Brief scoping of the nurse staffing evidence base

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Introduction
This brief scoping of the nurse staffing evidence base was commissioned by NIHR HS&DR under the Evidence Synthesis Centre contract. The scoping paper aims to outline current and recent research in nurse staffing with a focus on evidence from the UK with a background section based around three key systematic reviews addressing the key question.

Report Structure
This report is organised into four sections for ease of reading:
Overview, Section One – Key messages and research implications (organised by topic), Section Two – Table of evidence and Section Three – Methods

Overview

Key question
What research is currently being undertaken in nurse staffing and what gaps exist in the research literature? Specifically the scoping will focus on staffing in terms of staffing levels, skill mix, case mix, grademix and workload (where the evidence permits) and outcomes related to both staff and patients (in particular patient safety).

Background
There are three main reviews that address nurse staffing that have been completed in the last seven years (Kane 2007, Harris and Hall 2012 and Kitson et al 2013). These are key evidence syntheses in the topic. This scoping paper will firstly summarise these studies and then fill some of the identified gaps with more recent primary studies/evidence syntheses and policy documents.

Researchers from the United States (Kane et al 2007) produced an evidence report "*to assess how nurse to patient ratios and nurse work hours were associated with patient outcomes in acute care hospitals, factors that influence nurse staffing policies, and nurse staffing strategies that improved patient outcomes*". The evidence report found that, in the acute setting, greater staffing was associated with lower mortality, less failure to rescue and to a reduction in other patient related adverse outcomes. The reduction in relative risk appeared to be related to nurse:patient ratios but not to nursing hours or skill mix. The association between higher staffing levels and improved patient outcomes was not found to be necessarily causal and as the effect size was difficult to measure, they were unable to recommend a figure for nurse staffing that would lead to these improved outcomes. Evidence relating skill mix to patient outcomes was more equivocal than that relating to mortality, although there was a clear relationship between increasing the ratio of qualified staff to unqualified and improved outcomes.

Harris and Hall (2012) for the Canadian Nurses Association undertook a focused literature review to update previous work undertaken for the *Evaluation Framework to Determine the Impact of Nursing Staff Mix Decisions* (CNA 2005). This framework was an evidence based approach to making decisions about how nursing care should best be delivered, including how best to make decisions about nurse staff mix. The findings of this review reflect those of Kane (2007) that there is a link between higher nurse staffing levels and improved patient outcomes. However, this review argues that as models of care are evolving over time, this may influence the relationship between staffing and outcomes. They also point out that there is no gold-standard for the measurement of nurse staffing.

Kitson et al (2013), based in Australia produced an evidence synthesis looking at the factors that impact on quality nursing care. Using international evidence, they examined 79 systematic reviews (1979-2012) to look for the factors that impact on the ability of nurses to deliver high quality care. The factors that they identified that contributed to the delivery of high quality care (in terms of the research questions of this scoping paper) were: a positive practice environment which benefits the care environment, improved recruitment and retention and improved nurse wellbeing and patient outcomes. Secondly, in terms of resources, that increased nurse staffing (particularly of registered staff) and promoting nurse led care for specific conditions, improved patient outcomes.

Section One - Key Messages and research implications (based on HSE n.d)

Quality of work and error likelihood (this covers patient outcomes/safety)

What is already known?

The Francis Report (2013) into avoidable deaths at the Mid Staffordshire NHS Trust and the follow on Berwick Report (2013) which focussed on patient safety in the NHS had the following to say in terms of nurse staffing – "*NICE should interrogate the available evidence for establishing what all types of NHS services require in terms of staff numbers and skill mix to assure safe, high quality care for patients*" and "*Staffing levels should be consistent with the scientific evidence on safe staffing, adjusted to patient acuity and the local context. (This includes, but is not limited to, nurse-to-patient staffing ratios, skill mixes between registered and unregistered staff….)*"

The RCN (2014) report ***Frontline First: More than just a number*** reports on data that shows that "senior nursing roles have borne the brunt of workforce cuts leading to a dangerous loss of experience and skills that are essential to ensuring patient safety". They argue that there has been little consideration of the importance of skillmix in terms of outcomes, safety and quality when considering staffing levels.

Ways to measure the quality of nursing care are examined in ***High Quality Care Metrics for Nursing*** (Maben et al 2012). The report recommended further work to "develop metrics and systems that reflect the wider structural factors that underpin nursing quality such as staffing, skills mix and staff experiences and link to other quality care metrics such as patient experience".

The Cochrane Review by Butler et al (2011) found that patient outcomes could be improved by the addition of specialist roles (skillmix and grademix) to the nursing staff. There was less evidence relating to staff outcomes, and the authors cautioned over interpretation of the evidence due to the limitations of the evidence base.

Aiken et al (2014) in the ***Lancet***, reporting on the results of the RN4CAST study found that, when looking at the relationship between patient mortality and nurse staffing related factors found that both workload and education had a clear impact on patient mortality. They report that the associations they found could lead to a conclusion that in hospitals where 60% nurses had Bachelor degrees and nurses cared for an average of six patients, there would be 30% lower mortality than in hospitals where only 30% of nurses had degrees and cared for an average of eight patients.

Dubois et al (2013) undertook a literature review to conceptualise what is meant by nursing care performance which led to the development of a pool of indictors which can be used to measure performance. Using 101 published articles they found considerable diversity in how nursing care was measured. Their nursing care performance framework (NCPF) considers 'Acquiring, deploying and maintaining resources' as containing elements of quantity and skill mix, with the next stage of the framework looking at how resources are transformed to services then how this impacts on patient care.

