Safe Staffing for Nursing in Inpatient Mental Health Settings

Draft evidence review

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Draft for Consultation

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Executive Summary

The National Institute for Health and Care Excellence (NICE) was asked by the Department of Health and NHS England to develop an evidence based guideline on safe staffing for nursing in inpatient mental health settings.

To support the development of this guideline, a systematic review has been undertaken to identify, assess and synthesise the evidence base for safe nurse staffing in inpatient mental health settings. Specifically, this review aims to examine the evidence underpinning staffing decisions such as;

- What service user and other outcomes are associated with safe staffing for nursing inpatient mental health settings?
  - Is there evidence of a relationship between nursing staff levels or skill mix and increased risk of harm?
  - Do nursing staff levels or staff-to-service user ratios impact on outcomes?
  - Which outcomes should be used as indicators of safe staffing?
- What organisational factors affect nursing staff requirements in inpatient mental health settings? At a departmental level?
- What core nursing activities should be considered when determining safe staffing requirements for nursing in inpatient mental health settings?
  - What key activities are currently carried out by nursing staff?
  - Do the activities carried out by registered nurses, healthcare assistants and assistant practitioners differ?
  - How much time is needed for each activity?
  - Are activities that are carried out by nursing staff associated with service user outcomes?
- What approaches for identifying safe staffing for nursing and/or skill mix, including tool kits, are effective in inpatient mental health settings and how frequently should they be used?
  - What evidence is available on the reliability and/or validity of any identified toolkits?

Twenty-nine papers were identified for inclusion in this review. Most of the included studies were observational in design and provided only moderate or low quality evidence. No high quality intervention studies were identified for inclusion in this review.

The review identified 10 studies of low quality describing associations between nurse staffing levels and a range of outcomes such as conflict (e.g. assault, refusal of medication) and containment (e.g. constant observation) rates. This review did not identify any evidence that specifically described how minimum staffing levels or ratios may support safer nursing in inpatient mental health settings.

This review identified 8 studies (2 moderate and 6 low quality) reported in 16 papers indicating that staffing factors such as skill mix and nurse gender may be associated with outcomes such as conflict and containment rates. This review also identified 2 studies (1 moderate and 1 low quality) reported in 5 papers indicating that organisational factors such as leadership may be associated with outcomes such as conflict and containment rates. Evidence from 3 studies (1 moderate and 2 low quality) suggest that environmental factors such as ward configuration and single-gender units need to be taken into account when setting nursing staff establishments. This review did not identify any evidence to indicate which service user factors should be taken into account when setting nursing staff levels in mental health settings.

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This review identified 2 UK studies of low quality examining nursing activities undertaken in inpatient mental health settings. One study developed a 5 category classification system of nursing activities, and found that unqualified staff spend more minutes per hour with patients.

This review identified 3 studies of low quality describing toolkits or approaches for determining nursing staff requirements in inpatient mental health settings, however there was no strong evidence to support a specific toolkit or approach to determine nursing staff requirements in inpatient mental health settings In addition, none of the included studies contained enough detail to replicate the approach they used to determine safe staffing levels.

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1 Overview

The National Institute for Health and Care Excellence (NICE) was asked by the Department of Health and NHS England to develop an evidence based guideline on safe staffing for nursing in inpatient mental health settings.

A scope was developed which defines what the guideline will and will not consider. It also outlines the 7 review questions that will be addressed to inform the development of the guideline.

1.1 Introduction

Identifying approaches to safe nurse staffing in inpatient mental health settings is a key challenge for health service providers. Recent enquiries (Francis 2010, Berwick 2013, Francis 2013, Keogh 2013) have highlighted the role of poor staffing levels in deficits in care leading to adverse outcomes and poor service user experiences. Safe nurse staffing requires that there are sufficient nurses available to meet service user needs, that nurses have the required skills and are organised, managed and led in order to enable them to deliver the highest level of care possible.

The need for a review of staffing in inpatient mental health settings was highlighted by the Commission for Healthcare Audit and Inspection (2008).

The challenge facing providers of inpatient mental health care is ensuring that the right staff, with the right skill mix, are available in the right place at the right time. Currently there is no standardised method to determine safe staffing levels in inpatient mental health settings. However NHS England (2013) has recently proposed that some existing tools for calculating staffing levels may be applicable to inpatient mental health settings. These include:

- Nursing Hours per Patient day calculations
- Professional Judgement Software
- Ward Staff Per Occupied Bed
- Patient Dependency/Acuity Specialty Specific Tool.

This review is intended to identify the evidence base which would help determine the nursing staff requirements in inpatient mental health settings and assess how service user, staff, environmental and organisational factors influence nurse staffing requirements in these settings.

1.2 Review Questions

Seven review questions were identified and developed during the scoping of this guideline, as follows:

1. What service user and other outcomes are associated with safe staffing for nursing inpatient mental health settings?
    - Is there evidence of a relationship between nursing staff levels or skill mix and increased risk of harm?
    - Do nursing staff levels or staff-to-service user ratios impact on outcomes?
    - Which outcomes should be used as indicators of safe staffing?

2. What service user factors affect nursing staff requirements in inpatient mental health settings? These include:
    - Case mix and volume of service users (including whether they are voluntary or compulsory attendees)
    - Acuity (how ill the service user is)

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- Comorbid conditions
- Medication use
- Risk of crisis including self-harm
- Risk of violence
- Turnover (how quickly service users are admitted and discharged from inpatient mental health services)
- Availability of support (from family and carers etc.)
- Level of dependency on nursing care

3. What environmental factors affect nursing staff requirements in inpatient mental health settings? These include:
    - Ward type, size and physical layout
    - Access to outside areas
    - Ease of access to key specialties and the existence of other teams (such as crisis teams and acute day units) and their proximity to the ward

4. What staffing factors affect nursing staff requirements in inpatient mental health settings? These include:
    - Division and balance of tasks between registered nurses and healthcare assistants
    - Staff mix (including the balance of skills, proportion of temporary staff and proportion of male and female staff)
    - Experience
    - Staff turnover
    - Availability of care and services provided by other multidisciplinary team members
    - Management and administrative factors
    - Staff and student teaching and supervision arrangements

5. What organisational factors affect nursing staff requirements in inpatient mental health settings? At a departmental level, these include:
    - Organisational management structures and approaches
    - Organisational culture
    - Organisational policies and procedures, including those for staff training, preventing self-harm and 'blanket rules' (these are rules, whether written or matters of custom/practice, that are applied to everyone at the service and are generally inflexible e.g. regarding the use of mobile phones)

6. What core nursing activities should be considered when determining safe staffing requirements for nursing in inpatient mental health settings?
    - What key activities are currently carried out by nursing staff?
    - Do the activities carried out by registered nurses, healthcare assistants and assistant practitioners differ?
    - How much time is needed for each activity?
    - Are activities that are carried out by nursing staff associated with service user outcomes?

7. What approaches for identifying safe staffing for nursing and/or skill mix, including tool kits, are effective in inpatient mental health settings and how frequently should they be used?
    - What evidence is available on the reliability and/or validity of any identified toolkits?

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2 Methods

2.1 Overview

This systematic review was conducted in accordance with *Developing NICE Guidelines: the manual* (NICE 2014).

This evidence review included the following steps:

- Databases were searched using a peer-reviewed search strategy (Appendix A).
- Potentially relevant primary studies were identified by reviewing titles and abstracts using the pre-specified inclusion and exclusion criteria described in the review protocols (Appendix C).
- A second reviewer performed a consistency check by screening the titles and abstracts of a random sample of 10% of the references against the same checklist. Any disagreements between the two reviewers were discussed and resolved.
- Full text papers for all references assessed to be potentially relevant were retrieved.
- Full text papers were independently screened against the pre-specified inclusion and exclusion criteria (Appendix C) by two reviewers. Any disagreements between the two reviewers were discussed and resolved with recourse to a third reviewer when necessary.
- Included studies were critically appraised using an appropriate checklist as specified in *Developing NICE Guidelines: the manual* (NICE 2014) where possible.
- Study methods and results were extracted into evidence tables (Appendix D).
- The evidence was summarised into summary tables and a narrative description of the findings was produced.
- A narrative approach was taken for this evidence review as there is no published guidance for using modified GRADE.
- Evidence statements were generated.

2.2 Search strategy

Search strategies and review protocols were developed to identify relevant primary studies (studies that were carried out to acquire data directly from participants, rather than gathering data from published sources) and, review papers (papers that include the results of 2 or more primary research studies) including economic analyses (analyses that determine the best use of limited resources) (see Appendices A and C). Two search strategies were developed – one for review question 7 around toolkits and another for review questions 1 to 6. Separate protocols were developed for review question 7, review questions 1 to 5, and review question 6 around nursing care activities. The search strategies were developed by an information specialist and were quality assured by an independent information specialist within the Information Services team at NICE.

The search strategies included the following databases:

- British Nursing Index
- CENTRAL
- Cochrane Database of Systematic Reviews (CDSR)
- Cochrane Library
- Cumulative Index to Nursing and Allied Health (CINAHL)
- Database of Abstracts of Reviews of Effects (DARE)
- Econlit
- Embase

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- Health Economic Evaluations Database
- Health Management Information Consortium (HMIC)
- Health Technology Assessment (HTA) Database
- NHS Economic Evaluations Database (NHS EED)
- Medline including in-process
- PsychINFO
- Social Policy & Practice

A date restriction was used on the systematic review conducted for this guideline as it was deemed inappropriate to include all evidence. This is because practice and standards within psychiatric inpatient settings have changed substantially since the late 1990s. A specific cut-off date of 1998 was chosen following advice from a topic expert. Studies published before this date, or which used data collected before this date, were excluded.

To identify other potentially relevant evidence, the following resources/approaches were also used:

- The World Wide Web was searched for grey literature.
- Potentially relevant references provided by stakeholders during scope consultation were considered, as were any additional studies identified by NICE.
- Backwards and forwards citation searching on included studies and relevant review papers was undertaken as required.

2.3 Screening Criteria

As a minimum, the full text studies had to be comparative and fulfil one of the following criteria in order to be eligible for inclusion in the systematic review:

- Report staffing in relation to outcomes (see Box 1 below)
- Report staffing in relation to factors (such as service user factors, environmental factors)
- Report staffing in relation to factors and outcomes

Patient satisfaction studies were not eligible for inclusion unless the study compared the impact of nurse staffing on service user satisfaction.

A full list of the inclusion and exclusion criteria for this systematic review can be found in the review protocol in Appendix C. Operational definitions and outcomes used to inform the screening of titles, abstracts and full papers are included in sections 2.3.1 and 2.3.2.

2.3.1 Operational definitions

Nursing team: the group of workers delivering ‘hands on’ nursing care in inpatient mental health settings including:

- Registered nurses
- Non-registered nursing staff such as healthcare assistants or assistant practitioners

Nursing establishment: the number of registered and non-registered nursing staff posts funded to work in a particular ward, department or hospital.

Nurse staffing: the size and skill mix of the nursing team in the inpatient mental health setting, relative to the number of service users cared for. Expressed as nursing hours per service user day, nurse-to-service user ratios or an equivalent measure (e.g. nurse time required per number of beds available in a unit).

Inpatient mental health settings:

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- Adult and older adult inpatient mental health settings. This includes:
  - psychiatric intensive care units (PICU)
  - acute wards
  - designated section 136 units or places of safety that are staffed by the nursing establishment of inpatient mental health settings
  - rehabilitation units
  - low and medium secure units
- Tier 4 child and adolescent mental health service (CAMHS) inpatient settings

2.3.2 Outcomes

Box 1 shows a list of the outcomes that were considered when searching for and assessing the evidence. It should be noted that this list is not exhaustive and any outcomes that were linked to nursing in the studies were included in the evidence review. Many of these outcomes were not present in the literature.

Box 1: Outcomes considered

Serious incidents

- Deaths and serious untoward incidents attributable to problems with the care received in inpatient mental health settings. Serious untoward incidents include episodes of:
  - Self-harm
  - Physical aggression or violence
  - Containment incidents or restrictive practices (e.g. manual restraints, time out, seclusion, coerced medication)
  - Refusal of medication
  - Rapid tranquilisation
  - Episodes of absconding
  - Alcohol and substance misuse
  - Attempted suicide
- Serious, largely preventable service user safety incidents that should not occur if the available preventative measures have been implemented by healthcare providers (also known as 'never events'). Examples include:
  - Incorrect administration of drug treatments
  - Suicide using non-collapsible rails
  - Serious safeguarding incidents

Delivery of nursing care

- Appropriate levels of nurse-service user contact
- Appropriate levels of family liaison and service user chaperoning (including nurse escort during leave or treatment and investigations)
- Observation of behaviour/safety and therapeutic engagement
- Drug omission and other drug errors associated with nursing staff
- Falls
- Service users receiving help with activities, such as help with eating, drinking, washing and other personal needs, and missed care events.
- Addressing the needs of service users with disabilities
- Assessment of care needs, monitoring and record keeping

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• Assessment of physical health with regular reassessment, including response to treatment • Assessment of mental health problems (for example, severity of symptoms and duration of episode) with regular reassessment, including response to treatment and risk of relapse • Time to participate in multidisciplinary forums • Time to receiving medication • Timeliness of scheduled physical observations, clinical paperwork and delivery of interventions needed. • Continuity of community care if service users were receiving community care before hospital admission • Care by a nurse with appropriate competence • Completion of safeguarding duties
Other • Proportion of service users in crisis who are not seen within 4 hours of referral to secondary care services • Proportion of people admitted to a place of safety who are not assessed under the Mental Health Act within 4 hours • Proportion of service users in crisis who do not receive a comprehensive assessment (this includes inpatient care) • Proportion of service users using mental health services who are not involved in shared decision-making • Proportion of service users who do not have daily one-to-one contact with mental health professionals who are known to them • Care, staff and litigation costs • Current and up to date staff training • Nursing vacancy rates • Staff clinical appraisal and statutory review rates • Staff retention and sickness rates • Unsafe discharge and readmission • Nursing outcomes (e.g. burnout)
Reported feedback • Service users' and carers' experience and satisfaction ratings related to inpatient mental health settings, such as complaints related to nursing care and the Friends and Family Test • Staff experience and satisfaction ratings

2.4 Search Results

Two separate literature searches were undertaken as part of this review. One search aimed to retrieve evidence relevant to review questions 1 to 6 while a separate search was conducted for review question 7. Flow charts illustrating the detailed searching and screening process are contained in Appendix B.

2.4.1 Search 1: Review questions 1 to 6

The database searches returned 8917 unique items for screening. In addition, 21 unique references were identified from stakeholder recommendations as well as forwards and backwards citation searching of the reference lists of included studies and relevant reviews. . In total, the titles and abstracts of 8938 references were assessed.

