* adj3 surgical).tw. (82936) 16 (acute adj3 (ward* or unit*)).tw. (6697) 17 (acute adj3 care).tw. (22625) 18 (medical adj3 (unit* or ward*)).tw. (15040) 19 (surgical adj3 (unit* or ward*)).tw. (12179) 20 Surgical Ward/ (3313) 21 (patient* adj3 surgical).tw. (82936)	5364

22	("medical-surgical" or "surgical-medical").tw. (6525)	
23	(postsurgical or "post surgical").tw. (18230)	
24	or/15-23 (153754)	
25	14 and 24 (77035)	
26	Skill Mix/ (123)	
27	(skill* adj1 mix*).tw. (761)	
28	skillmix*.tw. (7)	
29	(staffmix* or "staff mix*").tw. (85)	
30	staffing.tw. (11381)	
31	understaff*.tw. (477)	
32	"under staff* ".tw. (46)	
33	"staff deficien* ".tw. (7)	
34	Personnel Management/ (50253)	
35	Total Quality Management/ (22857)	
36	"organization and management"/ (362172)	
37	(staff* adj3 (level* or ratio* or resourc* or model* or number* or mix* or rota* or rosta* or roster* or schedul* or overtime or supervision or supervisory)).tw. (9524)	
38	(staff* adj3 (sufficient* or sufficiency or adequate* or adequac* or target* or insufficient* or insufficienc* or inadequate* or inadequac* or short or shortage or efficient* or efficienc* or inefficien*)).ti. (247)	
39	("personnel staffing" or "personnel shortage" or "personnel schedul* ").tw. (180)	
40	Health Care Manpower/ (10092)	

41	Manpower Planning/ (827)	
42	manpower.tw. (7714)	
43	(workload* or workforce* or shift or shiftwork* or shifts or overtime or capacity).tw. (662508)	
44	Workload/ (27748)	
45	or/26-44 (1092175)	
46	8 and 25 and 45 (2577)	
47	(nursing and hours and patient and day).tw. (613)	
48	NHPPD.tw. (6)	
49	(nurs* and hours and care).tw. (5528)	
50	(nurs* and work* and hours).tw. (2907)	
51	(nurs* adj3 "patient* ratio*").tw. (335)	
52	"nurse-patient-ratio".tw. (75)	
53	(nurs* adj3 "patient* number*").tw. (4)	
54	(nurs* adj staffing).tw. (1097)	
55	(nurs* and staffing and hospital*).tw. (1892)	
56	(nurs* and staffing and ward*).tw. (267)	
57	(nurs* and staffing and unit*).tw. (1248)	
58	(nurs* and safe* and staffing).tw. (513)	
59	(nurs* and adequate* and staff*).tw. (1944)	
60	(nurs* and inadequate* and staff*).tw. (1024)	
61	(nurs* and understaff*).tw. (182)	
62	(nurs* and "under staff*").tw. (16)	
63	("nurs* unit*" and (organi?ation or characteristic* or	

	outcome* or level*)).tw. (602)	
64	(nurs* and staffing and outcome*).tw. (951)	
65	(nurs* and staff* and burnout).tw. (513)	
66	(nurs* and staff* and stress).tw. (1564)	
67	(nurs* and staff* and fatigue).tw. (217)	
68	(nurs* and staffing and practice).tw. (705)	
69	"care left undone".tw. (5)	
70	("missed care" or "missing care").tw. (37)	
71	(nurs* and skillmix*).tw. (2)	
72	(nurs* and "skill* mix*").tw. (414)	
73	(nurs* and (staffmix or "staff mix")).tw. (55)	
74	(nurs* and magnet and staff*).tw. (158)	
75	or/47-74 (14858)	
76	46 or 75 (16681)	
77	(MAU or "assessment unit*" or maternal or maternity or obstetric* or "accident and emergency" or "A&E" or "emergency room* or HIV or burns").tw. (320040)	
78	Emergency Health Service/ (68459)	
79	Maternity Ward/ or Maternity Care/ or Obstetrics/ (41451)	
80	Community Mental Health/ or Mental Health Service/ or Mental Health Center/ (51090)	
81	Psychiatric Department, Hospital/ or Emergency Services, Psychiatric/ or Hospitals, Psychiatric/ or Psychiatric Nursing/ (113664)	
82	(mental or mentally or psychiatry or psychiatric).tw.	