What is being investigated?

Current research projects are based in primary care and around widening access and the impact on staffing levels and therefore patient outcomes. A PhD study is assessing how metrics are used to influence decision making in nursing.

Job satisfaction and morale (includes wellbeing at work)

What is already known?

Staffing levels are likely to impact on job satisfaction and morale. Whether this has an impact on patient care is harder to determine. Measures such as satisfaction and morale are more challenging to measure when compared with 'harder' measures such as mortality and patient related outcomes. Satisfaction and morale are an interim outcome when examining the relationship between staffing levels and patient outcomes. The NNRU (2013a) briefing reported on studies which have linked wellbeing to improved staff performance and therefore better patient care.

Resource Flexibility

What is already known?

This body of evidence examines direct links between nurse staffing levels and patient outcomes. There have been a number of documents from the NNRU, RCN and National Quality Board relating to this and the recent NICE Safe Staffing Guideline address the relationship between staffing levels and patient outcomes.

Some of the evidence and policy documents address the issue of the relationship between staffing levels and outcomes and why and how low staffing levels can potentially influence outcomes. The NNRU (2013b) highlight the variability in NHS staffing levels, the areas in which staffing is traditionally lower (and with a more variable skill mix) and implications for nurses and patients, including care left undone and errors in care. They highlight the Kane (2007) review as a key document. The NICE evidence summary to support the Safe Staffing guidelines (Griffiths, 2014a) found that there was an association between higher nurse staffing levels and lower rates of mortality, failure to rescue, falls, length of stay and readmissions. This finding was echoed in a presentation to the RCN (Griffiths, 2013). The evidence also showed an association between lower nurse staffing levels and higher rates of drug administration errors and missed nursing care. The researchers also found that a higher proportion of registered nurses on wards was associated with lower rates of death, falls and failure to rescue. Buchan and Seccombe (2013) have analysed nurse staffing levels in the NHS and have found that the recent growth in nurse staffing levels has tailed off and there is a pattern of nurse staffing decline and the authors caution that attention needs to be paid to ensuring that sufficient staff are employed to ensure safe care. This journal article is a summary of the findings of the RCN Labour Market Review (RCN, 2013).

Shekelle (2013) undertook a systematic review of the relationship between nurse staffing levels and mortality (and other nurse sensitive outcomes). Their findings reflect those of Kane et al (2007) that nurse staffing has a relationship with hospital related mortality. They make clear recommendations for future work – that studies need to be undertaken where there is a planned change in nurse staffing levels, rather than observational studies of the impact of fluctuations in nurse staffing. They also caution that changes in staffing levels and outcomes may not be a causal relationship and that there may be underlying mechanisms around *what nurses do*, that are equally important in reducing mortality and that determining what this is, is just as important as determining a safe staffing level/ratio.

Associated with the research relating low staffing levels to adverse patient outcomes is the call for a mandated staffing level in nursing. The NQB (2013) have produced a document detailing expectations of the NHS when determining their staffing levels – particularly that the evidence base is taken into account when determining staffing levels (p.6). Using NHS case studies they demonstrate how providers and commissioners of nursing care can get staffing levels correct. In 2012, the NNRU examined whether mandated staffing levels might address the issue of safety, patient outcomes and quality. This issue has still to be resolved, although minimum levels do exist in other countries, there is an argument that minimum levels might lower levels in some specialties.

Looking at the staffing and outcomes question from another perspective, Subirana et al (2014) developed a realist logic model to identify the outcomes that may change as a result of changes in nursing care provision. Their model showed that staffing and patient outcomes have complex linkages: "this is mediated at a general level through factors in the process of care (for example, nurse surveillance, clinical judgement, level of education, level of nurse training and length of nursing experience) and tasks left undone. These operate in conjunction with working with other nurses who are clinically competent, having good nurse–physician relationships and communication, supportive nurse manager/supervisor and good teamwork" (Subirana, 2014, p19).

Research into 'care left undone' (Ball et al 2013, Auserhoffer 2014) has found that there are particular aspects of care in which staffing shortages have led to a reduction in the care delivered to patients and that care left undone could be the explanatory factor in why low staffing levels are related to patient safety.

What is being investigated?

The reviews by Griffiths et al (2014a) and economic analysis by Cookson and McGovern (2014) are part of a wider programme of work related to the NICE Safe Staffing Guideline. This initial work linked staffing levels with patient outcomes in acute care. Additional work will be undertaken to look at this relationship in other clinical settings such as Accident and Emergency, maternity settings, and mental health and learning disabilities in the acute and community settings.

Workload (physical and mental)

What is already known?

Research into workload of individual nurses is very closely linked with staffing levels, as clearly the fewer staff there are, the more work there is for each individual member of staff. It has been hard to differentiate the research on workload and on staffing levels. Therefore all of the research in this area is included in 'Resource Flexibility'.

Research Implications

There is a substantial body of research in the nurse staffing area, particularly relating staffing levels to patient outcomes in the attempt to define a safe staffing ratio and examine what factors contribute to safe, high quality nursing care. Although much of this research has been undertaken outside of the UK and NHS settings, there are still generalisable findings from this research that can inform NHS policy and practice. The research in 'Resource Flexibility' indicates that there is a clear imperative from stakeholders from within and outside the nursing profession to develop guidelines on safe staffing levels that are explicitly linked to improved outcomes for patients and an improved working environment for staff.