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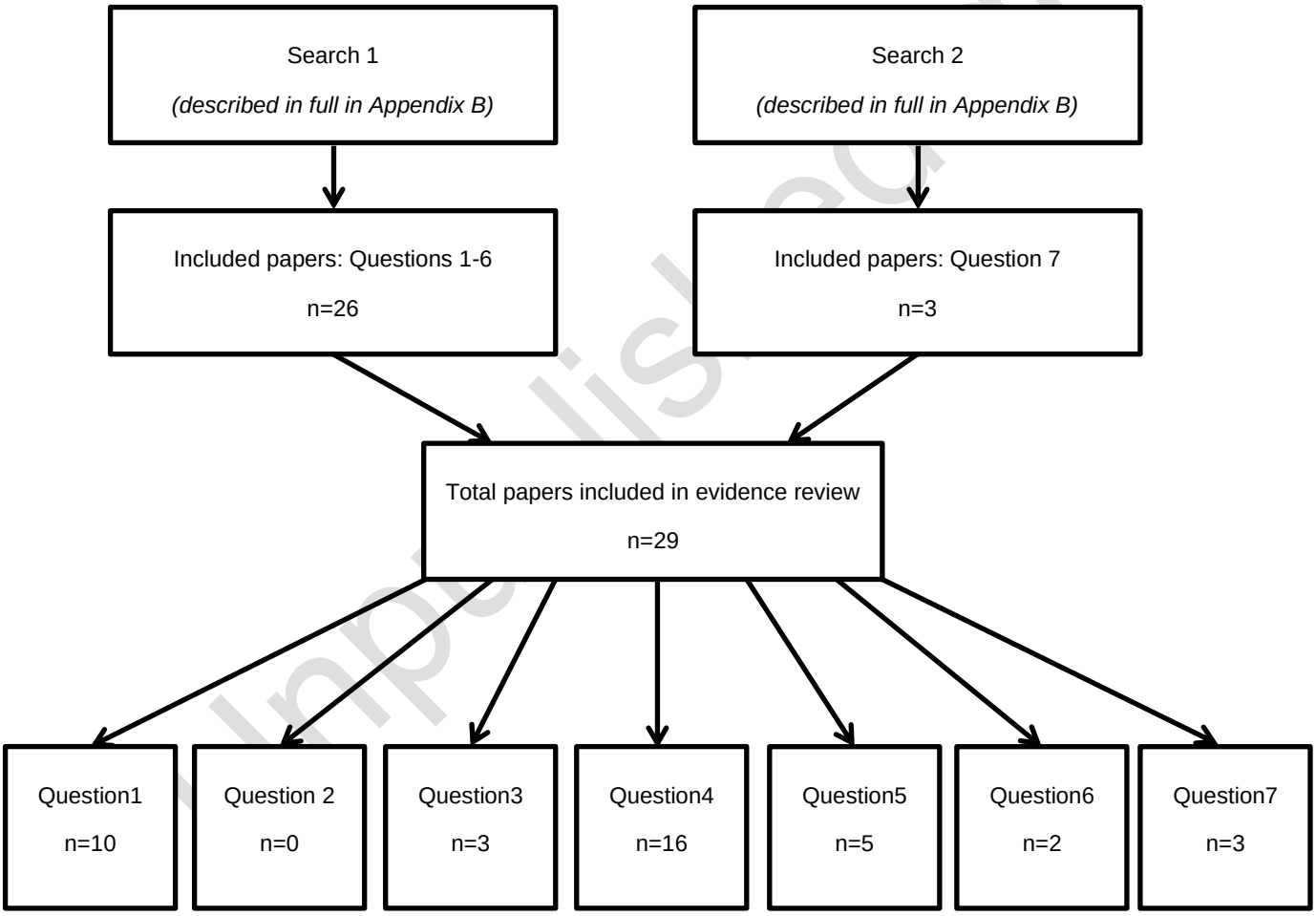
A total of 280 papers were requested for full text assessment. Of these, 26 studies met the inclusion criteria and were thus included in this systematic review (see Figure 1). A list of the 254 studies excluded at the full text assessment stage is available in Appendix F along with the reasons for their exclusion.

2.4.2 Search 2: Review question 7

The database searches returned 1899 unique items for screening. In addition, 47 references were identified through the searches for review questions 1 to 6 as well as forwards and backwards citation searching of the reference lists of included studies and relevant reviews. In total, the titles and abstracts of 1946 references were assessed.

Forty-one papers were retrieved for full text assessment. Of these, 3 studies met the inclusion criteria and were thus included in this systematic review (see Figure 1). A list of the studies excluded at the full text assessment stage is available in Appendix F along with the reasons for their exclusion.

Figure 1: Flow diagram of included studies



Please note: some studies were included in more than 1 question.

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2.5 Critical appraisal and quality assessment

2.5.1 Cross-sectional study checklist

Twenty five out of the 29 included studies were categorised as cross-sectional. None of the checklists currently suggested in *Developing NICE Guidelines: the manual* (NICE 2014) were considered suitable for the quality appraisal of the evidence identified by this review. The checklist selected for the studies in this review is a combination of items derived from the quality assessment methods reported in 3 previous evidence reviews undertaken within the NICE safe staffing programme (Bazian Ltd 2014, Drennan et al 2014, Simon et al 2014), and the Interim Methods Guide for Developing Service Guidance (NICE, 2014).

The checklist allowed for a summary assessment of bias and considered items such as study design, sampling procedures, data collection methods and analysis techniques. Each checklist item is accompanied by notes on potential bias factors to consider and ratings associated with different aspects of bias. A complete version of the tool is available in Appendix E.

Each study was independently quality assessed by two reviewers who then met to resolve any disagreements and confirm overall quality scores.

For each item, the following ratings were assigned:

++ where the item was unlikely to contribute to any bias in the study

+ where the item may have contributed to bias in the study, but the bias was unlikely to be significant

- where the item may have contributed to significant bias in the study

An overall quality score was then calculated for each study based on the individual ratings of each item within the assessment checklist. Each study was assigned one of the following quality scores:

++ High quality. Most items unlikely to contribute to any bias in the study, further research is very unlikely to change our confidence in the estimate of effect

+ Moderate quality. Most items may have contributed to bias in the study, but the bias was unlikely to be significant; further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate

- Low quality. Most items may have contributed to significant bias in the study, high risk of bias for the majority of evidence may decrease the confidence in the estimate of the effect, further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

2.5.2 Intervention checklist

Four out of the 29 included studies were not cross-sectional studies (e.g. non-randomised control trials) and these were quality assessed using the well-established Cochrane Effective Practice and Organisation of Care Group (EPOC) risk of bias tool which is recommended in *Developing NICE Guidelines: the manual* (NICE 2014). One additional question was added to the tool to assess the applicability of the study to a UK setting. A complete version of the tool is available in Appendix E.

For each item, the following ratings were suggested:

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++	'Yes'	The item was unlikely to contribute to any bias in the study
+	'Partly'	The item may have contributed to bias in the study, but the bias was unlikely to be significant
-	'No'	The item may have contributed to significant bias in the study
	'Unclear'	Report provides insufficient information to judge whether the item was likely to contribute to any bias in the study.
	'NA (not applicable)'	The item is not relevant in this particular instance.

Each study was independently quality assessed by two reviewers who then met to resolve any disagreements and confirm overall quality scores.

2.6 Data Extraction and Evidence Tables

Data from the included studies were extracted into evidence tables adapted from templates in *Developing NICE Guidelines: the manual* (NICE 2014). Evidence tables for the included studies can be found in Appendix D.

2.7 Evidence Synthesis

The synthesis of the evidence is presented in a narrative format with results tables used as appropriate to display patterns, direction and significance of relationships. Quantitative methods of synthesising evidence (e.g. meta-analysis) were not considered appropriate for this review. Evidence statements are provided for each review question. These are brief summary statements which outline key findings from the evidence review and include the number of studies identified, the overall quality of the evidence and the direction and certainty of the results.

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3 Results

This section of the report presents the findings to all 7 major review questions.

Several overarching themes were identified when assessing the evidence base for this review:

- There was a lack of high quality intervention studies identified in the literature searches.
- The majority of included studies are cross-sectional in design and are thus at risk of endogeneity and other biases. This is largely a consequence of the studies assessing staffing variables and outcomes that are both independently influenced by other variables, particularly service user acuity and dependency. As a result, some of the observed associations may underestimate the true impact of certain factors on outcomes.
- Endogeneity and other biases may also give rise to counter-intuitive findings whereby increases in certain variables (such as the proportion of registered staff) are associated with an increase in adverse outcomes.

A large number of studies retrieved in the literature searches reported staff and service user perceptions of the adequacy of staffing levels; however, the majority of these studies did not report any actual staffing data and thus had to be excluded. Several studies reporting the impact of the implementation of mandatory nurse ratios in California (USA) and Victoria (Australia) were identified in the searches. These provided intervention-based evidence but data specific to inpatient mental health settings were not presented separately and thus these papers were excluded.

Nine of the 29 papers selected for inclusion in the review were drawn from a single study, the City-128 Study (Bowers 2007a). This was a prospective observational study involving data collection from 136 adult acute wards located in 67 hospitals across 26 different NHS Trusts across England. The City-128 Study was rated as moderate in quality because of its large sample size, prospective design and relatively robust analysis methods. However, there is a risk that some of its significant findings may have arisen by chance. This is because a large number of statistical analyses were conducted to test the associations between multiple combinations of factors and outcomes. Another potential limitation of some papers in the City-128 Study is that their analyses sometimes reported outcomes inconsistently; it was not always clear why results for certain variables were included or omitted in different levels of univariate and multivariate modelling.

Another general theme identified throughout the papers included in the review was the poor reporting of both study methods and results:

- Some studies presented narrative results statements but failed to provide any numerical data to support their findings.
- Some studies failed to adequately describe their data collection instruments; for example, it was sometimes unclear whether a higher score on a particular tool indicated a better or worse outcome. Consequently it was difficult to interpret findings in certain studies.

No studies reporting economic evaluations or analyses were identified for any of the 7 review questions included in this report.

A range of outcomes are discussed in questions 1 to 5; these have been grouped under 4 headings:

- **Conflict outcomes** (such as incidents of aggression, self-harm, absconding and medication refusal)
- **Containment outcomes** (such as episodes of special observation, manual restraint, shows of force, time out, seclusion and coerced intramuscular medication)
- **Other adverse outcomes** (such as service user falls)

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- **Other nurse and ward outcomes** (such as nurse burnout)

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3.1 Review Question 1

This section of the evidence review examines the relationship between nursing staff levels in inpatient mental health settings, and service user and other nursing and ward outcomes. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 1 below. Results are reported in tables accompanying each section. No economic evidence was identified for this review question.

3.1.1 Review Question

What service user and other outcomes are associated with safe staffing for nurses in inpatient mental health settings?

- Is there evidence of a relationship between nursing staff levels or skill mix and increased risk of harm?
- Do nursing staff levels or staff-to-service user ratios impact on outcomes?
- Which outcomes should be used as indicators of safe staffing?

3.1.2 Evidence

In total, 10 papers (Hanrahan et al 2010a; Hanrahan et al 2010b; Jorgensen et al 2009; Lay et al 2011;Lewin et al 2012; Melvin et al 2005; Ng et al 2001; O'Malley et al 2007; Sawamura et al 2005; Staggs 2013) were included for this review question. A brief summary of these studies can be found in Table 1.

Most of the studies were cross-sectional by design: 7 were retrospective observational studies and 2 were prospective observational studies. Given the limitations of their designs, no direct causal inference can be made from any of the observed associations whether or not they reach statistical significance. One study used a naturalistic before and after design to assess the impact of a reconfiguration of ward structures which increased the nursing establishment from 25.9 full-time equivalent (FTE) staff to 27.9 FTE. This study was judged to have a high risk of bias and any observed associations should be interpreted with caution.

All of the included studies are at risk of endogeneity and other forms of bias. Endogeneity bias arises from the fact that both outcomes and staffing levels are independently influenced by factors such as service user need and acuity. This may serve to diminish reported associations with staffing outcomes. Both endogeneity and other types of bias can limit the reliability of study findings and may contribute to counter-intuitive results whereby increases to staffing are associated with increases in adverse outcomes.

Seven studies were set in a mixture of short and long-stay adult psychiatric facilities, some facilities were in general hospitals, and one study was conducted in a psychiatric intensive care unit (PICU) (O'Malley et al 2007). Only 1 study was conducted in the UK (Melvin et al 2005). Five studies were conducted in countries which are considered to have similar health systems as the UK: 2 were conducted in New Zealand (Ng et al 2001, O'Malley et al 2007), and 1 each in Australia (Lewin et al 2012), Norway (Jorgensen et al 2009) and Switzerland (Lay et al 2011). Three further studies were conducted in the USA (Hanrahan et al 2010a; Hanrahan et al 2010b; Staggs 2013), and 1 in Japan (Sawamura et al 2005). When assessed for quality, all of these studies had significant methodological limitations and were considered to be at a high risk of bias, with findings which were unreliable.

Methods for reporting staffing levels varied between studies; 4 studies reported a nurse-to-patient ratio; 1 study each reported patient days per nursing staff, total nurse hours per shift, and, total nurse hours per patient day, and 1 study reported an increase in the nursing establishment. In this section the relationship between staff levels and service user outcomes

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overall is discussed. The impact of different characteristics of nurse staffing factors (e.g. skill mix, gender mix) is discussed in Section 4.4.

There was variation in tools for measuring outcomes. Ng and colleagues (2001) used a 'log of ward incidents' to retrospectively gather data on assaults. Further details were not given. Staggs (2013) retrospectively collected monthly data on staffing and assaults from the American Nurses Association's National Database of Nursing Quality Indicators (NDNQI). The range of containment measures reported by Lay et al (2011) were drawn from the central psychiatric register for the region. Collecting of these data is legally mandated and these data are considered to be highly reliable. O'Malley and colleagues (2007) collected data on seclusion from daily seclusion and admission/discharge records kept by nursing staff. Adverse outcome data were collected in one study by asking nurses to recall the frequency of adverse events over the previous year (Hanrahan et al 2010a). These data are likely to be subject to recall bias. Methods for data collection of potential adverse drug events (PADE) were poorly reported in one study (Sawamura et al 2005). Data on elements of nurse burnout were collected using the Maslach Burnout Inventory (MBI), a validated and robust tool (Hanrahan et al 2010b). Data on elements of the social climate of the ward were collected using subscales of the Ward Atmosphere Scale (WAS), which is a validated data collection tool (Jorgensen et al 2010). Melvin and colleagues (2005) collected data on staffing from a daily questionnaire completed by nursing staff. This tool was not further described. Lewin and colleagues (2012) collected data on the socio-emotional climate within the ward at the end of each shift using the Shift Climate Rating (SCR) scale, which was developed for the study.