	(472040) 83 exp Intensive Care Unit/ or Burn/ or Human Immunodeficiency Virus Infection/ or Acquired Immune Deficiency Syndrome/ (421065) 84 (ICU or "intensive care unit*").tw. (117080) 85 exp "Home for the Aged"/ (10991) 86 ("nursing home*" or "care home*" or "medical home*").tw. (31398) 87 residential home/ (5733) 88 Outpatient/ or outpatient*.tw. (166637) 89 or/77-88 (1524255) 90 76 not (89 not 24) (11524) 91 (editorial or comment or letter).pt. (1314055) 92 90 not 91 (11466) 93 exp child/ or exp infant/ (1826229) 94 (child* or infant* or schoolchild* or preschool* or "pre-school*" or pediatric* or paediatric* or toddler* or newborn* or neonatal or baby or babies).tw. (1845807) 95 93 or 94 (2612649) 96 exp adult/ (4659638) 97 adult*1.tw. (962552) 98 96 or 97 (5182226) 99 92 not (95 not 98) (10462) 100 limit 99 to (english language and yr="2006 -Current") (5364)	
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Database - CINAHL Plus with Full Text EBBCO HOST Searched 01/02/2014 Search Limited to 2006-current Keywords Added: QUESTION 1 2006 TO CURRENT SEARCH CINAHL	S1 (MH "Nursing Staff, Hospital" (13,040) S2 (MH "Acute Care Nurse Practitioners") (283) S3 (MH "Nurses+") (157,605) S4 TI ((nurse or nurses or nursing)) OR AB ((nurse or nurses or nursing)) (355,892) S5 TI ((RN or "RNs" or "RN's")) OR AB ((RN or "RNs" or "RN's")) (13,617) S6 (MH "Nursing Assistants") (5,693) S7 TI (("healthcare assistant*" or "health care assistant*")) OR AB (("healthcare assistant*" or "health care assistant*")) (776) S8 (MH "Surgical Patients") (5,294) S9 TX (acute N3 surg*) (6,415) S10 TX (acute N3 medical) (6,654) S11 TX (surgical N3 (unit* or ward*)) (15,212) S12 TX (medical N3 (unit* or ward*)) (33,478) S13 TI (("medical-surgical" or "surgical-medical" or postsurgical or "post surgical")) OR AB (("medical-surgical" or "surgical-medical" or postsurgical or "post surgical")) (4,448) S14 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 (430,355) S15 S8 OR S9 OR S10 OR S11 OR S12 OR S13 (58,017) S16 S14 AND S15 (15,597) S17 (MH "Skill Mix+") OR (MH "RN Mix") (1,973) S18 TI ((skillmix* or "skill mix*" or staffmix* or "staff mix*")) OR AB ((skillmix* or "skill mix*" or staffmix* or "staff	2291