There seems to be a clear consensus that there is an association between staffing levels, particularly registered staff, and patient outcomes, including mortality. However, the recent evidence syntheses undertaken to support the work on the NICE Safe Staffing guideline found no evidence to support a single patient related outcome as an indicator of adequate nursing staffing levels and no evidence to support a recommendation of a safe staffing level for the NHS, particularly because of the diversity of the evidence base and the lack of UK evidence.

Kane et al (2007) did not identify any specific gaps requiring future research, rather they commented on the research field, arguing for more research in the form of natural experiments in which staffing levels are adjusted and other factors (such as medical care and patient characteristics as well as other nursing related variables) are controlled for. They argued that key to research in this area was the ability to isolate the effects of nurse staffing levels to therefore assess the impact of changing levels on patient outcomes.

Harris and Hall (2012) identified the following gaps in the literature: that the evidence base does not reflect the variability of nursing (aggregate data that has been used in studies often fails to represent the variability between and within units) and that much of the research is undertaken in acute settings. Other limitations that they highlight are differing definitions of nurse staffing measures, lack of methodological research, assumptions that associations are causal and issues relating to the data sources used (sporadic use of risk adjustment and use of administrative databases). Harris and Hall suggest that future research uses standardised measures "*that account for both micro and macro measures, including patient, nurse and system factors that are sensitive to nurse staffing"*(p, 25).

Kitson et al (2013) make several suggestions where primary research is needed on staffing levels and patient outcomes including "*optimal staffing levels and skill mix and the relationship between these and the quality of patient care across all care settings…nursing sensitive patient outcome measures…to evaluate the contribution of nursing care to patient outcomes and … the association between shift length and the quality of patient outcomes and the impact on nurses*" (p.79).

Griffiths et al (2014a) identified a lack of UK research as the main evidence gap from their review. They also reflected on how staffing levels are conceptualised, that most of the research focusses on variations in staffing levels, rather than actual staffing levels. Another limitation was the 'negative' views of care quality, that there was a focus on averting things going wrong rather than assessing what quality care actually is. Suggestions for future exploration in the area of nurse staffing focus on using and adjusting routinely collected data, for example, amending data collected by the NHS safety thermometer to allow for better risk adjustment-, the development of standard approaches to risk adjustment, an investigation of the relationship between routinely collected measures of missed care and outcomes and finally economic analyses based on NHS data.

In terms of future work, the following are key gaps in the existing evidence base from evidence and policy examined:

- UK and NHS based primary research, particularly qualitative research, to focus on how different factors contribute to safe, high quality nursing care.
- How best use can be made of the existing primary research and reviews and understanding of whether the current empirical evidence can be generalised to the UK and NHS setting. This could be addressed by integrating the significant recent body of research by Griffiths (et al) into the previous evidence base and/or updating the highly influential review by Kane et al (2007).
- Whilst there is relatively robust evidence linking staffing and outcomes, better understanding is needed for the potential underlying mechanisms. Traditional systematic reviews, adding to the already large evidence base in this area, may not answer the questions of interest around staffing levels, skillmix and grademix. More extended use of realist synthesis (cp. Subirana et al, 2014) may be required to better understand the mechanisms of how changes in staffing levels, skill mix, grade mix and case mix influence patient outcomes.

Section Two - Table of evidence (all of these are hyperlinks)

Quality of work and error likelihood (this covers patient outcomes/safety)		
What is being investigated?	What is already known?	
	Recent reports/policy briefings etc.	Relevant 2013-2014 evidence (includes a review from 2011)
Nurse Staffing and Quality of Care in UK General Practice – Griffiths - Southampton HS&DR - 12/209/02: Measuring quality in community nursing: a mixed methods study HS&DR - 12/128/48: The future of 24/7 care: investigating the links between staffing levels, patient access and inequalities in health outcomes PhD Study – University of Ulster - The Influence of Key Performance Indicators on decision making for nursing and midwifery practice.	RCN (2014) Frontline First report. More Than Just A Number Berwick Review into Patient Safety (2013) Francis Inquiry (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry	Aiken et al (2014) Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study Dubois et al (2013) Conceptualizing performance of nursing care as a prerequisite for better measurement: a systematic and interpretive review. Maben (2012) High Quality Care Metrics for Nursing Subirana, M (2012) The influence of nursing structure and process variables on patients' outcomes and safety within a High Dependency Unit. PhD thesis, University of Leeds. Butler et al (2011) Hospital nurse staffing models and patient and staff-related outcomes

Job satisfaction and morale (includes wellbeing at work		
What is being investigated?	What is already known?	
	Recent reports/policy briefings etc.	Relevant 2013-2014 evidence
	NNRU (2013) Does NHS staff wellbeing affect patient experiences of care?	