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Table 1: Summary of included evidence

Reference	Study Design, Country & Setting	Outcomes	Nursing Team	Limitations	Quality Score
Melvin et al (2005)	**Study design**: Naturalistic before and after study **Country**: UK (Scotland) **Setting**: 5 acute mental health admission wards	Increase /decrease in staff hours: • Short-term sickness • Long-term sickness • Maternity leave • Annual leave • Other leave • Training • Bank staff • Staff overtime • Total staff hours • Incidents • Locked doors • Absconding • Observations	Ward reconfiguration includes changes to staffing levels. Staff funded establishment increases from 25.9 FTE to 27.9 FTE. Prior to reconfiguration 17.9 FTE 'trained staff', 8 Nursing Assistants	Before and after study non-randomised No clear and proper control group. Nothing reported which indicates data were gathered from the same population pre- and post-intervention. No *p* values or confidence intervals reported.	-
Staggs (2013)	**Study design:** Retrospective observational **Country:** USA **Setting:** 351 adult inpatient units from 11 psychiatric hospitals & 244 general hospitals	• Total assaults • Injury assaults	Staffing measured by total nursing care hours per patient day (TNHPPD) which reflects care provided by RNs, LPNs and assistive personnel (including mental health technicians)	Secondary analysis of existing dataset. Unclear if data were collected using objective, validated tools.	-
O'Malley et al (2007)	**Study design**: Retrospective and prospective observational **Country:** New Zealand **Setting:** A single PICU	• Seclusion	Total nurse hours per shift was used as part of the analysis. It is unclear whether the definition of nurse staffing is restricted to RNs.	Small sample drawn from a single institution. Comparability of population before and after change not reported.	-

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Reference	Study Design, Country & Setting	Outcomes	Nursing Team	Limitations	Quality Score
Ng et al (2001)	**Study design:** Retrospective observational **Country:** New Zealand. **Setting:** a single 14-bed adult acute psychiatric unit with 2 intensive care beds.	• Verbal aggression • Physical aggression	Staff to patient ratio was used. The number of nursing staff directly involved in patient care was noted for each shift. When all acute beds occupied typical to have 6 RNs (morning shift), 5 RNs (afternoon shift), 2 RNs (night shift). Max 2 RNs or 2 aides form agency allowed when required (high acuity or RNs unavailable).	Secondary analysis of existing dataset. Small sample drawn from a single institution. No multivariate analyses undertaken. Data not presented to support narrative results statements	-
Lay et al (2011)	**Study design:** Retrospective observational **Country:** Switzerland **Setting:** 6 adult psychiatric hospitals (all units in Canton of Zurich)	• Restraint / seclusion	Patient-days per nursing staff (mean 378.9). Nursing staff not further described.	Secondary analysis of existing dataset. Selective reporting of *p* values.	-
Hanrahan et al (2010a)	**Study design:** Retrospective observational **Country:** USA **Setting:** Acute adult psychiatric wards in general hospitals	• Wrong medication or dose • Patient falls with injuries • Complaints from patients and families	Patient to nurse staffing ratio. 7.09 (± 3.50) patients to 1 nurse. Only includes registered nurse permanently assigned to direct care of psychiatric patients.	Secondary analysis of existing dataset. Staffing ratio data not collected by reliable, objective means. Outcome data collected via self-report using non-validated instruments.	-
Hanrahan et al (2010b)	**Study design:** Retrospective observational **Country:** USA **Setting:** Acute adult psychiatric wards in general hospitals	• Staff burnout	Patient to nurse staffing ratio. 7.09 (± 3.50) patients to 1 nurse. Only includes registered nurse permanently assigned to direct care of psychiatric patients.	Secondary analysis of existing dataset. Staffing ratio data not collected by reliable, objective means.	-
Sawamura et al (2005)	**Study design:** Prospective observational **Country:** Japan **Setting:**132 units in 44 adult long-stay wards in private hospitals	• Non-intercepted potential adverse drug events	Average number of patients per member of staff: Evening 25.3: 1 Nursing staff not further described.	Low response rate. Data collected via self-report using non-validated instruments.	-

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Reference	Study Design, Country & Setting	Outcomes	Nursing Team	Limitations	Quality Score
		(PADE)			
Jorgensen et al (2009)	**Study design:** Prospective observational **Country:** Norway **Setting:** 3 intermediary general psychiatric inpatient wards	• Ward atmosphere using patient-reported Ward Atmosphere Scale (WAS)	Bed: total daily patient to staff ratio, by ward. (Ward 1 =20:17, Ward 2=20:13, Ward 3=32:21) Nursing staff not further described.	Confidence intervals not provided. Small sample size Unclear recruitment methods Overall composite score for WAS not provided. No numerical data were provided for the link between staffing levels and outcomes.	-
Lewin et al (2012)	**Study design:** Retrospective secondary analysis **Country:** Australia **Setting:** 4 units in a psychiatric hospital and 7 psychiatric units in general hospitals	• Shift climate rating	Nurse-to-patient ratio Average 5.23 patients per nurse. Nursing staff not further described.	Unclear recruitment methods Unclear data collection methods for staffing ratio Unclear if data collection tool for shift climate rating was validated Results not clearly reported Confidence intervals not provided	-
Abbreviations used: FTE, full-time equivalent; RN, Registered Nurse; LPN, Licensed Practical Nurse.					

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3.1.2.1 Conflict Outcomes

Four studies reported on the association between staffing levels and conflict related outcomes (see Table 2). One small study from the UK reported a reduction in the number of incidents which may pose a risk to patients or staff (not further reported) (n=42, 22.1%), following a ward reconfiguration which resulted in a small increase in the nursing establishment (Melvin et al 2005). The same study reported an increase in patient absconding (n=2, 66.7%) following reconfiguration. However, the authors do not present any statistical analysis by which to judge the significance of these findings. One large study from the USA (Staggs 2013) retrospectively analysed data from 351 adult psychiatric units and found a significant positive association between total nursing care hours per patient day and total assaults (IRR 1.118 [95% CI 1.072 to 1.164], p<0.001) and assaults resulting in injury (IRR 1.118 [95% CI 1.064 to 1.175], p<0.001). In this study, higher staffing levels were associated with higher assault rates. Ng and colleagues (2001) found no significant associations between staffing ratio and either physical or verbal aggression towards staff when studying an acute adult psychiatric unit of 14 beds in New Zealand. No data were presented to support their findings. Hanrahan and colleagues (2010a) in the USA found some evidence to suggest that lower patient to nurse staffing ratios were associated with a decrease in verbal abuse to nurses (Adjusted β=-1.30 (SE 0.89), p=0.053), although this was not statistically significant.

In summary, whilst the evidence is conflicting, it suggests that higher nurse staffing levels are associated with increased assault rates. However, given the possibility of endogeneity and other biases, this observed association may reflect the need for higher nursing levels when there is increased conflict on the ward. There is no evidence of a statistically significant association between verbal aggression towards staff and patient to staff ratios.

Table 2: Conflict outcomes

Study/Paper reference	Outcomes	Statistical analysis	Staffing measure	Results
Melvin et al (2005)	Incidents	None	Staff funded establishment increases from 25.9 FTE to 27.9 FTE.	Reduction, n=42 (22.1%)
	Patient absconding			Increase, n=2 (66.7%)
Staggs (2013)	Total Assaults	Hierarchical Poisson regression	Total nursing care hours per patient day (TNHPPD)	IRR[a]= 1.118 (95% CI 1.072 to1.164) p<0.001[b]
	Injury Assaults			IRR[a]= 1.118 (95% CI 1.064 to 1.175) p<0.001[b]
Ng et al (2001)	Incidents of verbal aggression	Logistic regression[d]	Staff-to -patient ratio	Assumed p>0.05[c]
	Incidents of physical aggression			Assumed p>0.05[c]
Hanrahan et al (2010a)	Verbal abuse directed toward nurses	Adjusted general linear regression[e]	Patient to nurse staffing ratio. Mean 7.09 (± 3.50) patients to 1 registered nurse.	Adjusted β=-1.30 (SE 0.89), p=0.053

Abbreviations used: IRR, incident rate ratio; CI, confidence interval.
a Reported as exponentiated beta in the full paper
b The following variables were statistically significant in the linear model: RN skill mix. The following variables were not statistically significant: the unit locked status, hospital type and hospital teaching status. The

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interaction between TNHPPD and nursing skill mix was not significant for total assaults (IRR 1.00, 95% CI 0.996 to 1.003, p=0.92) or injury assaults (IRR 0.99, 95% CI 0.996 to 1.003, p=0.7).

c The model for injury assaults contained 2 significant variables: RN skill mix and hospital teaching status. The following variables were not statistically significant: the unit locked status and hospital type.

d Unclear if narrative results reported in the full paper for staff to patient ratio are from logistic regression

e Coefficients from multivariate regression models adjusted for hospital characteristics (bed capacity, teaching status and advanced technology status) and psychiatric nurse characteristics (gender, bachelor's degree in nursing and years as a registered nurse).

3.1.2.2 Containment Outcomes

Three studies reported on the association between staffing levels and containment related outcomes (see Table 3). A small UK study reported that the ward doors were locked 13 times more often following reconfiguration of the ward, an increase of 5.8% (Melvin et al 2005). The same study also reported that the number of patients under 15 minute observations was reduced from 3417 to 3158 (6.1%), as were the number of patients under close observation (1021 to 856, 6.4%), and those under special observation (111 to 42, 62.2%). However, the authors do not present any statistical analysis by which to judge the significance of these findings, and reported that most of the observations were made on only 1 patient. One small study conducted in New Zealand (O'Malley et al 2007) evaluated the impact of splitting a 20-bed PICU into 2 separate 10-bed units. The study found a statistically significant but weak negative association between total nurse hours per shift and seclusion (R^2 -0.25, p=0.001); that is, increases in nurse staffing were associated with reduced incidents of seclusion. Nurse hours alone explained 3% of the variance in seclusion incidents after the reconfiguration. A different finding was reported by Lay and colleagues (Lay et al 2011) in a Swiss study which found that fewer patient days per nursing staff (i.e. a lighter workload) was positively associated with an increased risk of restraint/seclusion (OR 0.978 [95% CI 0.965 to 0.990], p<0.01). This study was conducted in 6 adult psychiatric hospitals. In this study, data for seclusion and restraint are combined. The same study found no statistically significant association between patient days per nursing staff and involuntary medication (OR 1.005 [95% CI 1.000 to 1.010]) or compulsory admission (OR 1.003 [95% CI 1.000 to 1.005]).

In summary, whilst results were inconclusive, the evidence suggests that higher nurse staffing may be associated with increased seclusion and restraint rates. The evidence for the impact of increased staffing on observations is inconclusive. However, given the possibility of endogeneity and other biases, this observed association may reflect the need for higher nursing levels when there is increased need for containment on the ward.

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Table 3: Containment outcomes

Study/Paper reference	Outcomes	Statistical analysis	Staffing measure	Results
Melvin et al (2005)	Locked doors	None	Staff funded establishment increases from 25.9 FTE to 27.9 FTE.	13 times more often, an increase of 5.8%
	15 minute observations			Reduced from 3417 to 3158 (6.1%)
	Close observation			Reduced from 1021 to 856, (6.4%)
	Special observation			Reduced from 111 to 42, (62.2%)
O'Malley et al (2007)	Seclusion	Multivariate analysis. General linear model.	Total nurse hours per shift	R^2= 0.23 p<0.05[a]
Lay et al (2011)	Restraint / seclusion	Marginal generalised estimating equations model (GEE) were applied.	Patient-days per nursing staff (mean 378.9)	OR= 0.978 (95% CI 0.965 to 0.990) p<0.01[b]
	Involuntary medication			OR= 1.005 (95% CI 1.000 to 1.010) p>0.05 [c]
	Compulsory admission			OR= 1.003 (95% CI 1.000 to1.005) p>0.05 [d]

Abbreviations used: OR, odds ratio; CI, confidence interval

a Adjusted for period (the block of time from which sampling occurred: period 1=12 weeks immediately prior to split in the unit, period 2 = 12 weeks following, period 3 = 1 year after the split) and shift (morning afternoon or night, and day of week). Both of these variables showed independent statistical significance. No further measures of effect were reported.

b The following variables were statistically significant in the GEE model: patient gender, age, residential situation, severity of disorder, number of hospital beds, ICD-10 diagnosis. The following variables were not statistically significant in the GEE model: education, occupational status, citizenship, mean length of stay and bed occupancy.

c The following variables were statistically significant in the GEE model: occupational status, residential situation, severity of disorder, ICD-10 diagnosis, and the number of hospital beds. The following variables were not statistically significant in the GEE model: citizenship, patient gender, age, education, mean length of stay and bed occupancy.

d The following variables were statistically significant in the GEE model: patient gender, age, citizenship, residential situation, severity of disorder, ICD-10 diagnosis, number of hospital beds, mean length of stay. The following variables were not statistically significant in the GEE model: education, occupational status and bed occupancy.

3.1.2.3 Other adverse outcomes

Hanrahan and colleagues (2010a) found that nurse to patient staffing ratios did not predict the number of patient falls with injury (adjusted β -0.64 [SE 0.72]), or complaints from patients or families (adjusted β -1.14 [SE 0.68]). They also did not predict incidents of wrong medication or dose being delivered to patients (adjusted β -0.02 [SE 0.61]). One study (Sawamura et al 2005) found that higher patient to staff ratios in the evening were associated with a decrease in the possibility of intercepting a potential adverse drug event (PADE) (OR 1.055 [95%CI 1.002 to 1.11], p=0.04).

In summary, there is limited evidence to suggest that staffing measures are associated with the adverse outcomes reported here. There is a little evidence to suggest that higher patient to staff ratios in the evening may predict ability to intercept PADE.

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Table 4: Other adverse outcomes

Study/paper reference	Outcomes	Statistical analysis	Staffing measure	Results
Hanrahan et al (2010a)	Wrong medication or dose	Adjusted general linear regression[b]	Patient to nurse staffing ratio. Mean 7.09 (± 3.50) patients to 1 registered nurse.	Adjusted β= -0.02 (SE 0.61), p>0.05
	Patient falls with injuries			Adjusted β= -0.64 (SE 0.72), p>0.05
	Complaints from patients and families			Adjusted β= -1.14 (SE 0.68), p>0.05
Sawamura et al (2005)	Potential adverse drug events (PADE): Non-intercepted	Multivariate logistic regression	Average number of patients per member of staff: Evening 25.3: 1	OR= 1.055 (95% CI 1.002 to 1.111) p= 0.04[a]

Abbreviations used: OR, odds ratio; CI, confidence interval

a The following variables were statistically significant in the multivariate logistic regression: number of tablets, fourth admission, diagnosis of schizophrenia. The following variable was not statistically significant: frequency of admission (second and third admission).

3.1.2.4 Other nursing and ward related outcomes

Five studies were identified that assessed the relationship between nurse staffing measures and other nurse and ward related outcomes (Hanrahan et al 2010b, Jorgensen et al 2009, Lewin et al 2012, Melvin et al 2005, Hanrahan et al 2010a). One large retrospective observational study conducted in adult psychiatric wards in general hospitals in the USA assessed to what extent patient to nurse staffing ratios predicted nurse burnout as measured by the emotional exhaustion, depersonalisation, and personal accomplishment subsets of the Maslach Burnout Inventory (MBI) (Hanrahan et al 2010b).The same dataset was used by Hanrahan and colleagues (2010a) to assess to what extent nurse to patient staffing ratios predicted work related injuries. Jorgensen and colleagues (2009) in Norway provided prospective observational data of the relationship between total daily ward staff ratios across three intermediary general psychiatric wards and patient-reported subscales from the Ward Atmosphere Scale (WAS). Lewin and colleagues (2012) in Australia performed a secondary analysis of psychiatric unit datasets to assess socio-emotional climate during each shift. Melvin and colleagues (2005) conducted a small naturalistic before and after study across five acute mental health admission wards. This study measured increases and decreases in nurse staffing hours following a reconfiguration of ward structures which increased the nursing establishment from 25.9 full-time equivalent (FTE) staff to 27.9 FTE staff. All of these studies were assessed as having a high risk of bias and any observed associations between staffing measures and outcomes should be treated with caution.