	mix*"))) (795) S19 TI ((understaff* or "under staff*")) OR AB ((understaff* or "under staff*")) (330) S20 (MH "Personnel Staffing and Scheduling+") (21,401) S21 TI ((staff* N3 (level* or ratio* or resourc* or model* or number* or mix* or rota* or rosta* or roster* or schedul* or overtime or supervision or supervisory))) OR AB ((staff* N3 (level* or ratio* or resourc* or model* or number* or mix* or rota* or rosta* or roster* or schedul* or overtime or supervision or supervisory))) (5,688) S22 TI ((staff* N3 (sufficient* or sufficiency or adequate* or adequac* or target* or insufficient* or insufficienc* or inadequate* or inadequac* or short or shortage or efficient* or efficienc* or inefficien*))) OR AB ((staff* N3 (sufficient* or sufficiency or adequate* or adequac* or target* or insufficient* or insufficienc* or inadequate* or inadequac* or short or shortage or efficient* or efficienc* or inefficien*))) (1,885) S23 (MH "Nursing Manpower") (4,705) S24 TI ((manpower or workload* or workforce* or shift or shiftwork or shifts or overtime)) AND AB ((manpower or workload* or workforce* or shift or shiftwork or shifts or overtime or capacity)) (2,556) S25 (MH "Workforce") (4,922) S26 (MH "Nursing Care Delivery Systems") OR (MH "Nursing Care Studies") OR (MH "Nursing Intensity") (1,484) S27 TX "safe staffing" Search modes - Boolean/Phrase (2,643) S28 S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR	
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	S24 OR S25 OR S26 OR S27 (39,331) S29 S16 AND S28 (1,388) S30 TX NHPPD (69) S31 TX "nursing hours per patient day" (202) S32 TX (nurs* and magnet and staff*) (4,707) S33 TI ((nurs* and staff* and burnout)) OR AB ((nurs* and staff* and burnout)) (379) S34 (MH "Burnout, Professional") (4,700) S35 TI ("missed care" or "missing care") OR AB (("missed care" or "missing care")) (20) S36 TI "care left undone" OR AB "care left undone" (5) S37 TI (nurs* N3 "patient ratio*") OR AB (nurs* N3 "patient ratio*") (383) S38 TI (("nurs* unit*" N5 (organi?ation or characteristic* or design or outcome* or level* or turnover or acuity or dependence))) OR AB (("nurs* unit*" N5 (organi?ation or characteristic* or design or outcome* or level* or turnover or acuity or dependence)))) (142) S39 TI (patient* N5 acuity) OR AB (patient* N5 acuity) (1,068) S40 S30 OR S31 OR S32 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 (11,070) S41 S15 AND S40 (2,034) S42 S29 OR S41 (3,112) S43 S29 OR S41 Limiters - Published Date: 20060101-	
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	20141231 (2,291)	
COCHRAN E LIBRARY (Wiley) Central Issue 1 of 12 Jan 2014 CDSR Issue 1 of 12 Jan 2014 DARE Issue 1 of 4 Jan 2014 NHSEED Issue 1 of 4 Jan 2014 Search Limited to 2006- current Searched 02/02/201 4 Keywords Added:	#1 MeSH descriptor: [Nursing Staff, Hospital] this term only 341 #2 (nurse or nurses or nursing):ti,ab 12149 #3 (RN or "RNs" or "RN's"):ti,ab 161 #4 MeSH descriptor: [Nurses' Aides] this term only 48 #5 ("healthcare assistant*" or "health care assistant*") 41 #6 MeSH descriptor: [Nursing Administration Research] this term only 35 #7 MeSH descriptor: [Nursing Audit] this term only 48 #8 MeSH descriptor: [Models, Nursing] this term only 156 #9 #2 or #3 or #4 or #5 or #6 or #7 or #8 12323 #10 MeSH descriptor: [Hospitals] explode all trees 2763 #11 MeSH descriptor: [Hospital Units] explode all trees 2896 #12 hospital*:ti,ab 50784 #13 acute near/3 care:ti,ab 965 #14 (acute near/3 (ward* or unit*)):ti,ab 322 #15 (medical near/3 (unit* or ward*)):ti,ab 724 #16 (surgical near/3 (unit* or ward*)):ti,ab 782 #17 MeSH descriptor: [Surgery Department, Hospital] this term only 50	Total: 1152 CDSR 490 DARE 56 HTA 6 NHSEED 38 CENTRA L 562

QUESTION	#18	("medical-surgical" or "surgical-medical" or postsurgical or "post-surgical"):ti,ab 1501	
1 2006 TO			
CURRENT			
SEARCH	#19	(mixed near/3 (surgical and medical)):ti,ab 24	
COCHRAN	#20	(surgical near/3 patient*):ti,ab 4315	
E CDSR	#21	(patient* near/3 (surgical or medical)):ti,ab 6965	
COHRANE	#22	#12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 58062	
DARE			
COCHRAN	#23	#9 and #22 3426	
E			
CENTRAL	#24	#1 and #22 177	
COCHRAN	#25	#23 or #24 3443	
E HTA	#26	MeSH descriptor: [Personnel Staffing and Scheduling] this term only 100	
COCHRAN			
E NHSEED	#27	skill* near/3 mix* 66	
	#28	staff* near/3 mix* 32	
	#29	staffing 9074	
	#30	(understaff* or "under staff*") 13	
	#31	735 (staff* near/3 (level* or ratio* or resourc* or model* or number* or mix* or rota* or rosta* or roster* or schedul* or overtime or supervision or supervisory))	
	#32	151 (staff* near/3 (sufficient* or sufficiency or adequate* or adequac* or target* or insufficient* or insufficienc* or inadequate* or inadequac* or short or shortage or efficient* or efficienc* or inefficien*))	
	#33	MeSH descriptor: [Health Manpower] this term only 11	
	#34	manpower 499	
	#35	(workload* or workforce* or shift or shiftwork* or	