Resource Flexibility (includes staffing levels)		
What is being investigated?	What is already known?	
	Recent reports/policy briefings etc.	Relevant 2013-2014 evidence (includes one paper from 2012)
	NICE Safe Staffing Guideline SG1 (2014) NNRU (2013) Registered Nurse Staffing Levels and Patient	Ausserhofer et al (2014). Prevalence, patterns and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study

	Outcomes. National Quality Board (2013) How to ensure the right people, with the right skills are in the right place at the right time: a guide to nursing, midwifery and care staffing capacity and capability. RCN Labour Market Review (2013) NNRU (2012) Is it time to set minimum nurse staffing levels in English hospitals? NNRU (2012) RN4CAST Nurse Survey in England RCN (2012) Safe Staffing for older peoples wards. An RCN Toolkit RCN (2012) Policy Briefing: Mandatory Nurse Staffing levels RCN (2010) Guidance on safe nurse staffing levels in the UK. NNRU (2009) RN+RN = better care. What do we know about the association between Registered Nurse staffing levels and patient outcomes?	Cookson and McGovern (2014) The Cost-Effectiveness of Nurse Staffing and Skill Mix on Nurse Sensitive Outcomes. A Report for the National Institute for Health and Care Excellence. Griffiths et al. (2014a). The association between patient safety outcomes and nurse/healthcare assistant skill mix and staffing levels & factors that may influence staffing requirements. Subirana (2014) A realist logic model of the links between nurse staffing and the outcomes of nursing West (2014) Nurse staffing, medical staffing and mortality in Intensive Care: An observational study Ball et al (2013) 'Care left undone' during nursing shifts: associations with workload and perceived quality of care Buchan (2013) The end of growth? Analysing NHS nurse staffing Griffiths (2013) 'Nurse, care assistant and medical staffing: the relationship with mortality in English Acute Hospitals' Shekelle (2013) Nurse-Patient Ratios as a Patient Safety Strategy: A Systematic Review McGahan et al (2012) Nurse staffing levels and the incidence of mortality and morbidity in the adult intensive care unit: a literature review

No evidence was found to populate the area of 'Quality of supervision and Error Detection'. 'Workload: Physical and Mental' is included in the 'Resource Flexibility' section.

Section Three - Methods, background and definitions

Aim of the brief scoping review – to determine what research is currently being undertaken in nurse staffing and to identify any gaps in the existing research. This will allow a decision to be made about whether a full evidence review is required on the topic.

Research Question - The relationship between nurse staffing levels (including issues of grade mix and skill mix, if possible) and performance (especially quality)

Potential issues to address

- What are the aspects of staffing? Safe staffing numbers, nurse patient ratios, impact of registered nurses on performance, what do we mean by performance?
- Who are the key researchers in the field and what are they currently working on?
- What are the key evidence sources in this area?

Framework for the brief scoping review – The review document is based around a framework/typology in order to present the information gathered in the brief scoping exercise. "The term 'staffing levels' refers to having the right people in the right place at the right time. It is not just a matter of having enough staff, but also ensuring that they have suitable knowledge, skill and experience to operate safely" (HSE, n.d, p.1). Factors included in the framework are: Job satisfaction and morale, Resource flexibility, Quality of work and error likelihood, Workload (physical and mental) and Quality of supervision and error detection.

Methods – The method for the brief scoping review was desk based research, primarily of key websites and databases. Given the substantial body of published research and information on websites to populate the areas of interest, the review team decided not to pursue contact with experts at this stage. The work was undertaken, as per the protocol, in 4 days. Contact with experts might well constitute a further phase of this initial assessment of the evidence.

Sources searched

Source Type	Source
Search Engines	Google searches
Websites	RCN
	Kings College London Policy+ briefings
	Safe Staffing Alliance
Searches of funding bodies	NIHR Portfolio of projects,
Searches of nursing unit websites (nursing research and academic units)	NNRU, RCN Research Conference 2014, Schools of Nursing (KCL, Nottingham, Sheffield, Sheffield Hallam, Glasgow, Manchester, Salford, UEA, Edinburgh, City, UWL, Brighton, Keele, Robert Gordon, Plymouth, UWS, Cardiff, De Montfort)
Searches of key academics personal webpages	Linda Aiken, Peter Griffiths, Ann-Marie Rafferty, all academics at the NNRU, Elizabeth West (Greenwich)
Database searches	NHS Evidence

Citation searches were also performed on Google Scholar searching for the occurrence of "UK" in items citing: Kane et al (2007) The Association of Registered Nurse Staffing Levels and Patient Outcomes: Systematic Review and Meta-Analysis.

Limitations of the brief scoping paper

We reviewed evidence and information with a focus on very recent evidence, except in the case of highly influential systematic reviews. The review is necessarily brief, being completed in four days as per the protocol. The searches for the review were not exhaustive. Our focus was on nursing related evidence only, however it is our perception that the wider literature relating to staffing levels and outcomes, including evidence on staff composition and outcomes would usefully inform the evidence base in this area. The review covers evidence relating to adult nursing only (except where nursing care is considered as a whole).

References

Aiken, L H., Sloane, D M., Bruyneel, L, Van den Heede, K, Griffiths, P, Busse, R, Diomidous, M, Kinnunen, J, Kózka, M, Lesaffre, E, McHugh, M D., Moreno-Casbas, M. T., Rafferty, A M, Schwendimann, R, Scott, P. A, Tishelman, C, van Achterberg, T and Sermeus, W (2014) Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study. Lancet, *383*(9931), 1824-1830. (doi:10.1016/S0140-6736(13)62631-8).

Aiken, L. H., Sermeus, W., Van den Heede, K., Sloane, D. M., Busse, R., McKee, M., & Kutney-Lee, A. (2012). Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. BMJ 344:e1717.

Aiken, L. H., Sloane, D. M., Clarke, S., Poghosyan, L., Cho, E., You, L.,& Aungsuroch, Y. (2011). Importance of work environments on hospital outcomes in nine countries. *International Journal for Quality in Health Care*, *23*(4), 357-364.