Patient to nurse staffing ratios were found to be significantly predictive of emotional exhaustion in nurses (adjusted β= -0.52 [SE 0.19], p=0.026) (Hanrahan et al 2010b); that is, a lower patient to staff ratio predicted lower emotional exhaustion scores. However patient to staff ratios were not found to predict depersonalisation or personal accomplishment scores. A lower patient to staff ratio was strongly and significantly predictive of a reduction in work-related injuries (Adjusted β=-1.34 [SE 0.60], p<0.05). Jorgensen and colleagues (2009) found small significant differences in three subset scores of the WAS, between wards with smaller patient to staff ratios (see Table 5). The correlation between socio-emotional shift climate and the nurse-to-patient ratio reported by Lewin and colleagues (2012) was not statistically significant (partial correlation= -0.01, R^2 0.031).The impact of a ward reconfiguration evaluated by Melvin and colleagues (2005) was reported to result in an overall decrease in staff hours, although no calculation of statistical significance was presented. The ward reconfiguration involved raising the number of beds in four wards from

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25 to 28 and to close one of the wards, with the resulting staffing resources reinvested in the existing community mental health team and inpatient services. This small study had serious methodological flaws and its findings should be treated with caution. In summary, lower patient to nurse staffing ratios may predict improved emotional exhaustion scores, and reduced work-related injuries to staff. There is little robust evidence of the impact of staffing measures on ward and nurse outcomes. There is no evidence to suggest that staffing is associated with socio-emotional shift climate.

Table 5: Other nurse and ward related outcomes

Study/paper reference	Outcomes	Statistical analysis	Staffing measure	Results
Hanrahan et al (2010b)	Emotional exhaustion	Adjusted general linear regression[a]	Patient to nurse staffing ratio. Mean 7.09 (SD ± 3.50) patients to 1 registered nurse.	Adjusted β= -0.52 (SE 0.19, p=0.026)
	Depersonalisation			Adjusted β= - 0.18 (SE 0.10, p=0.106)
	Personal Accomplishment			Adjusted β= - 0.30 (SE 0.16, p=0.637)
Jorgensen et al 2009	Order and Organisation (WAS subscale)	Multivariate ANOVA followed by MANOVA	Bed: total daily patient to staff ratio, by ward (Ward 1=20:17, Ward 2=20:13, Ward 3=32:21).	Ward 1= 7.1164 Ward 2= 8.0467 Ward 3= 6.9753 1 vs. 2: not significant 1 vs. 3: not significant 2 vs. 3: p<0.05[b]
	Programme clarity (WAS subscale)			Ward 1= 6.4914 Ward 2= 6.2802 Ward 3= 4.8508 1 vs. 2: not significant 1 vs. 3: p<0.01 2 vs. 3: p<0.05
	Staff control (WAS subscale)			Ward 1= 4.1960 Ward 2= 4.2210 Ward 3= 4.4819 No significant difference between any wards.
	Involvement (WAS subscale)			Involvement Ward 1= 6.3624 Ward 2= 6.6023 Ward 3= 4.2458 1 vs. 2: not significant 1 vs. 3: p<0.001 2 vs. 3: p<0.001
	Support (WAS subscale)			Ward 1= 6.5928 Ward 2= 6.7778 Ward 3= 4.9750 1 vs. 2: not significant 1 vs. 3: p<0.001 2 vs. 3: p<0.001
	Spontaneity (WAS subscale)			Ward 1= 5.0179 Ward 2= 5.0362 Ward 3= 3.3210 1 vs. 2: not significant

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Study/paper reference	Outcomes	Statistical analysis	Staffing measure	Results
				1 vs. 3: p<0.01 2 vs. 3: p<0.01
	Autonomy (WAS subscale)			Autonomy Ward 1= 6.1329 Ward 2= 6.2029 Ward 3= 4.8333 1 vs. 2: not significant 1 vs. 3: p<0.05 2 vs. 3: p<0.05
	Practical orientation (WAS subscale)			Ward 1= 6.1412 Ward 2= 6.7909 Ward 3= 4.1652 1 vs. 2: not significant 1 vs. 3: p<0.001 2 vs. 3: p<0.001
	Personal problem orientation (WAS subscale)			Ward 1= 5.9444 Ward 2= 5.8792 Ward 3= 3.6008 1 vs. 2: not significant 1 vs. 3: p<0.001 2 vs. 3: p<0.001
	Anger and aggression (WAS subscale)			Ward 1= 2.6894 Ward 2= 2.9066 Ward 3= 2.3944 1 vs. 2: not significant 1 vs. 3: not significant 2 vs. 3: not significant
Melvin et al 2005	Outcome	No statistical analysis conducted	Ward reconfiguration includes changes to staffing levels. Staff funded establishment increases from 25.9 FTE to 27.9 FTE.	Increase/decrease in staff hours:
	Short-term sickness			-200
	Long-term sickness			+610
	Maternity leave			-1029
	Annual leave			+689
	Other leave			+140
	Training			+504
	Bank staff			-590
	Staff overtime			+175
	Total staff hours			-1165
Lewin et al (2012)	Total socio-emotional shift climate rating	Hierarchical regression	Staffing ratio. Mean 5.23 patients to 1 nurse.	Partial correlation = -0.01[c] R^2 0.031
Hanrahan et al (2010a)	Work-related injuries	Adjusted general linear regression[d]	Patient to nurse staffing ratio. Mean 7.09 (± 3.50) patients to 1 registered nurse.	Adjusted β=-1.34 (SE 0.60), p<0.05

Abbreviations used: FTE, full-time equivalent; SD, standard deviation; SE, standard error; WAS, ward atmosphere scale.
a All adjusted regression models controlled for nurse characteristics (baccalaureate degree and years of

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experience) and hospital characteristics (bed size, teaching status and high technology).
b Reporting is unclear, but results do not appear to have been adjusted for any variables.
c. All data extracted from model 2 in which the same predictors (unit size, shift, occupancy rate, staffing experience, patient gender, patient age, proportion of involuntary patients, ward movements, structured therapy, visitors, reportable aggressive incidents, non-reportable aggressive incidents, unauthorised leave, PRN medication, emotional distress, withdrawal, disinhibition, psychosis, cognitive impairment, additional staffing demands) were examined after controlling for unit location and non-specific unit differences. The R^2 after entering Step 1 into the regression model (step 1= unit and shift characteristics) was 0.031. R^2 for model 2 overall was 0.671.
d The multivariate model for work related injuries included the following variables which were statistically significant: nurse-physician relationship and manager and leadership skill. The following variables were not statistically significant: foundations for quality of care and nurse participation in hospital affairs (all p>0.05).

3.1.3 Evidence Statements

Evidence from 1 retrospective study conducted in the USA (Staggs 2013, [-]) found that higher nurse staffing levels were associated with increased conflict rates (IRR= 1.12 [95% CI 1.072 to 1.16], p <0.001) and increased assaults (IRR= 1.12 [95% CI 1.06 to 1.18], p<0.001).

One small study (Ng et al 2001, [-]) reported no significant associations between staffing ratios and either physical or verbal aggression towards staff. No data were presented to support their findings.

A small study conducted in New Zealand (O'Malley et al 2007, [-]) found that incidents of seclusion were reduced by an increase in nurse staffing (R^2= 0.23, p<0.05). However, a larger Swiss study (Lay et al 2011, [-]) found that higher nurse staffing levels were associated with an increase in the use of seclusion or restraint (OR= 0.978 [95% CI 0.965 to 0.990], p<0.01).

One study (Lay et al 2011, [-]) found no association between patient days per nursing staff and involuntary medication (OR= 1.005 [95% CI 1.000 to 1.010]) or compulsory admission (OR= 1.003 [95% CI 1.000 to 1.005]).

Evidence from 1 study (Hanrahan et al 2010a, [-]) found no association between staffing levels and injurious patient falls (adjusted β= -0.64 [SE 0.72]), complaints from patients and families (adjusted β= -1.14 [SE 0.68]), mistakes in medication (adjusted β= -0.02 [SE 0.61]) or verbal abuse directed towards staff (adjusted β=-1.30 [SE 0.89], p=0.053) .

One study (Sawamura et al 2005, [-]) observed an association between increased patient to staff ratios in the evening with a decrease in ability to intercept adverse drug events (OR= 1.055 [95%CI 1.002 to 1.111], p=0.04).

One American study (Hanrahan et al 2010b, [-]) found patient to nurse staffing ratios to be significantly predictive of emotional exhaustion in nurses (adjusted β= -0.52 [SE 0.19], p=0.026) with a lower patient to staff ratio predicting lower emotional exhaustion scores. However, the same study found patient to staff ratios did not predict depersonalisation or personal accomplishment scores.

One study (Hanrahan et al 2010a, [-]) conducted in USA found patient to nurse staffing ratios to be significantly predictive of work-related injuries to staff (adjusted β=-1.34 (SE 0.60), p<0.05) with a lower patient to staff ratio predicting fewer work-related injuries.

Jorgensen and colleagues (Jorgensen et al 2009, [-]), found small significant differences in some subset scores of the Ward Atmosphere Scale, between wards with smaller patient to staff ratios. However an overall composite score for the WAS was not provided.

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Evidence from 1 study (Lewin et al 2012, [-]) did not find a significant correlation between the socio-emotional climate rating of a shift and the nurse-to-patient ratio.

One study evaluating the impact of a ward reconfiguration (Melvin et al 2005, [-]) reported an overall decrease in staff hours (-1165), although no calculation of statistical significance was presented.

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3.2 Review Question 2

3.2.1 Review Question

What service user factors affect nursing staff requirements in inpatient mental health settings?

3.2.2 Evidence

No evidence was identified that met the inclusion criteria for this review question.

Whilst we identified what appears to be a large body of evidence which considers the relationship between service user factors and a range of outcomes, none of these studies included data relating to staffing, and therefore did not meet the inclusion criteria for this review. This represents a major gap in the evidence base.

3.2.3 Evidence Statements

No evidence statements have been identified for this review question.

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3.3 Review Question 3

This section of the evidence review examines the relationship between environmental factors of inpatient mental health settings, and service user and other nursing and ward outcomes. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 6 below. Results are reported in Table 7. No economic evidence was identified for this review question.

3.3.1 Review Question

What environmental factors affect nursing staff requirements in inpatient mental health settings?

3.3.2 Evidence

Three studies were identified (Daffern et al 2006; Noda et al 2012; O'Malley et al 2007) that presented data on the effect of environmental factors on nursing staff requirements in inpatient mental health settings. We also identified what appears to be a large body of evidence which considers the relationship between environmental factors and a range of outcomes, none of these studies included data relating to staffing, and therefore did not meet the inclusion criteria for this review. This represents a major gap in the evidence base.

One study was a prospective cross-sectional study (Noda et al 2012), 1 study was a retrospective cross-sectional study (Daffern et al 2006) and 1 study (O'Malley et al 2007) was a retrospective and prospective observational study. 1 study included a secure hospital (Daffern et al 2006), 1 study included a psychiatric intensive care unit (O'Malley et al 2007) and 1 study included 15 inpatient psychiatric wards (Noda 2012). One study was performed in New Zealand (O'Malley et al 2007), 1 in Australia (Daffern et al 2006) and 1 in Japan (Noda et al 2012).

Limitations of these studies include not reporting a power calculation (Daffern et al 2006; Noda et al 2012; O'Malley et al 2007) and not reporting confidence intervals (Daffern et al 2006, Noda et al 2012). Further details are included in Table 6.

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Table 6: Summary of included studies

Study	Study Design, Country & Setting	Environmental factor	Nursing Team	Limitations	Quality Score
Daffern et al (2006)	**Study design:** Retrospective cross-sectional **Country:** Australia **Setting:**1 secure hospital	Male ward	Not reported	Study author assisted staff in completing forms. Power calculation not reported. Multivariate analysis not reported. Confidence intervals not reported.	-
		Female ward	Not reported		
Noda et al (2012)	**Study design:** Prospective cross-sectional **Country:** Japan **Setting:** 15 inpatient psychiatric wards	Emergency ward	10 patients per nurse	Method of recruitment not reported. Power calculation not reported. Unclear methods for regression analysis. Confidence intervals not reported.	+
		Acute ward	13 patients per nurse		
		'S' ward	15 patients per nurse		
O'Malley et al (2007)	**Study design:** Retrospective and prospective observational **Country:** New Zealand **Setting:**1 psychiatric intensive care unit	20 single rooms	AM: 10 PM: 8 Night: 5	Comparability of population before and after change not reported.	-
		2 10-bed units	AM: 11 (over 2 units) PM: 8 (4 per unit) Night: 5 (over 2 units)		
Abbreviations used: AM, morning; PM, afternoon.					

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3.3.2.1 Conflict outcomes

3.3.2.1.1 Aggression

One study (Noda et al 2012) reported incidents of aggression of 3.24 per 1000 beds (1.65 per bed per day) in an emergency ward, 3.27 per 1000 beds (0.96 per bed per day) in an acute ward, and 3.35 per 1000 beds (1.22 per bed per day) in a ward with a 15:1 patient to staff ratio. The number of incidents in the different wards were not compared.

One study (Daffern et al 2006) reported that aggression was not significantly more likely to occur when the nurse was female compared with when the nurse was male, for both female and male wards (numerical data and p values not reported).

One study (Daffern et al 2006) reported no statistically significant difference in the percentage of female staff working on a female ward on shifts when there was an aggressive incident compared with when there was not an aggressive incident (68.71% vs. 68.02%, p value not significant).

One study (Daffern et al 2006) reported no significant difference in the percentage of male staff working on a male ward on shifts when there was an aggressive incident compared with when there was not an aggressive incident (56.51% vs. 58.41%, p value not significant).

One study (Daffern et al. 2006) reported that a correlation between the severity of aggressive incidents and the percentage of male staff was not statistically significant on a female ward (Pearson coefficient= 0.115, p value = not significant) or male ward (Pearson coefficient= 0.99, p=0.2).

3.3.2.2 Containment outcomes

3.3.2.2.1 Seclusion

One study (O'Malley et al. 2007) reported a statistically significant reduction in seclusion rates when a psychiatric intensive care unit of 20 single rooms was changed into 2 10-bed units (8.2% as 20 single rooms, 4.4% 1-12 weeks after change to 2 units, 3.6% 1 year after change to 2 units, p=0.001). This remained statistically significant in a multivariate analysis ($p<0.005$).

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Table 7: Conflict and containment outcomes

Study	Outcome	Statistical analysis	Environmental factors	Results
O'Malley et al (2007)	Seclusion	One-way ANOVA and Spearman's correlation	20 single rooms	8.2% p=0.001[a]
			2 10-bed units	4.4% (at 1 to 12 weeks)
				3.6% (at 1 year)
Noda et al (2012)	Aggression	Multilevel regression	Emergency ward	3.24 incidents per1000 beds (1.65/bed/day) p= NR
			Acute ward	3.27 incidents per 1000 beds (0.96/bed/day) p= NR
			15:1 patient to staff ward	3.35 incidents per 1000 beds (1.22/bed/day) p= NR
Daffern et al (2006)		*T*-tests, chi-square analyses and Spearman's correlations[b]	Female ward	Female nurse vs. male nurse (data not reported)
				Female staff on shift with incident vs. no incidents= 68.71% vs. 68.02%, p= NS
				Correlation of severity with percentage of male staff: Coefficient[b] 0.99, p= NS
			Male ward	Female nurse vs. male nurse (data not reported)
				Male staff on shift with incident vs. no incidents= 56.51% vs. 58.41%, p= NS
				Correlation of severity with percentage of male staff: Coefficient[b] 0.115, p=0.2

Abbreviations used: NS, not significant; NR, not reported
a This p value is assumed to relate to the differences between seclusion levels at the 3 time points although this is not clearly reported in the study.
b The results are reported as Pearson's coefficients in Daffern et al (2006). However, given that the authors of the study used Spearman's rho analysis, the reviewers assume that this is a reporting error in the paper describing the study.