	shifts or overtime or capacity):ti,ab 18503	
	#36 MeSH descriptor: [Burnout, Professional] this term only 118	
	#37 burnout 240	
	#38 #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 27738	
	#39 #25 and #38 891	
	#40 NHPPD 0	
	#41 "nursing hours" 14	
	#42 nurse* near/3 "patient ratio*" 46	
	#43 "nurse-patient ratio*" 29	
	#44 nurs* near/2 staffing 1620	
	#45 ("nurs* unit*" and (organi?ation or characteristic* or outcome* or level*)) 81	
	#46 nurs* near/5 burnout 27	
	#47 nurs* near/5 stress 240	
	#48 nurs* near/5 fatigue 63	
	#49 nurs* and magnet and staffing 38	
	#50 (nurs* and (skillmix* or "skill mix*" or "staffmix*" or "staff mix*")) 55	
	#51 (nurs* and ("patient dependency" or "patient acuity")) 24	
	#52 #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50 or #51 2059	
	#53 #39 or #52 from 2006 to 2014 1169 (1152 from central, cdsr, dare, HTA, NHSEED)	

	Last Saved: 02/02/2014 14:35:18.123	
ECONLIT EBSCO Searched 02/02/2014 Search Limited 2006-2014 Keywords: ECONLIT QUESTION 1 2006 TO CURRENT SEARCH	Searched CEA registry – no results 2006-2014 https://research.tufts-nemc.org/cear4/SearchingtheCEARegistry/SearchtheCEARegistry.aspx ECONLIT Search: Limiters - Published Date: 20060101-20141231; Publication Type: Journal Article S1 nurs* AND staffing 29 S2 (nurs* and (understaff* or "under staff*")) (2) S3 (nurs* and (skillmix* or "skill mix*" or staffmix* or "staff mix*")) (49) S4 (nurs* and "patient turnover") (6) S5 ("surgical ward" or "medical ward") (0) S6 ("medical unit*" or "surgical unit*") (7) S7 "medical-surgical unit*" (2) S8 (nurs* and ratio* and patient*) (12) S9 S1 OR S2 OR S4 OR S5 OR S6 OR S7 OR S8 (47) (23 SELECTED FOR DOWNLOAD)	23 (econlit)

B) Included studies

AIKEN, L. H., BUCHAN, J., BALL, J. & RAFFERTY, A. M. 2008. Transformative impact of Magnet designation: England case study. *Journal of Clinical Nursing*, 17, 3330-3337.

BARKELL, N. P., KILLINGER, K. A. & SCHULTZ, S. D. 2002. The relationship between nurse staffing models and patient outcomes: a descriptive study. *Outcomes Manag*, 6, 27-33.

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BURRITT, J. E., WALLACE, P., STECKEL, C. & HUNTER, A. 2007. Achieving quality and fiscal outcomes in patient care: the clinical mentor care delivery model. *Journal of Nursing Administration*, 37, 558-563.

DUBOIS, C. A., D'AMOUR, D., TCHOUAKET, E., CLARKE, S., RIVARD, M. & BLAIS, R. 2013. Associations of patient safety outcomes with models of nursing care organization at unit level in hospitals. *Int J Qual Health Care*, 25, 110-7.

FAIRBROTHER, G., JONES, A. & RIVAS, K. 2010. Changing model of nursing care from individual patient allocation to team nursing in the acute inpatient environment. *Contemporary Nurse*, 35, 202-220.

GOODE, C. J., BLEGEN, M. A., PARK, S. H., VAUGHN, T. & SPETZ, J. 2011. Comparison of patient outcomes in Magnet(R) and non-Magnet hospitals. *J Nurs Adm*, 41, 517-23.

HESS, R., DESROCHES, C., DONELAN, K., NORMAN, L. & BUERHAUS, P. I. 2011. Perceptions of nurses in magnet(R) hospitals, non-magnet hospitals, and hospitals pursuing magnet status. *J Nurs Adm*, 41, 315-23.

KALISCH, B. J. & LEE, K. H. 2012. Missed nursing care: Magnet versus non-Magnet hospitals. *Nursing Outlook*, 60, e32-e39.