Ausserhofer, D., Zander, B., Busse, R., Schubert, M., De Geest, S., Rafferty, A. M., & van Achterberg, T. (2014). Prevalence, patterns and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study. *BMJ Quality & Safety*, *23*(2), 126-135.

Ball, J E., Murrells, T, Rafferty, A M, Morrow, E and Griffiths, P (2013) 'Care left undone' during nursing shifts: associations with workload and perceived quality of care. BMJ Quality & Safety, n/a,1-12.(doi:10.1136/bmjqs-2012-001767).(PMID:23898215).

Ball J, Pike G, Griffiths P. Rafferty A-M, Murrells T (2012) RN4CAST Nurse Survey in England. National Nursing Research Unit. Available from http://www.kcl.ac.uk/nursing/research/nnru/publications/Reports/RN4Cast-Nurse-survey-report-27-6-12-FINAL.pdf

Ball, J., & Catton, H. (2011). Planning nurse staffing: are we willing and able? *Journal of Research in Nursing*, 1744987111422425

Berwick, D. (2013). A promise to learn – a commitment to act: improving the safety of patients in England. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226703/Berwick_Report.pdf .

Brand, C. A., Barker, A. L., Morello, R. T., Vitale, M. R., Evans, S. M., Scott, I. A., ... & Cameron, P. A. (2012). A review of hospital characteristics associated with improved performance. *International Journal for Quality in Health Care*, mzs044.

Buchan J and Seccombe I. (2013) The end of growth? Analysing NHS nurse staffing. J Adv Nurs 69(9):2123-30.

Butler, M., Collins, R., Drennan J., Halligan, P., O'Mathuna D, P., Schultz T, J., Sheridan, A. & Vilis, E. 2011. Hospital nurse staffing models and patient and staff-related outcomes. *Cochrane Database of Systematic Reviews*. Available: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007019.pub2/abstract .

Canadian Nurses Association [CNA] (2005) *Evaluation Framework to Determine the Impact of Nursing Staff Mix Decisions* Canadian Council for Practical Nurse Regulators, Registered Psychiatric Nurses of Canada & Canadian Practical Nurses Association, 2005). Available from https://www.nurseone.ca/docs/NurseOne/KnowledgeFeature/StaffMix/Staff_Mix_Literature_Review_e.pdf

Clark, A., Moule, P., Topping, A., & Serpell, M. (2013). Rescheduling nursing shifts: scoping the challenge and examining the potential of mathematical model based tools.*Journal of nursing management*. 2013 Aug 8. doi: 10.1111/jonm.12158

Cookson, G., & McGovern, A. (2014). The Cost-Effectiveness of Nurse Staffing and Skill Mix on Nurse Sensitive Outcomes. A Report for the National Institute for Health and Care Excellence. University of Surrey.http://www.gserve.nice.org.uk/media/E19/41/SafeStaffingAdultWardsInAcuteHospitalsEconomicAnalysis.pdf

Department of Health (2013) Berwick Review into patient safety. Available from https://www.gov.uk/government/publications/berwick-review-into-patient-safety

Dubois CA, D'Amour D, Pomey MP, Girard F, Brault I. Conceptualizing performance of nursing care as a prerequisite for better measurement: a systematic and interpretive review. BMC Nurs. 2013 Mar 7;12:7. doi: 10.1186/1472-6955-12-7.

Foulkes, M. (2011). Nursing metrics: measuring quality in patient care. *Nursing Standard*, *25*(42), 40-45.

Francis, R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. Available from http://www.midstaffspublicinquiry.com/report

Gage, W., Heywood, S., & Norton, C. (2012). Measuring quality in nursing and midwifery practice. *Nursing Standard*, *26*(45), 35-40.

Gerova, V., Griffiths, P., Jones, S., & Bick, D. (2010). The association between midwifery staffing and outcomes in maternity services in England: observational study using routinely collected data. Preliminary report and feasibility assessment. *Preliminary Report and Feasibility Assessment. National Nursing Research Unit, King's College London*. Available from http://epubs.surrey.ac.uk/804170/1/NNRU MidwiferyReportDec10.pdf

Goryakin, Y., Griffiths, P., & Maben, J. (2011). Economic evaluation of nurse staffing and nurse substitution in health care: a scoping review. *International Journal of Nursing Studies*, *48*(4), 501-512.

Griffiths, P., Ball, J., Drennan, J., James, L., Jones, J., Recio-Saucedo, A., & Simon, M. (2014a). The association between patient safety outcomes and nurse/healthcare assistant skill mix and staffing levels & factors that may influence staffing requirements. http://www.nice.org.uk/guidance/gid-safenursestaffingadultwardsacutehospitals/resources/safe-staffing-guideline-consultation5

Griffiths, P. (2014b). Nurse patient ratios, skill mix and work futures. *International journal of nursing studies*, *51*(3), 353-354.

Griffiths, P., Ball J., Rafferty, A.M., Murrells, T.M., Jones, S (2013a). *'Nurse, care assistant and medical staffing: the relationship with mortality in English Acute Hospitals*' RCN research conference March 2013. Available from https://www.rcn.org.uk/__data/assets/pdf_file/0020/513173/Griffiths_keynote_research_2013.pdf AND http://www.safestaffing.org.uk/downloads/nurse-care-assistant-and-medical-staffing-the-relationship-with-mortality-in-english-acute-hospitals-abstract

Griffiths, P., Jones, S., & Bottle, A. (2013b). Is "failure to rescue" derived from administrative data in England a nurse sensitive patient safety indicator for surgical care? Observational study. *International Journal of Nursing Studies*, *50*(2), 292-300.