3.3.2.3 Other adverse outcomes

None reported.

3.3.2.4 Other nurse and ward outcomes

None reported.

3.3.3 Evidence Statements

Evidence from 1 observational study with retrospective and prospective data collection (O'Malley 2007 et al [-]) suggests that seclusion rates are statistically significantly lower with 2 10-bed units compared with 20 single rooms with a similar patient to staff ratio (8.2% vs. 3.6%, p=0.001).

Evidence from 1 prospective cross-sectional study (Noda et al 2012, [+]) suggests that there are fewer incidences of aggression on emergency wards with 10 patients per nurse (3.24 incidences per 1000 beds) than acute wards with 13 patients per nurse (3.27 incidences per 1000 beds) or wards with 15 patients per nurse (3.35 incidences per 1000 beds). It also

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suggests there are fewer incidences of aggression on acute wards with 13 patients per nurse (3.27 incidents per 1000 beds) than on wards with 15 patients per nurse (3.35 incidences per 1000 beds). The statistical significance of these comparisons was not reported.

Evidence from 1 retrospective cross-sectional study (Daffern et al 2006, [-]) suggests that there are no statistically significant differences in incidences of aggression on female wards or male wards. The numerical data for these comparisons were not reported. The p values were reported as 'not significant'.

Evidence from 1 retrospective cross-sectional study (Daffern et al 2006, [-]) suggests that there is no statistically significant difference in the percentage of female staff working on female wards when aggressive incidents took place compared with when they did not take place (68.71% vs. 68.02%, p value reported as 'not significant')

Evidence from 1 retrospective cross-sectional study (Daffern et al 2006, [-]) suggests that there is no statistically significant difference in the percentage of male staff working on male wards when aggressive incidents took place compared with when they did not take place (56.51% vs. 58.41%, p value reported as 'not significant')

Evidence from 1 retrospective cross-sectional study (Daffern et al 2006, [-]) suggests that the correlation between the severity of aggressive incidents and the percentage of male staff is not significant on female wards (Pearson's coefficient= 0.115, p value reported as 'not significant') or male wards (Pearson's coefficient= 0.99, p=0.2).

The evidence included for this review question is not directly applicable to inpatient mental health units in the UK. This is because none of the studies used data from the UK.

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3.4 Review Question 4

This section of the evidence review examines the relationship between staffing factors and outcomes in inpatient mental health settings. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 8 below. Results are reported in tables throughout the chapter. No economic evidence was identified for this review question.

3.4.1 Review Question

What staffing factors affect nursing staff requirements in inpatient mental health settings?

3.4.2 Evidence

In total, 16 papers were included for this review question (Baker et al 2009; Bowers et al 2007a; Bowers et al 2007b; Bowers 2009a; Bowers et al 2009b; Bowers et al 2010; Bowers et al 2012; Bowers & Crowder 2012; Bowers et al 2013; Daffern et al 2006; Janssen et al 2007; Noda et al 2012; O'Malley et al 2007; Staggs 2013; Stewart & Bowers 2012; Williams et al 2001). These 16 papers were drawn from 8 different studies. Nine of the papers were drawn from the City-128 Study (Baker et al 2009; Bowers et al 2007a; Bowers 2009a; Bowers et al 2009b; Bowers et al 2010; Bowers et al 2012; Bowers & Crowder 2012; Bowers et al 2013; Stewart & Bowers 2012).

Seven studies were cross-sectional in design: 4 were retrospective cross-sectional studies (Bowers et al 2007b; Daffern et al 2006; Janssen et al 2007, Staggs 2013) and 3 were prospective cross-sectional studies (Bowers et al 2007a; Noda et al 2012; Williams et al 2001). Given the limitations of their design, no direct causal inference can be drawn from any of the observed associations regardless of their level of statistical significance. An exception is a paper from the City-128 study (Bowers & Crowder 2012) that employed a cross-sectional time series analysis; this gives a stronger indication of the time sequence of events between staff skill mix and rates of conflict and containment. However, this study had several other limitations which affect the reliability of its findings. One study used a combination of retrospective and prospective cross-sectional methods to assess the impact of a ward reconfiguration (O'Malley et al 2007); this study had a high risk of bias due to its methods and the findings should be interpreted cautiously.

All of the identified studies were at risk of endogeneity. This is largely a consequence of the studies assessing outcomes and staffing factors which are both independently influenced by other variables, particularly patient acuity and dependency. As a result, some of the observed associations may underestimate the true impact of staffing factors on outcomes. Endogeneity and other biases may also give rise to counter-intuitive findings whereby increases in certain staffing variables (such as the proportion of registered staff) are associated with an increase in adverse outcomes.

Five of the studies were conducted in a mixture of short and long-stay adult psychiatric settings. One study was carried out in a secure forensic hospital (Daffern et al 2006) and another was conducted in an adult psychiatric intensive care unit (PICU) (O'Malley et al 2007). One was carried out in a mixture of acute, emergency and other psychiatric wards (Noda et al 2012).

Two of the included studies were conducted in the UK: the City-128 Study (Bowers et al 2007a) from which 9 relevant papers were identified, and the Tomkins Acute Ward (TAW) Study (Bowers et al 2007b).The Tomkins Acute Ward (TAW) Study collected data from 14 adult psychiatric wards in 1 London NHS Trust. The City-128 study was a prospective observational study involving data collection from 136 adult acute wards located in 67 hospitals across 26 different NHS Trusts. One paper from this study (Bowers & Crowder 2012) used a subset of 32 wards in its analysis. The City-128 Study was rated as moderate

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in quality because of its large UK sample, prospective design and relatively robust analysis methods. However, there is a risk that some of its significant findings may have arisen by chance. This is because a very large number of statistical analyses were conducted to test the associations between multiple combinations of factors and outcomes. Another potential limitation of the City-128 Study is that some analyses report outcomes inconsistently and thus it is not always clear whether certain factors were significantly associated with certain outcomes or not.

Three studies were conducted in countries that are judged to have broadly similar health systems to the UK: 1 was conducted in Australia (Daffern et al 2006), 1 in New Zealand (O'Malley et al 2007) and 1 in the Netherlands (Janssen et al 2007). When assessed for quality, all of these studies were found to have significant methodological limitations; the risk of bias in these studies is therefore considered to be high and their findings should be judged as unreliable.

Two studies were conducted in the USA (Staggs 2013, Williams et al 2001) and 1 in Japan (Noda et al 2012). The American studies were considered to have a high risk of bias and thus potentially unreliable findings. The Japanese study was conducted more rigorously and thus scored higher on the quality assessment checklist; the findings from this study are likely to be less biased and can thus be interpreted more confidently. However, both the USA and Japan are considered to have substantially different healthcare systems to the UK and this limits the generalisability of the findings of these studies to UK settings.

The identified studies consider a large number of staffing factors (or variables) in relation to a range of outcomes. For the purposes of our analysis, these staffing factors have been grouped into the following categories:

- Staff skill mix
  - Proportions of qualified and unqualified staff
  - Proportions of permanent staff members and temporary staff
  - Proportions of staff with different levels of nursing education
- Staff experience
- Staff gender mix
- Staff ethnicity
- Staff attitudes/perceptions
- Other factors
  - Proportion of nurses who have/do not have a caseload
  - Age
  - Staff absence

No economic evidence was identified for this review question

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Table 8: Summary of included evidence

Reference	Study Design, Country & Setting	Staffing factors	Nursing Team	Limitations	Quality Score
City-128 Study *(linked papers listed below)* Baker et al (2009) Bowers et al (2007a) Bowers (2009a) Bowers et al (2009b) Bowers et al (2010) Bowers et al (2012) Bowers et al (2013) Stewart & Bowers (2012)	**Study design**: Prospective cross-sectional **Country**: UK **Setting**: Adult acute psychiatric wards (26 NHS Trusts, 67 hospitals, 136 wards)	• Skill mix • Gender • Ethnicity • Staff attitudes • Staff burnout	The mean number of nursing staff in post per bed was 0.99 WTE (SD 0.22); the mean proportion of these staff who were qualified nurses was 0.61 (SD 0.12), and the mean vacancy rate was high, at 15%. Includes total nursing establishment: • Regular qualified staff • Regular unqualified staff • Bank/agency qualified staff • Bank/agency unqualified staff.	Large number of statistical tests conducted – risk of chance findings. Findings reported inconsistently/unclearly	+
Bowers & Crowder (2012)	Subset of City-128 dataset: 32 adult psychiatric wards.	• Skill mix	As above	As above	+
Bowers et al (2007b)	**Study design**: Retrospective cross-sectional **Country**: UK **Setting**: 14 adult psychiatric wards in 1 London NHS Trust	• Total staff absence	Includes total nursing establishment: • Regular qualified staff • Regular unqualified staff • Bank/agency qualified staff • Bank/agency unqualified staff.	Secondary analysis of existing dataset	-
Daffern et al (2006)	**Study design**: Retrospective cross-sectional **Country**: Australia **Setting:** 1 secure hospital	• Gender	Staff gender ratio was expressed as the percentage of male/female members of nursing staff on duty during a shift.	Study author assisted staff in completing forms. Power calculation not reported. Multivariate analysis not reported. Confidence intervals not reported.	-
Noda et al (2012)	**Study design:** Prospective cross-sectional **Country**: Japan	• Gender • Experience	Staff gender was considered as a predictor variable in the analysis. Staff ratios were expressed as the number of patients per nurse per day but they were not	Method of recruitment not reported. Power calculation not	+

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Reference	Study Design, Country & Setting	Staffing factors	Nursing Team	Limitations	Quality Score
	Setting: 15 inpatient psychiatric wards		considered in the analysis.	reported. Unclear methods for regression analysis. Confidence intervals not reported.	
Staggs (2013)	**Study design**: Retrospective observational **Country**: USA **Setting:** 351 adult inpatient unit	• Skill mix	Staffing measured by total nursing care hours per patient day (TNHPPD) which reflects care provided by RNs, LPNs and assistive personnel (including mental health technicians).	Secondary analysis of existing dataset. Not clear if data were collected using objective, validated tools.	-
Janssen et al (2007)	**Study design**: Retrospective observational **Country**: Netherlands **Setting:** 4 psychiatric hospitals	• Skill mix (nursing education level) • Experience • Gender	Staffing levels described as the number of nurses in a team per day (24h). Patient-staff ratio was calculated by dividing the number of patients admitted on the ward by the number of staff. A male-female staff ratio was calculated by dividing the number of male staff by the number of female staff.	Secondary analysis of existing datasets. Data not collected on likely confounders (e.g. patient dependency/acuity).	-
O'Malley et al (2007)	**Study design:** Retrospective and prospective observational **Country:** New Zealand **Setting:** 1 PICU	• Caseload • Experience • Gender	Total nurse hours per shift. Fewer than 2 male nurses per shift. Nurse experience as a weighted skill mix, scored 1-4 based on13 different characteristics of experience. Period 1 (before the split into 2 units): 8 registered nurses, 1 critical care nurse and 1 clinical nurse specialist in the AM, 8 registered nurses in the PM, 5 registered nurses at night Periods 2 and 3 (after the split into 2 units) 8 registered nurses, 1 critical care nurse and 2 clinical nurse specialists in the AM, 8 registered nurses (4 in each unit) in the PM, 5 registered nurses (over both units) at night.	Small sample drawn from a single institution. Comparability of population before and after change not reported.	-
Williams et al (2001)	**Study design**: Retrospective	• Experience	Staff mix was expressed as the proportion of	Small sample drawn from	-

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Reference	Study Design, Country & Setting	Staffing factors	Nursing Team	Limitations	Quality Score
	observational **Country**: USA **Setting:** 148-bed adult psychiatric facility	• Skill mix	licensed staff on a nursing team.	a single institution. Multivariate analysis not conducted. Confidence intervals not reported.	
Abbreviations used: AM, morning; LPN, licensed practical nurse; PICU, psychiatric intensive care unit; PM, afternoon; RN, registered nurse; SD, standard deviation; WTE, whole-time equivalent.					

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3.4.2.1 Conflict outcomes

3.4.2.1.1 Total conflict

Two papers drawn from the City-128 Study (Bowers 2009a; Bowers & Crowder 2012) investigated the impact of staffing factors on total conflict rates. 'Total' conflict rates included all incidents of aggression, self-harm, absconding, drug/alcohol use and medication refusal. Bowers (2009a) found total conflict to be significantly associated with the proportion of male nursing staff on shift (coefficient= 0.381, p=0.004); increased episodes of conflict were associated with higher numbers of male nursing staff. Bowers & Crowder (2012) utilised a time series analysis to assess whether rises in staffing numbers preceded or followed levels of conflict on 32 acute wards. The authors reported that their results indicate that numbers of regular qualified staff were systematically and consistently related to total conflict rates over time. Moreover, rises in the numbers of nurses preceded rather than followed increases in conflict and containment. For example, the number of regular qualified staff working up to 9 shifts earlier was significantly associated with total conflict rates with an incident rate ratio (IRR) of 1.03 (p<0.001). This indicates that for every 1 extra member of regular qualified staff on duty 9 shifts prior, 1 additional conflict incident was 3% more likely. However, the relationship was stronger between regular qualified staff and total conflict levels when assessed at the same point in time (IRR= 1.04, p<0.001). No clear trend emerges between levels of either regular unqualified staff or bank/agency qualified staff and total conflict levels. The association between unqualified bank/agency staff and subsequent conflict was patchy: positive, inverse and no relationship with conflict was observed at different lag times. The results reported in this paper undermine the explanation that rises in conflict rates lead to deployment of more staff to affected wards. Instead they suggest that higher nurse numbers lead to more conflict events.

The TAW Study (Bowers et al 2007b) found that increases in total staff absence were a significant predictor of the total number of conflict incidents (IRR=1.11 [95% CI 1.06 to 1.16], p = not reported). That is, a 1 unit increase in staff absence (assumed to be measured in hours) was associated with an 11% increase in the likelihood of 1 additional conflict event occurring.

One paper from the City-128 Study (Bowers et al 2013) looked at staffing factors in relation to combined conflict and containment rates on sampled wards. Wards were broadly classified as follows: high conflict/high containment; high conflict/low containment; low conflict/high containment; and low conflict/low containment. High conflict/high containment wards were found to have relatively high levels of unqualified staff and use of high levels of temporary staff. High conflict/low containment wards had a greater proportion of male staff than the other types of wards. No staffing-related features were noted as particularly significant features of low conflict/high containment wards or low conflict/containment wards.