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d) Checklist

	Scores	Internal	External
Design		2 strong (++)	NA not applicable
Study design & analysis cross sectional (0) or allows for cause / effect (exposure precedes outcome) 2		1 moderate (+), NR (not recorded)	
		0 weak (-)	
1.1 Is the source population well described? Is it applicable to the UK?		2	
(Did the setting differ significantly from the UK?			1
(UK ++			
(Other developed countries +			
Other -			
1.2 Is the eligible population or area representative of the source population or area?			
(Large Multisite study with a representative sample of population with clearly defined recruitment strategy (+2)			0
(Were the wards/ staff / patients eligible to be included in the hospitals representative of general / medical and / or surgical units [census/ stratified / random samples of med / surg units or patients] (+1)			
(Sample includes some ineligible units (-1)			
(Single site study (-)			
1.2 Do the selected participants or areas represent the eligible population or area?			
(What 60% of selected hospitals /units agreed to participate (+1)			
(What % of eligible individuals (staff / patients) participated (60% + is acceptable)?(+1)			
(Was the data derived from administrative systems and complete (Give +1)			0
Were the inclusion or exclusion criteria explicit and appropriate? (if no -1)			
2.9 Did the setting reflect usual UK practice in general medical surgical settings?			1
(No significant difference of the setting to UK practice? (+2)			
(Some differences from UK practice? (1+)			
(Unclear (0)			
2.2 Where interventions well described?		0	
(Were interventions and comparisons described detailed enough for replication? (+2)			
(Were comparison appropriate (e.g. intervention vs. usual care)? (+1)			
(Unclear intervention and / or comparison (-)			
2.10 Did the intervention or control comparison reflect usual UK practice?			1
(No significant difference of the intervention/control from UK practice? (+2)			
(Some differences from UK practice? (1+)			
(Unclear (0)			
2.5 Was the exposure to the intervention and comparison adequate?		0	
(The extent to which the intervention / control is implemented is clear and complete (+2)			
(Lower fidelity, unlikely to introduce important bias (1+)			
(Unclear or incomplete implementation (0)			
2.7 Were other interventions similar in both groups?		0	
(Staffing levels measured and equal in both groups (+1)			
(Other interventions similar in both groups (+1)			
(Groups were treated equally by researchers and involved personnel (+1)			
(Staffing levels not measured / controlled or substantially different between groups (-)			
2.1 Allocation of intervention - how was selection bias minimised?		0	
(Randomisation of multiple units (6+) or individuals? (+2)			
(Differences between groups assessed and if necessary adjusted? (+1)			
(Before and after study, non equivalent control or no control (-)			
(Confounding was likely (e.g. small number of units, limited / no adjustment)? (-)			
3.1 Were the outcome measures and procedures reliable?		0	
(Were main patient outcome measures subjective or objective (give ++ for objective measures or)			
(Study reports good reliability for outcome measures (e.g. inter- or intra-rater reliability scores .7 or above)? (+)			
Was there any indication that measures had been validated (e.g. validated against a gold standard measure or assessed for content) (+)			
3.4 Were outcomes relevant?		1	
(Was a surrogate measure used (e.g. nurse reported falls as opposed to actual falls)? (+1)			
(Is the surrogate a reliable and valid measure? (+1)			
(Unclear (0)			
4.3 Was the study sufficiently powered to find an intervention effect?		0	
(Explicit and appropriate power analysis based on minimal clinically important difference (+2)			
(Incomplete power considerations? (+1)			
(Unclear or absent (0)			
4.5 Were the analytical methods appropriate?		0	
(Adjustment for follow-up times or differences in confounders (+2)			
(Cluster adjustment (if required) (+1)			
(Unclear or cluster adjustment not undertaken when it was needed (0)			
4.1 Were exposure and comparison groups similar at baseline?		0	
(No difference (+2)			
(Difference, but adjusted for? (+1)			
(Unclear (0)			
2.8 Were all participants accounted for in study conclusion?		0	
(Lost to follow-up acceptably low (20% or less)? (+1)			
(Did proportion dropped differ substantially by group? (1+)			
(Unclear (0)			
4.6 Was precision of intervention effect given? Were they meaningful?		0	
(Were exact p values or confidence intervals given? (+1)			
(Effect estimates precise enough for decision making (+1)			
(Unclear (0)			
5.1 Are the study results internally valid (i.e. unbiased)?		Only edit below the line if the study is internally valid	
(How well did the study minimise sources of bias (i.e. adjusting for potential confounders)?		-	
Were there significant flaws in the study design?			
5.2 Are the findings generalisable to the source population (i.e. externally valid)?			
(Are there sufficient details given about the study to determine if the findings are generalisable to the source population?		-	
Consider: participants, interventions and comparisons, outcomes, resource and policy implications.			
Overall:		strong (++)	All / most checklist items met
		moderate (+)	Some checklist items met
		weak (-)	Few criteria fulfilled