Griffiths, P., Maben, J., & Murrells, T. (2011). Organisational quality, nurse staffing and the quality of chronic disease management in primary care: observational study using routinely collected data. *International journal of nursing studies*, *48*(10), 1199-1210.

Harris, A and Hall, L.M (2012) Evidence to Inform Staff Mix Decision-making: A Focused Literature Review. Available from https://www.nurseone.ca/docs/NurseOne/KnowledgeFeature/StaffMix/Staff_Mix_Literature_Review_e.pdf

Hayes N, Ball J (2012) *Safe staffing for older people's wards.* Royal College of Nursing's full report and recommendations. RCN. London. Available from http://www.rcn.org.uk/__data/assets/pdf_file/0009/479349/004301.pdf

Hinchliffe S. *Delivering Quality Care Through Effective Nursing Establishments*. Leeds Teaching Hospitals. http://www.leedsth.nhs.uk/uploads/tx_lthboardmeetings/23.6_Nursing_Establishment_Review.pdf

HSE Health and Safety Executive (n.d) Staffing Levels – Briefing Note. Available from http://www.hse.gov.uk/humanfactors/resources/staffing-levels-briefing-note.pdf

Kane et al (2007) The Association of Registered Nurse Staffing Levels and Patient Outcomes: Systematic Review and Meta-Analysis. *Medical Care*, 45, 1195-1204

Kitson, A. L., Wiechula, R. J., Conroy, T. A., Muntlin Athlin, A., & Whitaker, N. L. (2013). *The future shape of the nursing workforce: a synthesis of the evidence of factors that impact on quality nursing care.* Available from http://ebooks.adelaide.edu.au/dspace/bitstream/2440/77059/1/hdl_77059.pdf.

Lindqvist, R, Alenius, LS, Griffiths, P, Runesdotter, S and Tishelman, C (2013) Structural characteristics of hospitals and nurse-reported care quality, work environment, burnout and leaving intentions. Journal of Nursing Management (doi:10.1111/jonm.12123). (PMID:24047463).

Maben, J., Morrow, E., Ball, J., Robert, G., and Griffiths, P. High Quality Care Metrics for Nursing. National Nursing Research Unit, King's College London, 2012. Available from http://eprints.soton.ac.uk/346019/1/High-Quality-Care-Metrics-for-Nursing----Nov-2012.pdf

National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to nursing, midwifery and care staffing capacity and capability. http://www.england.nhs.uk/wp-content/uploads/2013/11/nqb-how-to-guid.pdf

NICE (2014a) NICE safe staffing guidelines. http://www.nice.org.uk/About/What-we-do/Our-Programmes/NICE-guidance/NICE-guidelines/NICE-safe-staffing-guidelines

NICE (2014b) NICE safe staffing guidelines http://www.nice.org.uk/Guidance/InDevelopment/GID-SAFENURSESTAFFINGADULTWARDSACUTEHOSPITALS/Documents
NNRU (2009) Registered Nurse staffing levels and patient outcomes? Policy+ briefing. Available from http://www.kcl.ac.uk/nursing/research/nnru/policy/Policy-Plus-Issues-by-Theme/impactofnursingcare/PolicyIssue20.pdf

NNRU (2013a) Does NHS staff wellbeing affect patient experience of care? Policy+ briefing. Available from http://www.kcl.ac.uk/nursing/research/nnru/policy/Currentissue/Policy-Plus--Issue-39.pdf

NNRU (2013b) Registered Nurse staffing levels and patient outcomes. Available from https://www.kcl.ac.uk/nursing/.../NNRU-evidence-staffing-levels.doc

NNRU (2012) Is it time to set minimum nurse staffing levels in English hospitals? Policy+ briefing. Available from http://www.kcl.ac.uk/nursing/research/nnru/policy/Policy-Plus-Issues-by-Theme/Whodeliversnursingcare(roles)/PolicyIssue34.pdf

NNRU (2009) RN+RN = better care. What do we know about the association between Registered Nurse staffing levels and patient outcomes. Available from http://www.kcl.ac.uk/nursing/research/nnru/policy/Policy-Plus-Issues-by-Theme/impactofnursingcare/PolicyIssue20.pdf

Poghosyan, L., Clarke, S. P., Finlayson, M., & Aiken, L. H. (2010). Nurse burnout and quality of care: Cross-national investigation in six countries. *Research in nursing & health*, *33*(4), 288-298.

RCN (2014) Frontline First – More than just a number. RCN Frontline First Reports. Available from http://www.rcn.org.uk/__data/assets/pdf_file/0007/564739/004598.pdf

RCN (2013) RCN Labour Market Review. Safe staffing levels – a national imperative The UK nursing labour market review 2013. Available from http://www.rcn.org.uk/__data/assets/pdf_file/0018/541224/004504.pdf

RCN (2012) Policy Briefing: Mandatory Nurse Staffing levels. Available from http://www.rcn.org.uk/__data/assets/pdf_file/0009/439578/03.12_Mandatory_nurse_staffing_levels_v2_FINAL.pdf

Sermeus, W., Aiken, L. H., Van den Heede, K., Rafferty, A. M., Griffiths, P., Moreno-Casbas, M. T., ... & Zikos, D. (2011). Nurse Forecasting in Europe (RN4CAST): Rationale, design and methodology. *BMC nursing*, *10*(1), 6.