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Table 9: Total conflict

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Bowers (2009a)	Total conflict	Hierarchical multilevel modelling	Proportion of male staff	Coefficient[a]= 0.381 (SE 0.120) p=0.004
City-128 Study: Bowers & Crowder (2012)	Total conflict[b]	Cross-sectional time series Poisson regression	Regular qualified staff	IRR on same shift as conflict events= 1.04 (95% CI NR) p<0.001
				IRR 1 shift before conflict events= 1.02 (95% CI NR) p<0.01
				IRR 9 shifts before conflict events= 1.03 (95% CI NR) p<0.001
			Regular unqualified staff	IRR on same shift as conflict events= 1.00 (95% CI NR) p=NS
				IRR 1 shift before conflict events= 0.98 (95% CI NR) p=NS
				IRR 9 shifts before conflict events= 0.97 (95% CI NR) p<0.01
			Agency/bank qualified staff	IRR on same shift as conflict events= 0.97 (95% CI NR) p<0.01
				IRR 1 shift before conflict events=0.97 (95% CI NR) p=NS
				IRR 9 shifts before conflict events= 1.02 (95% CI NR) p=NS
			Agency/bank unqualified staff	IRR on same shift as conflict events= 1.03 (95% CI NR) p<0.001
				IRR 1 shift before conflict events= 1.05 (95% CI NR) p<0.001
				IRR 9 shifts before conflict events= 1.00 (95% CI NR) p=NS
Tomkins Acute Ward (TAW) Study: Bowers et al (2007b)	All conflict incidents[c]	Poisson regression	Total staff absence	IRR[d]= 1.11 (95% CI 1.06 to 1.16) p not reported
City-128 Study: Bowers et al	Conflict and containment (combined)	Multivariate analysis of variance with	Higher levels of temporary staff	High conflict/high containment wards vs high conflict/low containment wards

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Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
(2013)		post hoc Tukey multiple comparisons of differences[e]		p<0.001
				High conflict/high containment wards vs low conflict/high containment wards p<0.001
				High conflict/high containment wards vs low conflict/low containment wards p<0.01
			Higher levels of unqualified staff	High conflict/high containment wards vs high conflict/low containment wards p<0.01
				High conflict/high containment wards vs low conflict/high containment wards p<0.001
				High conflict/high containment wards vs low conflict/low containment wards p<0.001
			Higher levels of male staff	High conflict/low containment vs high conflict/high containment p<0.01
				High conflict/low containment vs low conflict/high containment p<0.05
				High conflict/low containment vs low conflict/low containment p<0.001

Abbreviations used: CI, confidence interval; IRR, incident rate ratio; NR, not reported; NS, not significant.

a Final model adjusted for service users' socioeconomic status (measured by Index of Multiple Deprivation), physical environment quality, proportion of beds in single rooms, locked doors, show of force, manual restraint, and the Ward Atmosphere Scale (WAS) order and organization subscale . All achieved statistical significance (p<0.05) in the final model. Only staffing factors included in the final combined model for total conflict are presented here. Staff attitudes and burnout (as measured by the Team Climate Inventory (TCI) scale and the Maslach Burnout Inventory (MBI)) were only included as significant factors in domain-level models. Staff ethnicity was analysed in the univariate analyses but was not included in either the domain or final combined models for total conflict.

b Data are also available for the shifts preceding conflict events from 2 shifts preceding up to 9 shifts preceding. The analyses adjusted for NHS trust and ward-level characteristics, the shift type (am, pm, or night), day of the week, and number of admissions during the shift. The statistical significance of the association between total conflict and these control variables is not reported.

c 'All conflict incidents' covers absconds, incidents of aggression, self-harm incidents and 'other' events (not defined).

d Adjusted for male admissions during the same week as well as male admissions one and two weeks prior; p value not reported but assumed to be <0.05 as 95% CI do not cross 1.

e It is not clear what variables have been controlled for in the analysis

3.4.2.1.2 Self-harm

Both The City-128 Study (Bowers et al 2007a) and the Tomkins Acute Ward Study (Bowers et al 2007b) assessed how staffing factors impacted on rates of self-harm. Bowers and colleagues (2007a) found that the likelihood of self-harm incidents decreased slightly as the

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number of qualified nurses on duty increased (OR= 0.941 [95% CI 0.901 to 0.982], p<0.01). Bowers and colleagues (2007b) reported data showing that total staff absence is a predictor of deliberate self-harm incidents (IRR= 1.22 [95% CI 1.11 to 1.34], p not reported) – increased levels of staff absence were associated with higher levels of self-harm.

Table 10: Self harm

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Bowers et al (2007a)	Self-harm	Multilevel random effects modelling[a]	Qualified staff	OR= 0.941 (95% CI 0.901 to 0.982) p<0.01
Tomkins Acute Ward (TAW) Study: Bowers et al (2007b)	Self-harm	Poisson regression	Total staff absence	IRR[b]= 1.22 (95% CI 1.11 to 1.34) p=NR

Abbreviations used: CI, confidence interval; IRR, incident rate ratio; NR, not reported; OR, odds ratio.

a Final model adjusted for the following variables: % of service users with schizophrenia, % of service users under 35, % of Caribbean service users, service users' socioeconomic status (as measured by the Index of Multiple Deprivation), number of admissions during the shift, number of admissions per day, incidents of aggression towards others, incidents of refusing to see workers, absconding (officially reported), door locking status, pro re nata (PRN) administration of medication, seclusion, intermittent observation, manual restraint and the number of student nurses on duty. All variables achieved statistical significance in the final model (p<0.05) with the exception of door locking status – the variables 'door locked <1 hr' and 'door locked 1-3 hrs' reported as not significant. Only staffing factors included in the final combined model for self-harm are presented here. The proportion of white staff was only included as a significant factor in domain level analyses.

b Adjusted for physical aggression and all discharges; p value not reported but assumed to be <0.05 as 95% CI do not cross 1.

3.4.2.1.3 Medication conflict

One study (Baker et al 2009) looked at the impact of staffing variables on rates of conflict behaviour relating to medication. The analysis considered 3 specific conflict behaviours as outcomes:

- Refusal of regular medication
- Refusal of pro re nata (PRN, "as needed") medication
- Demanding PRN medication

Higher regular staffing levels (i.e. not the use of temporary staff) were associated with lower rates of medication refusal. The number of regular qualified staff was inversely associated with incidents of patients refusing regular medication (IRR= 0.941 [95% CI 0.921 to 0.961[, p<0.001) as was the number of regular unqualified staff (IRR= 0.963 [95% CI 0.944 to 0.982], p<0.001).

Neither the numbers of regular qualified or unqualified staff were associated with the likelihood of service users refusing PRN medication. The number of regular qualified staff was inversely associated with the likelihood of service users demanding PRN medication (OR= 0.897 [95% CI 0.879 to 0.914], p<0.001).

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Table 11: Medication conflict

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Baker et al (2009)	Refusal of regular medication[a] Refusal of PRN medication[b] Demanding PRN medication[c]	Multilevel random effects modelling with Poisson regression	Regular qualified staff	Refusing regular medication IRR= 0.941 (95% CI 0.921 to 0.961) p≤0.001
				Demanding PRN medication OR= 0.897 (95% CI 0.879 to 0.914) p≤0.001
			Regular unqualified staff	Refusing regular medication IRR= 0.963 (95% CI 0.944 to 0.982) p≤0.001

Abbreviations used: CI, confidence interval; IRR, incident rate ratio; NR, not reported; OR, odds ratio; PRN, pro re nata.

a Final model adjusted for the following variables: % of service users admitted for harm to self, service users' mean score on the Attitude Toward Containment Measures Questionnaire (ACMQ), whether ward is served by crisis intervention team, whether ward is served by early intervention team, verbal aggression, smoking in a no-smoking area, refusing to eat, refusing to drink, refusing to attend to personal hygiene, refusing to get up out of bed, reusing to go to bed, refusing to see workers, attempting to abscond, refusing PRN medication, demanding PRN medication, door locking status, total restrictions on patients, whether service users were given PRN medication, whether service users were given intramuscular medication, intermittent special observation, special observation with and without engagement, show of force, time out, Ward Atmosphere Scale (WAS) scores (for order, organisation and program clarity). All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'door locked <1h', 'door locked 1-3h' and 'door locked >3h' were reported as not significant. Only staffing factors included in the final combined model are presented here. The number of bank/agency unqualified staff were only included as a significant factor in domain level analyses.

b No staffing factors were included as significant variables in the final combined model for the refusal of PRN medication. The numbers of bank/agency qualified staff and bank/agency unqualified staff were significant in domain level analyses.

c Final model adjusted for the following variables: seclusion availability, verbal aggression, smoking in a no-smoking area, refusing to eat, refusing to attend to personal hygiene, refusing to go to bed, refusing to see workers, alcohol use, other substance misuse, attempting to abscond, absconding (missing without permission), refusing regular medication , refusing PRN medication, door locking status, whether service users were given PRN medication, whether service users were given intramuscular medication, intermittent special observation, special observation with and without engagement, show of force, time out, and the number of student nurses. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'door locked <1h' and 'door locked >3h' were reported as not significant. Only staffing factors included in the final combined model are presented here. The number of bank/agency unqualified staff were only included as a significant factor in domain level analyses.

3.4.2.1.4 Aggression

Four papers assessed how staffing factors were related to incidents of aggression (Bowers et al 2007b; Bowers et al 2009b; Daffern et al 2006; Noda et al 2012).

Bowers and colleagues (2009b) considered 3 specific aggressive behaviours as conflict outcomes:

- Verbal aggression
- Physical aggression towards objects
- Physical aggression towards others

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Increased incidents of verbal aggression were significantly associated with increased numbers of regular qualified staff (IRR= 1.028 [95% CI 1.018 to 1.039], p<0.001), temporary qualified staff (IRR= 1.018 [95% CI 1.010 to 1.026], p<0.001) and temporary unqualified staff (IRR= 1.017 [95% CI 1.009 to 1.025], p<0.001). Increased incidents of physical aggression against objects were significantly associated with increased numbers of regular qualified staff (IRR= 1.123 [95% CI 1.088 to 1.159], p<0.001), temporary qualified staff (IRR= 1.071 [95% CI 1.040 to 1.103], p<0.001) and temporary unqualified staff (IRR= 1.037 [95% CI 1.009 to 1.065], p<0.01). Increased incidents of physical aggression against others were significantly associated with increased numbers of regular qualified staff (IRR= 1.145 [95% CI 1.105 to 1.186], p<0.001) and temporary qualified staff (IRR= 1.075 [95% CI 1.039 to 1.111], p<0.001). Overall, analyses indicated strong positive associations between nurse staffing numbers and aggressive behaviour; these associations were most consistent for the number of regular qualified staff working on a shift. Effects were detected at both shift and ward level; that is, even individual shifts within wards showed higher levels of aggressive behaviour when more qualified nurses were on duty.

Bowers and colleagues (2007b) reported data indicating that increased staff absence was associated with increased rates of physical aggression (IRR= 1.10 [95% CI 1.02 to 1.19], p not reported).

A study by Daffern et al (2006) conducted in an Australian secure forensic hospital assessed the impact of gender ratio on the occurrence and severity of aggressive incidents. There was no significant difference in the mean proportion of female staff working on the female acute ward on the shifts when there was an aggressive incident compared with when there was no aggressive incident. Similarly, there was no significant difference in the mean proportion of male staff working on the male acute ward on the shifts when there was an aggressive incident compared with when there was no aggressive incident. The correlations between the severity of aggressive incidents and the proportions of male/female staff were not significant on either male or female wards. No significant difference was detected in the occurrence of aggressive incidents in relation the gender of the nurse in charge. This low quality study was small and potentially underpowered to detect significant effects.

A moderate quality Japanese study (Noda et al 2012) assessed the impact of nurse gender and experience on nurses' perceptions of the severity of aggressive incidents. In the final multilevel analysis, severity scores were explained to a significant degree by nurse gender with male nurses corresponding to higher severity scores (β= -0.176, p<0.01).

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Table 12: Aggression

Study/ paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Bowers et al (2009b)	Verbal aggression[a] Physical aggression towards objects[b] Physical aggression towards others[c]	Multilevel random effects modelling with Poisson regression	Regular qualified staff[j]	<u>Verbal aggression:</u> IRR= 1.028 (95% CI 1.018 to 1.039), p<0.001) <u>Physical aggression objects</u> IRR= 1.123 (95% CI 1.088 to 1.159), p<0.001 <u>Physical aggression others</u> IRR= 1.145 (95% CI 1.105 to 1.186), p<0.001
			Bank/ agency qualified staff[j]	<u>Verbal aggression:</u> IRR= 1.018 (95% CI 1.010 to 1.026), p<0.001) <u>Physical aggression objects</u> IRR= 1.071 (95% CI 1.040 to 1.103), p<0.001 <u>Physical aggression others</u> IRR= 1.075 (95% CI 1.039 to 1.111), p<0.001
			Bank/ agency unqualified staff[j]	<u>Verbal aggression:</u> IRR= 1.017 (95% CI 1.009 to 1.025), p<0.001) <u>Physical aggression objects</u> IRR= 1.037 (95% CI 1.009 to 1.065), p<0.01
Tomkins Acute Ward (TAW) Study: Bowers et al (2007b)	Physical aggression	Poisson regression	Total staff absence	IRR[d]= 1.10 (95% CI 1.02 to 1.19), p=NR
Daffern et al (2006)	Aggressive incidents (occurrence and severity) Likelihood of seclusion following aggressive incident	*T*-tests, chi-square analyses and Spearman's correlation[e]	Gender	<u>Female wards</u> Mean % female staff (aggressive incident)= 68.71% Mean % female staff (no aggressive incident)= 68.02% t= -0.220, p=NS Incident severity: r= 0.115, p=NS <u>Male wards</u> Mean % male staff (aggressive incident)= 56.51% Mean % male staff (no aggressive incident)= 58.41% t= 0.220, p=NS Incident severity: r= 0.99, p=0.2

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Study/ paper reference	Outcomes	Statistical analysis	Staffing factors	Results
			Gender of RPN3 (nurse in charge of shift)	Female RPN3/female wards X^2= 1.363, p=NS Male RPN3/male wards X^2= 1.204, p=NS Likelihood of seclusion: X^2= 0.335, p=NS
Noda et al (2012)	Severity scores assigned to aggressive incidents[f]	Multilevel regression analyses	Female gender	[g]β= -0.176, p<0.01 [h] Explanatory value of gender + experience= 4.1%
			Experience (years)	β= 0.047, p=NS

Abbreviations used: IRR, incident rate ratio; NR, not reported; NS, not significant; OR, odds ratio; RPN3, level 3 registered psychiatric nurse (the nurse in charge of the shift).

a Final model adjusted for the following variables: % of service users compulsorily admitted, violence to objects, violence to others, smoking in a no smoking area, refusing to eat, refusing to attend to personal hygiene, refusing to get up and out of bed, refusing to go to bed, refusing to see workers, alcohol use, substance use, attempting to abscond, refusal of regular/pro re nata (PRN) medication, demanding PRN medication, door locked status, total restrictions on service users, administration of PRN medication, administration of intramuscular medication, seclusion, intermittent special observation, continuous special observation with engagement, show of force, manual restraint, time out and numbers of student nurses. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'door locked more than three hours' and 'door locked full shift' were reported as not significant. Only staffing factors included in the final combined models for verbal aggression are presented here. Numbers of regular unqualified staff and staff burnout (as measured by the MBI subscales of emotional exhaustion & depersonalization) were only included as significant factors in domain level analyses.

b Final model adjusted for the following variables: number of admissions during shift, verbal abuse, smoking in a no smoking area, refusing to eat, refusing to go to bed, refusing to see workers, alcohol use, attempting to abscond, absconding (officially reported), refusal of PRN medication, demanding PRN medication, self-harm, , door locked status, searching, total restrictions on service users, administration of PRN medication, administration of intramuscular medication, seclusion, continuous special observation with engagement, show of force, time out and numbers of student nurses. All of these variables achieved statistical significance in the final model. Only staffing factors included in the final combined models for verbal aggression are presented here. Numbers of regular unqualified staff, the % of white staff , the % of male staff, and staff burnout (as measured by the MBI subscales of emotional exhaustion & depersonalization) were only included as significant factors in domain level analyses.

c Final model adjusted for the following variables: number of admissions during shift, verbal abuse, aggression to objects, smoking in a no smoking area, refusing to eat, refusing to wash, refusing to go to bed, refusing to see workers, alcohol use, attempting to abscond, absconding (missing), refusal of PRN medication, demanding PRN medication, self-harm, door locked status, administration of PRN medication, administration of intramuscular medication, seclusion, continuous special observation with engagement, show of force and manual restraint. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variable 'door locked more than three hours' was reported as not significant. Only staffing factors included in the final combined models for physical aggression towards others are presented here. Numbers of regular unqualified staff and bank/agency unqualified staff were only included as significant factors in domain level analyses.

d Adjusted for verbal aggression, absconds, and male admissions one week prior; p value not reported but assumed to be <0.05 as 95% CI do not cross 1.

e No multivariate analyses were performed. Results are therefore not adjusted for the impact of potentially significant confounding variables.

f Incident severity measured using the Japanese language version of Staff Observation Aggression Scale – Revised (SOAS – R). Theoretical range = 0 to 22 points; higher scores indicate greater incident severity. Scores were validated against a visual analogue scale (VAS) – nurses marked on a 100mm line the perceived severity of an incident from 0 mm (not severe at all) to 100mm (extremely severe). Dependent variable = VAS score.

g The following variables were statistically significant in the multiple regression analysis: patient characteristics (age, gender, diagnosis); nurse gender and SOAS-R severity score. The following variables were not statistically significant (all p>0.05): years of experience as a psychiatric nurse and ward type (acute, emergency, other)

h In final model.