Shekelle PG. (2013) Nurse-patient ratios as a patient safety strategy: a systematic review. Ann Intern Med.;158(5 Pt 2):404-9. doi:10.7326/0003-4819-158-5-201303051-00007.

Smith, A., Shepherd, A., Jessiman, W., & Scott, J. (2010). Evaluating the impact of nursing and midwifery sensitive clinical quality indicators on practice. *University of Stirling*. Available from http://rms.stir.ac.uk/converis-stirling/publication/5501

Subirana M, Long A, Greenhalgh J, and Firth J (2014) A realist logic model of the links between nurse staffing and the outcomes of nursing. Journal of Research in Nursing February 2014 19: 8-23, first published on April 11, 2013 doi:10.1177/1744987113481782

Tanishima, N. (2012). *A comparative study of nursing workforce planning policies related to recently qualified nurses in Scotland and Japan* (Doctoral dissertation, University of Glasgow). http://theses.gla.ac.uk/3639/

West E, Barron D N, Harrison D, Rafferty A M, Rowan K, Sanderson C (2014) Nurse staffing, medical staffing and mortality in Intensive Care: An observational study. *International Journal of Nursing Studies*, 51, 5, 781-794, http://dx.doi.org/10.1016/j.ijnurstu.2014.02.007

List of relevant papers included in the NICE Evidence Synthesis (2010 onwards only)

(This includes all papers not identified or included in our reference list above)

Ausserhofer, D., Schubert, M., Desmedt, M., Blegen, M. A., De, G. S. & SchwendimannR. 2013. The association of patient safety climate and nurse-related organizational factors with selected patient outcomes: a cross-sectional survey. *International Journal of Nursing Studies,* 50**,** 240-252.

Bender, M., Connelly, C. D., Glaser D. & Brown, C. 2012. Clinical nurse leader impact on microsystem care quality. *Nursing Research,* 61**,** 326-332.

Blegen, M. A., Goode C., Spetz, J., Vaughn, T. & Park, S. H. 2011. Nurse Staffing effects on patient outcomes: safety-net and non-safety net hospitals. *Medical Care,* 49**,** 406-414.

Cameron, I. D., Gillespie, L. D., Robertson, M. C., Murray, G. R., Hill, K. D., Cumming, R. G. & Kerse, N. 2012. Interventions for preventing falls in older people in care facilities and hospitals. *Cochrane Database Syst Rev,* 12.

Chang, Y. & Mark, B. 2011. Effects of learning climate and registered nurse staffing on medication errors. *Journal of Nursing Administration,* 41**,** Suppl-13.

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.

Duffield, C., Diers, D., O'Brien - Pallas L., Aisbett, C., Roche, M., King, M. & Aisbett, K. 2011. Nursing staffing, nursing workload, the work environment and patient outcomes. *Appl Nurs Res,* 24**,** 244-55.

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.

Fasoli, D. R. & Haddock, K. S. 2010. Results of an integrative review of patient classification systems. *Annual Review of Nursing Research,* 28**,** 295-316.

Frith, K. H., Anderson, E. F., Caspers Tseng, F., Sanford, K., Hoyt, N. G. & Moore, K. 2010. Effects of nurse staffing on hospital-acquired conditions and length of stay in community hospitals. *Quality Management in Health Care,* 19**,** 147-155

Frith, K. H., Anderson, E. F., Tseng, F. & Fong, E. A. 2012. Nurse staffing is an important strategy to prevent medication error in community hospitals. *Nursing Economics,* 30**,** 288-294.

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.

Hart, P. & Davis, N. 2011. Effects of nursing care and staff skill mix on patient outcomes within acute care nursing units. *Journal of Nursing Care Quality,* 26**,** 161-168.

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.

Huisman, E. R. C. M., Morales, E., Van Hoof, J. & Kort H. S. M. 2012. Healing environment: A review of the impact of physical environmental factors on users. *Building and Environment,* 58**,** 70-80.

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

Kalsich, B. J., Xie, B. & Ronis, D. L. 2013. Train-the-trainer intervention to increase nursing teamwork and decrease missed nursing care in acute care patient units. *Nursing Research,* 62**,** 405-413.

Kapinos, K. A., Fitzgerald, P., Greer, N., Rutks, I. & Wilt, T. J. 2012. The Effect of Working Conditions on Patient Care: A Systematic Review. Washington (DC).

Kelly, L. A., McHugh, M. D. & Aiken, L. H. 2011. Nurse outcomes in magnet and non-magnet hospitals. *Journal of Nursing Administration,* 41**,** 428-433.

Kooker, B. M. & Kamikawa, C. 2011. Successful strategies to improve RN retention and patient outcomes in a large medical centre in Hawaii. *Journal of Clinical Nursing,* 20**,** 34-39.

Kutney-Lee, A., Sloane, D. M. & Aiken, L. H. 2013. An Increase In The Number Of Nurses With Baccalaureate Degrees Is Linked To Lower Rates Of Postsurgery Mortality. *Health Affairs,* 32**,** 579-586.

Lake, E. T., Shang, J., Klaus, S. & Dunton, N. E. 2010. Patient falls: Association with hospital Magnet status and nursing unit staffing. *Research in Nursing & Health,* 33**,** 413-425.