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Study/ paper reference	Outcomes	Statistical analysis	Staffing factors	Results
i Variables entered into the regression model at shift level.				

3.4.2.1.5 Assault

1 study (Staggs 2013) assessed assault rates in relation to skill mix in 351 adult psychiatric units across the USA. Higher levels of registered nurses (as a proportion of total nursing staff) were associated with lower assault rates. An increase of 5% in the proportion of registered nurses was associated with an estimated 6% average decrease in total assault rates as well as a 6% decrease in assaults resulting in injury. Although this study was scored as low quality as a consequence of its retrospective design, many aspects of its analysis are robust.

Table 13: Assaults

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
Staggs (2013)	Total assaults[b] Assaults causing injury[c]	Hierarchical Poisson regression[a]	Skill mix	Total assaults IRR[d] (% registered nurses)= 0.939 (95% CI 0.904 to 0.975) p=0.001
				Injury assaults IRR[d] (% registered nurses)= 0.939 (95% CI 0.899 to 0.980) p=0.004

Abbreviations used: CI, confidence interval; IRR, incident rate ratio

a Estimates from linear model are presented here but the full paper also reports results from a spline model.
b The following variable was statistically significant in the linear model for total assaults: TNHPPD. The following variables were not statistically significant (all p>0.05): the unit locked status, hospital type and hospital teaching status. The interaction between TNHPPD and nursing skill mix was not significant for total assaults (IRR 1.00, 95% CI 0.996 to 1.003, p=0.92).
c The following variables were statistically significant in the linear model for assaults causing injury: TNHPPD and hospital teaching status. The following variables were not statistically significant: the unit locked status and hospital type. The interaction between TNHPPD and nursing skill mix was not significant for injury assaults (IRR 0.99, 95% CI 0.996 to 1.003, p=0.7).
d Results reported as exponentiated betas in the paper.

3.4.2.2 Containment Outcomes

3.4.2.2.1 Total containment

Two papers drawn from the City-128 study (Bowers 2009a; Bowers & Crowder 2012) investigated the impact of staffing factors on total containment rates. 'Total' containment rates included all incidents of PRN medication administration, special observation, manual restraint, shows of force, time out, seclusion and coerced intramuscular medication. Bowers (2009a) found total containment rates to be significantly positively associated with the proportion of white nursing staff on shift (coefficient= 0.313, p=0.018). As with total conflict, Bowers & Crowder (2012) reported that numbers of regular qualified staff were most systematically and consistently related to total containment rates over time. No clear trend emerges between total containment and either the numbers of bank and agency qualified staff or regular/agency unqualified staff working on the preceding shifts.

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Table 14: Total containment

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Bowers (2009a)	Total containment	Hierarchical multilevel modelling[a]	Proportion of white British staff	Coefficient= 0.313 (SE 0.124) p=0.018
City-128 Study: Bowers & Crowder (2012)	Total containment	Cross-sectional time series Poisson regression[b]	Regular qualified staff	IRR on same shift as conflict events= 1.05 95% CI NR, p<0.001
				IRR 1 shift before conflict events= 1.03 95% CI NR, p<0.05
				IRR 9 shifts before conflict events= 1.03 95% CI NR, p<0.01
			Regular unqualified staff	IRR on same shift as conflict events= 1.01 95% CI NR, p=NS
				IRR 1 shift before conflict events= 1.00 95% CI NR, p=NS
				IRR 9 shifts before conflict events= 1.00 95% CI NR, p=NS
			Bank and agency qualified staff	IRR on same shift as conflict events= 0.99 95% CI NR, p=NS
				IRR 1 shift before conflict events= 1.00 95% CI NR, p=NS
				IRR 9 shifts before conflict events= 0.99 95% CI NR, p=NS
			Bank and agency unqualified staff	IRR on same shift as conflict events= 1.06 95% CI NR, p<0.001
				IRR 1 shift before conflict events= 1.04 95% CI NR, p<0.01
				IRR 9 shifts before conflict events= 1.00 95% CI NR, p=NS

Abbreviations used: CI, confidence interval; IRR, incident rate ratio; NR, not reported; NS, not significant.

a Final model adjusted for the following variables: medication-related conflict, the number of occupational therapists, Ward Atmosphere Scale (WAS) score on the program clarity subscale, and score on the transactional leadership subscale of the Multifactor Leadership Questionnaire (MLQ) . All variables achieved statistical significance in the final model. Only staffing factors included in the final combined model for total containment are presented here.

b Data are also available for the shifts preceding conflict events from 2 shifts preceding up to 9 shifts preceding. The analyses adjusted for NHS trust and ward-level characteristics, the shift type (am, pm, or night), day of the week, and number of admissions during the shift. The statistical significance of the association between total conflict and these control variables is not reported.

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3.4.2.2.2 Seclusion

Three studies examined the impact of staffing factors in relation to seclusion rates (Bowers et al 2010; Janssen et al 2007; O'Malley et al 2007). One of these studies also assessed 'time out' as a separate outcome (Bowers et al 2010).

Bowers and colleagues (2010) combined the variables of skill mix and gender ratio in a multilevel analysis and found a small yet significant positive association with seclusion rates (IRR= 1.104 [95% CI 1.011 to 1.206], p<0.05). This indicates that seclusion was associated with greater numbers of qualified staff on duty during a shift and also with higher numbers of male staff. Better attitudes towards patients (as measured by the APDQ) were associated with lower seclusion rates. No significant associations were observed between the use of time out and either skill mix or gender. Time out was also associated with larger numbers of staff on duty but not as strongly with higher numbers of qualified staff as was observed for seclusion. See Table 15.

One small, low quality study (O'Malley et al 2007) assessed the impact of staff gender, experience and caseload on seclusion rates in a PICU in a New Zealand psychiatric hospital. Seclusion rates were significantly lower on shifts where some senior nurses did not have a caseload due to operating in a more supervisory/consultant role (mean difference= 1.6%, p=0.01). There were also significantly lower seclusion episodes when 2 or more male nurses were on shift (mean difference= 1.8%, p=0.01). Seclusion rates showed no significant difference when comparing shifts with more experienced staff (mean experience >3 years) on shift (p=0.56). In common with O'Malley et al (2007), a study conducted in the Netherlands (Janssen et al 2007) found significant relationships between staff gender and seclusion rates. On the admissions wards 'variability of work experience' and 'male-female staff ratio' were significantly associated with seclusion in a logistic regression analysis. Variability of work experience was the most powerful predictor (OR= 0.871 [95% CI = 0.808 to 0.938], p<0.001), followed by male-female ratio (OR= 0.75 [95% CI 0.674 to 0.898], p=0.001). On the long-stay wards the variables 'male-female staff ratio', 'variability in work experience' and the employment of mid-level vocational educated nurses' were significantly associated with seclusion in the regression model. Male-female staff ratio was the most powerful predictor (OR= 0.353 [95% CI 0.220 to 0.567], p<0.001), followed by variability of work experience (OR= 0.778 [95% CI 0.674 to 0.898], p<0.001) and employment of mid-level vocational educated nurses (OR= 0.02 [95% CI 0.002 to 0.257], p<0.003).On both types of wards more males and more variability of working experience were related to a decrease in seclusion. Taking odds ratios into account, these variables were more strongly associated with seclusions on long-stay wards.

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Table 15: Seclusion

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Bowers et al (2010)	Seclusion[a] Time out[b]	Multilevel random effects modelling	Regular qualified staff	<u>Seclusion</u> IRR= 1.014 (95% CI 1.011 to 1.206), p<0.05
				<u>Time out</u> IRR= 1.284 (95% CI 1.232 to 1.338), p<0.001
			Regular unqualified staff	<u>Time out</u> IRR= 1.073 (95% CI 1.035 to 1.111), p<0.001
			Ethnicity	<u>Time out</u> IRR[c]= 1.791 (95% CI 1.2448 to 2.579), p<0.01 IRR[d]= 1.636 (95% CI 1.145 to 2.337), p<0.01
			Staff attitudes	<u>Seclusion</u> IRR[e]= 0.781 (95% CI 0.620 to 0.984), p<0.05
Janssen et al (2007)	Seclusion[f]	Logistic regression	Skill mix (nursing education level)	<u>Admission wards:</u> NS <u>Long stay wards:</u> Employment of mid-level vocational educated nurses: OR= 0.02 (95% CI 0.002 to 0.257), p<0.003
			Experience	<u>Admission wards:</u> Variability of work experience: OR= 0.871 (95% CI 0.808 to 0.938), p<0.001 <u>Long stay wards:</u> Variability of work experience: OR= 0.778 (95% CI 0.674 to 0.898), p<0.001
			Gender	<u>Admission wards:</u> Male-female ratio: OR= 0.75 (95% CI 0.674 to 0.898), p=0.001 <u>Long stay wards:</u> Male-female staff ratio: OR= 0.353 (95% CI 0.220 to 0.567), p<0.001
O'Malley et al (2007)	Seclusion	One-way ANOVA and Spearman's correlation[g]	Caseload	Seclusion (all nurses had caseload)= 5.0% Seclusion (>1 nurse had no caseload)= 3.4% F= 6.6; df= 1,166; p=0.01
			Experience	Seclusion levels not reported. F= 0.3; df= 1,166; p=0.56
			Gender	Seclusion (< 2 males on shift)= 5.7% Seclusion (≥ 2 males on shift)= 3.9% F= 7.3; df= 1,166; p=0.009

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Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results

Abbreviations used: CI, confidence interval; df, degrees of freedom; ICA, intensive care area; IRR, incident rate ratio; NR, not reported; NS, not significant; OR, odds ratio; PICU, psychiatric intensive care unit; PRN, pro re nata.

a The final model for seclusion adjusted for the following variables: number of admissions during shift, access to specialist PICU, availability of seclusion, aggression against objects, alcohol use, attempting to abscond, absconding (officially reported), refusal of PRN medication, door locked status, administration of intramuscular medication, service users sent to PICU or ICA, special observation with engagement, show or force, physical restraint and time out. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'main ward door locked (>3 hours)' and 'main ward door locked (whole shift)' were reported as not significant. Only staffing factors included in the final combined model for seclusion are presented here. The proportion of male staff was only included as a significant factor in domain level analyses.

b The final model for time out adjusted for the following variables: % of service users sectioned, whether ward is served by crisis intervention team, verbal aggression, aggression against objects, refusing to eat, refusing to drink, refusing to attend to personal hygiene, refusing to see workers, other substance misuse, attempting to abscond, refusal of regular/PRN medication, demanding PRN medication, locked door status, total restrictions on service users, administration of PRN/intramuscular medication, seclusion, intermittent special observation, show of force, physical restraint, number of student nurses, number of consultant psychiatrists and other doctors. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'main ward door locked to patients leaving (<1 hour)' and 'main ward door locked to patients leaving (>3 hours)' were reported as not significant. Only staffing factors included in the final combined model for time out are presented here: the number of bank/agency unqualified staff was only included as a significant factor in domain level analyses.

c Proportion of white British staff on duty.

d Proportion of African staff on duty.

e Attitude to Personality Disorder Questionnaire (APDQ) total score.

f It is not clear what variables have been adjusted for in the logistic regression analyses.

g Data from univariate analyses are presented here; results have not been adjusted for potentially significant confounding factors. Neither of the statistically significant staffing factors (caseload and gender) are discussed in the findings from the multivariate analysis although both are assumed to have been included in the linear regression model – it is therefore assumed that these factors did not maintain statistical significance in the final multivariate model.

3.4.2.2.3 Other containment outcomes

One paper (Stewart & Bowers 2012) assessed how staffing factors were associated with the levels of special observation (SO) conducted on inpatient psychiatric units included in the City-128 study. Staffing variables were more closely associated with levels of constant SO than intermittent SO but both were significantly associated with higher numbers of unqualified staff (see Table 16).

One paper from the City-128 study (Bowers et al 2012) examined whether manual restraint and shows of force by staff were related to staffing variables. Numbers of qualified staff were positively associated with both restraint and shows of force with the effect being observed at ward level: this indicates that better-staffed wards used more coercive measures. Staff ethnicity was also associated with these outcomes such that greater proportions of staff from ethnic minorities were linked to lower use. See Table16.

One small, low quality study (Williams et al 2001) looked at how the use of 'lesser restrictive interventions' (LRI) varied according to certain staffing factors in a single psychiatric hospital in the USA. LRI are "alternative treatments to seclusion and restraint during a crisis event that are used to assist the patient with managing self using the least restrictive means." The study found no significant correlation between average years of psychiatric experience and the use of LRI ($r= 0.146$, $p=0.096$). However, a moderate positive relationship was detected between staff mix and the use of LRI ($r= 0.379$, $p<0.001$) with simple regression indicating that 14.3% of the variance in the number of LRI could be explained by the proportion of 'licensed' staff on shift.