Lake, E. T., Staiger, D., Horbar, J. & et al. 2012. Association between hospital recognition for nursing excellence and outcomes of very low-birth-weight infants. *JAMA,* 307**,** 1709-1716.

Mark, B. A., Harless, D. W., Spetz, J., Reiter, K. L. & Pink, G. H. 2013. California's minimum nurse staffing legislation: results from a natural experiment. *Health Serv Res,* 48**,** 435-54.

McHugh, M. D., Brooks Carthon, M., Sloane, D. M., Wu, E., Kelly, L. & Aiken, L. H. 2012. Impact of nurse staffing mandates on safety-net hospitals: lessons from California. *Milbank Q,* 90**,** 160-86.

McHugh, M. D., Kelly, L. A., Sloane, D. M. & Aiken L. H. 2011. Contradicting fears, California's nurse-to-patient mandate did not reduce the skill level of the nursing workforce in hospitals. *Health Aff (Millwood),* 30**,** 1299-306.

Myny, D., Van Goubergen, D., Gobert, M., Vanderwee, K., Van Hecke, A. & Defloor, T. 2011. Non-direct patient care factors influencing nursing workload: a review of the literature. *Journal of Advanced Nursing,* 67**,** 2109-2129.

Needleman, J., Buerhaus, P., Pankratz, V. S., Leibson, C. L., Stevens, S. R. & Harris, M. 2011. Nurse staffing and inpatient hospital mortality. *N Engl J Med,* 364**,** 1037-45.

O'Brien-Pallas, L., Li, X. M., Wang, S., Meyer, R. M. & Thomson, D. 2010a. Evaluation of a patient care delivery model: system outcomes in acute cardiac care. *Canadian Journal of Nursing Research,* 42**,** 98-120.

O'Brien-Pallas, L., Murphy, G. T., Shaiman, J., Li, X. & Hayes, L. J. 2010b. Impact and determinants of nurse turnover: a pan-Canadian study. *Journal of Nursing Management,* 18**,** 1073-1086.

Park, S. H., Blegen, M. A., Spetz, J., Chapman, S. A. & De Groot, H. 2012. Patient turnover and the relationship between nurse staffing and patient outcomes. *Research in Nursing and Health,* 35**,** 277-288.

Patrician, P. A., Loan, L., McCarthy, M., Fridman, M., Donaldson, N., Bingham, M. & Brosch, L. R. 2011. The association of shift-level nurse staffing with adverse patient events. *Journal of Nursing Administration,* 41**,** 64-70.

Schubert, M., Clarke, S. P., Aiken, L. H. & De Geest, S. 2012. Associations between rationing of nursing care and inpatient mortality in Swiss hospitals. *International Journal for Quality in Health Care,* 24**,** 230-238.

Spetz, J., Harless, D. W., Herrera, C.-N. & Mark, B. A. 2013. Using Minimum Nurse Staffing Regulations to Measure the Relationship Between Nursing and Hospital Quality of Care. *Medical Care Research and Review*.

Staggs, V. S. & Dunton, N. 2012. Hospital and unit characteristics associated with nursing turnover include skill mix but not staffing level: an observational cross-sectional study. *International Journal of Nursing Studies,* 49**,** 1138-1145.

Torangeau, A. E. 2011. Mortality rate as a nurse-sensitive outcome. *In:* DORAN, D. M. (ed.) *Nursing Outcomes: The State of the Science.* Second ed. USA: Jones and Bartlett Learning, LLC.

Tran, D. T., Johnson, M., Fernanadez R. & Jones, S. 2010. A shared care model vs. a patient allocation model of nursing care delivery: comparing nursing staff satisfaction and stress outcomes. *International Journal of Nursing Practice,* 16**,** 148-158.

Tschannen, D., Kalisch, B. J. & Lee, K. H. 2010. Missed nursing care: the impact on intention to leave and turnover. *Canadian Journal of Nursing Research,* 42**,** 22-39.

Twigg, D., Duffield, C., Bremner, A., Rapley, P. & Finn, J. 2011. The impact of the nursing hours per patient day (NHPPD) staffing method on patient outcomes: A retrospective analysis of patient and staffing data. *International Journal of Nursing Studies,* 48**,** 540-548.

Twigg, D. E., Geelhoed, E. A., Bremner, A. P. & M. Duffield, C.. 2013. The economic benefits of increased levels of nursing care in the hospital setting. *J Adv Nurs,* 69**,** 2253-61.

Weiss, M. E., Yakusheva, O. & Bobay, K. L. 2011. Quality and cost analysis of nurse staffing, discharge preparation, and postdischarge utilization. *Health Services Research,* 46**,** 1473-1494.

Wells, J., Manual, M. & Cunning, G. 2011. Changing the model of care delivery: nurses' perceptions of job satisfaction and care effectiveness. *Journal of Nursing Management,* 19**,** 777-785.

West, M. & Lubovnikova, J. 2013. Why teamwork matters: enabling health care team effectiveness for the delivery of high quality patient care. *In:* Salas, E., Tannaenbaum S., Cohen, D. & Latham, G. (eds.) *Developing and Enhancing Teamwork in Organizations: Evidence-based Best Practices and Guidelines.* Jossey-Bass.

Wright, S. & McSherry, W. 2013. A systematic literature review of Releasing Time to Care: The Productive Ward. *Journal of Clinical Nursing,* 22**,** 1361-1371.