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Table 16: Other containment outcomes

Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results
City-128 Study: Stewart & Bowers (2012)	Constant SO[a] Intermittent SO[b]	Multilevel random effects modelling	Regular qualified staff	Constant SO IRR= 0.911 (95% CI 0.894 to 0.929), p<0.001
			Regular unqualified staff	Constant SO IRR= 1.051 (95% CI 1.034 to 1.069), p<0.001
			Bank/agency qualified staff	Constant SO IRR= 0.842 (95% CI 0.823 to 0.862), p<0.001
			Bank/agency unqualified staff	Constant SO IRR= 0.616 (95% CI 0.420 to 0.902), p=0.013
City-128: Bowers et al 2012	Shows of force[c] Manual restraint[d]	Multilevel random effects modelling	Regular qualified staff	Show of force: IRR= 1.088 (95% CI 1.046 to 1.131), p<0.001
				Manual restraint: IRR= 1.121 (95% CI 1.071 to 1.172), p<0.001
			Ethnicity	Show of force: IRR[e]= 0.854 (95% CI 0.756 to 0.964), p<0.05 IRR[f]=0.820 (95% CI 0.7036 to 0.955), p<0.05
Williams et al 2001	Use of lesser restrictive interventions (LRI)	Chi-square analyses, Pearson's correlation and simple regression[g]	Experience (years)	Mean experience= 4.89 (SD 1.68) Mean LRI= 11.28 (SD 5.47) r= 0.146, p=0.096
			Skill mix	Mean % licensed staff= 58.79% Mean LRI= 11.28 (SD 5.47) r= 0.379, p<0.001 R^2= 0.143

Abbreviations used: CI, confidence interval; ICA, intensive care area; IRR, incident rate ratio; LRI, lesser restrictive interventions; OR, odds ratio; PICU, psychiatric intensive care unit; PRN, pro re nata; SD, standard deviation; SO, special observation.

a Final combined model for constant special observation adjusted for the following variables: number of admission during shift, windows in the ward, verbal aggression, aggression against objects, aggression against others, refusing to drink, refusing to attend to personal hygiene, attempting to abscond, absconding (missing without permission), absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, banned items score, locked door status, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, intermittent SO, show of force and team climate (as measured by the team climate inventory, TCI). All of these variables achieved statistical significance in the final model with the exception of door locking status: the variable 'locked doors (compared to open) less than an hour' was reported as not significant. Only staffing factors included in the final combined model for constant SO are presented here. The proportion of Asian staff and the mean staff score on the Attitudes to Containment Measures Questionnaire (ACMQ) were significantly associated with constant SO in domain level analyses.

b No staffing factors were included in the final combined model for intermittent special observation. Numbers of bank/agency unqualified staff and staff burnout (as measured by the MBI positive appreciation subscale) were significant related to intermittent SO in domain level analyses.

c Final combined model for show of force adjusted for the following variables: number of admissions during shift, verbal aggression, aggression against others, refusing to eat, refusing to attend to personal hygiene, alcohol use, attempting to abscond, absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, locked door status, total restrictions on service users, administration of PRN/forced

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Study/paper reference	Outcomes	Statistical analysis	Staffing factors	Results

intramuscular medication, service users sent to PICU/ICA, seclusion, intermittent SO, special observation with engagement, manual restraint, time out and the number of student nurses. . All of these variables achieved statistical significance in the final model. Only staffing factors included in the final combined model for show of force are presented here. Regular unqualified staff, bank/agency qualified staff and bank/agency unqualified staff were each significantly associated with shows of force in domain level analyses.

d Final combined model for manual restraint adjusted for the following variables: number of admissions during shift, verbal aggression, aggression against objects, aggression against others, refusing to drink, refusing to attend to personal hygiene, alcohol use, attempting to abscond, absconding (missing without permission), absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, locked door status, availability of security guards, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, special observation with and without engagement, show of force, time out, the number of student nurses and the number of doctors other than consultant psychiatrists. . All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'main ward door locked (more than 3 hours)' and 'main ward door locked (whole shift)' were reported as not significant. Only staffing factors included in the final combined model for manual restraint are presented here. Regular unqualified staff, bank/agency qualified staff, bank/agency unqualified staff, and the proportions of Irish/Caribbean/Asian staff were each significantly associated with manual restraint in domain level analyses.

e Proportion of Irish staff on duty.

f Proportion of African staff on duty.

g Data from univariate analyses are presented here; results have therefore not been adjusted for potentially significant confounding factors.

3.4.2.3 Other adverse outcomes

None reported.

3.4.2.4 Nurse and ward related outcomes

None reported.

3.4.3 Evidence Statements

The evidence included for this review question is only partially applicable to inpatient mental health settings in the UK. This is because only 2 identified studies were conducted in the UK (City-128 Study; Tomkins Acute Ward Study) while 3 studies (Staggs 2013; Williams et al 2001; Noda et al 2012) used data from countries with health care systems that are significantly different to the health care system in the UK.

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers 2009a, Bowers & Crowder 2012, Bowers et al 2013) shows a statistically significant association between staff factors and rates of total conflict. Specifically, a higher proportion of male staff was associated with increased rates of conflict (coefficient= 0.381 [SE 0.120], p=0.004) (Bowers 2009a). An additional time series analysis (Bowers & Crowder 2012) showed that increased numbers of regular qualified staff were systematically and consistently related to higher conflict rates over time. Rises in the numbers of qualified nurses preceded rather than followed increases in conflict and containment. Further analysis (Bowers et al 2013) indicated that wards with both high conflict and high containment levels had relatively high levels of unqualified staff and use of high levels of temporary staff compared to wards with lower conflict and/or containment rates. These differences were significant although effect sizes were not reported. Wards characterised by high conflict and low containment levels had a greater proportion of male staff. Effect sizes were not reported.

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Evidence from 1 UK retrospective cross-sectional study (TAW Study, [-]; Bowers et al 2007b) indicates that higher levels of staff absence are predictive of higher overall numbers of conflict incidents (IRR= 1.11 [95% CI 1.06 to 1.16], p not reported.

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers et al 2007a) suggests that the likelihood of self-harm incidents decreased slightly as the number of qualified nurses on duty increased (OR= 0.941 [95% CI 0.901 to 0.982], p≤0.01) and evidence from 1 UK retrospective cross-sectional study (TAW Study, [-]; Bowers et al 2007b) indicates that higher levels of staff absence are significantly associated with an increased incidence of self-harm (IRR= 1.22 [95% CI 1.11 to 1.34], p not reported).

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Baker 2009) found that higher regular staffing levels (i.e. not the use of temporary staff) were associated with lower rates of service users refusing their regular medication. This effect was observed for both regular qualified and unqualified staff.

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers et al 2009b) suggests that staff mix is associated with incidents of aggressive behaviour. Specifically, incidents of verbal aggression, physical aggression against objects and physical aggression against others were associated with increased numbers of nursing staff and the associations were most consistent for the number of regular qualified nurses working on a shift. Effects were detected at both shift and ward level; that is, even individual shifts within wards showed higher levels of aggressive behaviour when more qualified nurses were on duty. Evidence from 1 Australian retrospective cross-sectional study (Daffern et al 2006, [-]) failed to detect any significant associations between staff gender and the occurrence and severity of aggressive incidents while evidence from 1 Japanese prospective cross-sectional study (Noda et al 2012, [+]) suggests that nurses' perceptions of the severity of aggressive incidents is influenced by gender. A higher proportion of male staff was associated with higher severity scores (β= -0.176, p<0.01). Evidence from 1 UK retrospective cross-sectional study (TAW Study, [-]; Bowers et al 2007b) indicates that increased staff absence was associated with increased rates of physical aggression (IRR= 1.10 [95% CI 1.02 to 1.19], p not reported).

Evidence from 1 USA retrospective cross-sectional study (Staggs 2013, [-]) found that skill mix was positively associated with lower rates of assault. An increase of 5% in the proportion of registered nurses was associated with an estimated 6% average decrease in assault rates (p=0.001).

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers 2009a, Bowers & Crowder) suggests that staff ethnicity is associated with total containment rates. Specifically, increased containment measures were positively associated with a higher proportion of White British nursing staff on duty (coefficient= 0.313, p=0.018). An additional time series analysis (Bowers & Crowder 2012) showed that increased numbers of regular qualified staff were systematically and consistently related to higher containment rates over time. Rises in the numbers of qualified nurses preceded rather than followed increases in conflict and containment.

Evidence from 1 moderate quality UK prospective cross-sectional study (City-128 Study, [+]; Bowers et al 2010) found that the use of seclusion was slightly associated with higher numbers of male staff on duty (IRR= 1.014, p<0.05). This is in contrast to evidence from 2 low quality studies that found that seclusion rates were lower when the proportion of male staff increased: 1 Dutch retrospective cross-sectional study (Janssen 2007, [-]) (admissions wards: OR= 0.75 [95% CI 0.674 to 0.898], p=0.001) and 1 New Zealand retrospective and prospective cross-sectional study (O'Malley 2007, [-]) (F= 7.3; p=0.009).

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers et al 2010) found that the use of seclusion was inversely associated with better staff attitudes towards patients (IRR= 1.014, p<0.05). Evidence from 1 Dutch retrospective cross-sectional

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study (Janssen 2007, [-]) suggested that the variability of work experience (the extent to which a ward had more or fewer experienced staff) was significantly associated with seclusion on admissions wards (OR= 0.871 [95% CI 0.808 to 0.938], p<0.001) and long-stay wards (OR= 0.778 [95% CI 0.674 to 0.898], p<0.001). The employment of 'mid-level vocational educated nurses' was significantly inversely related to seclusion (OR= 0.02 [95% CI 0.002 to 0.257], p<0.003). Evidence from 1 New Zealand retrospective and prospective study (O'Malley 2007, [-]) suggested that seclusion rates were significantly lower on shifts where some senior nurses didn't have a caseload due to operating in a more supervisory/consultant role (mean difference= 1.6%, p=0.01)

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Stewart & Bowers 2012) suggests that levels of both constant special observation (SO) and intermittent special observation (SO) were significantly associated with higher numbers of unqualified staff although the relationship was stronger for constant SO.

Evidence from 1 UK prospective cross-sectional study (City-128 Study, [+]; Bowers et al 2012) suggest that skill mix was positively associated with both manual restraint and shows of force with the effects being observed at ward level. This indicates that wards with higher proportions of qualified staff used more coercive measures. Staff ethnicity was also associated with manual restraint such that greater proportions of staff from ethnic minorities were linked to lower use.

Evidence from 1 USA retrospective cross-sectional study (Williams et al 2001, [-]) suggested that skill mix was moderately and positively associated (r= 0.379, p>0.001) with the use of 'lesser restrictive interventions' (defined as measures which are taken as alternatives to seclusion and restraint for service users during crisis events).

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3.5 Review Question 5

This review question aims to examine the relationship between ward level organisation factors and nursing staff requirements in inpatient mental health settings. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 17 below. Results are reported in tables accompanying each section. No economic evidence was identified for this review question.

3.5.1 Review Question

What organisational factors at a ward level influence nursing staff requirements in inpatient mental health settings?

3.5.2 Evidence

The papers included here are driven by the City-128 study which explored several organisational factors under the heading of 'staff group factors'. Therefore these papers were considered to include data on both organisational factors and staffing and were included for this review question. Other papers which included similar variables were also included for consistency.

In total,5 papers (Baker et al 2009; Bowers 2009a; Bowers et al 2010;Stewart & Bowers 2012; Hanrahan et al 2010b) reporting the findings of 2 individual studies were identified.

Both of the included studies were cross-sectional studies: 1 was retrospective (Hanrahan et al 2010b) and 1 was prospective in design (City-128 Study). Given the limitations of their designs, no direct causal inference can be made from any of the observed associations whether or not they reach statistical significance. All of the included studies were at high risk of endogeneity bias. This arises from the fact that both outcomes and staffing levels are independently influenced by patient need and acuity. This may serve to diminish reported associations with organisational factors and outcomes.

One large UK study, the City-128 Study (Baker et al 2009, Bowers 2009a, Bowers et al 2010, Stewart & Bowers 2012), was a prospective observational study with data collected from 136 adult acute wards in 26 different NHS Trusts. It is the only included study for this review question that was conducted in the UK, and it is the only study which was considered to have a low risk of bias for many aspects if its design and conduct. The other study was a large retrospective observational design conducted in the USA, with psychiatric nurses working in acute care general hospitals (Hanrahan 2010b). This study was considered to have a high risk of bias and unreliable findings.

Both studies used validated tools for data collection of a range of organisational factors.

The City-128 Study assessed:

- Ward structure and organisation using the Order and Organisation, Programme Clarity and Staff Control subscales of the Ward Atmosphere Scale (WAS);
- Multi-disciplinary team cohesion using the Vision and Participative Safety subscales from the Team Climate Inventory (TCI);
- Quality of ward leadership was assessed using the transactional leadership subscale of the Multifactor Leadership Questionnaire (MLQ).
- Nurses attitudes towards personality disorder using the Attitude to Personality Disorder Questionnaire (APDQ)

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Hanrahan and colleagues (2010b) measured organisational factors of the nurse practice environment using the Practice Environment Scale-Nurse Work Index (PES-NWI). The PES-NWI has 5 subscales of which 4 contributed to a composite measure: Nurse Participation in Hospital Affairs; Foundations for Quality of Care; Manager Skill at Leadership; and, Nurse-Physician Relationship. The Adequate Staffing and Resource subscale was not included in the composite measure because it was highly correlated with the author's own measure of nurse staffing.

No economic evaluations were identified for this review question.

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Table 17: Summary of included evidence

Reference	Study Design, Country & Setting	Organisational factors	Nursing Team	Limitations	Quality score
City-128 Study *(linked papers listed below)* Baker et al (2009) Bowers (2009a) Bowers et al 2010 Stewart & Bowers (2012)	**Study design**: Prospective observational **Country**: UK **Setting:** Adult acute psychiatric wards (26 NHS Trusts, 67 hospitals, 136 wards)	• Ward atmosphere • Leadership • Team climate • Attitude to personality disorder	Mean full-time equivalent nursing staff in post per bed= 0.99 (SD 0.22). Includes total nursing establishment: Regular qualified staff Regular unqualified staff Bank/agency qualified staff Bank/agency unqualified staff	Large number of statistical tests conducted – risk of chance findings. Findings reported inconsistently/unclearly	+
Hanrahan et al (2010b)	**Study design**: Retrospective observational **Country**: USA **Setting:** Acute adult psychiatric wards in general hospitals	• Practice environment	Patient to nurse staffing ratio. Mean 7.09 patients (SD ± 3.50) to 1 nurse. Only includes registered nurse permanently assigned to direct care of psychiatric patients.	Secondary analysis of existing dataset. Staffing ratio data not collected by reliable, objective means. Data collected via self-report using non-validated instruments.	-
Abbreviations used: SD, standard deviation					

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3.5.2.1 Conflict Outcomes

Ward structure and other organisational factors measured using the WAS were significantly associated with total conflict (e.g. aggression, substance use, absconding, rule breaking etc.) (coefficient= -0.48 [SE 0.023], p=0.048, r^2=0.184) (Bowers 2009a). Provision of an effective structure for the ward was associated with a reduction in overall conflict.

Organisational factors measured using the WAS were significantly associated with refusal of regular medication (final combined model: IRR= 0.923 [95% CI 0.885 to 0.996], p<0.05) (Baker et al 2009). Provision of an effective structure for the ward was accompanied by reduced rates of refusal of regular medication.

In summary, effective ward structures and other organisation factors are associated with a reduction in overall levels of both conflict and containment. Aspects of team cohesions may be associated with reductions in total conflict.

Table 18: Organisational factors and conflict outcomes

Study/Paper reference	Outcomes	Statistical analysis	Organisational factor	Results
City-128: Bowers (2009a)	Total conflict	Hierarchical multi-level modelling	Ward Atmosphere Scale (WAS) (order, organisation)	Coefficient= -0.48 (SE 0.023) p=0.048[a]
City-128: Baker et al (2009)	Refusal of regular medication	Multilevel random effects modelling and Poisson regression	Ward Atmosphere Scale (WAS) (order, organisation, program clarity)	IRR= 0.923 (95% CI 0.885 to 0.996) p<0.05[b]

Abbreviations used: CI, confidence interval; IRR, incident rate ratio; SE, standard error.

a Final model adjusted for service users' socioeconomic status (measured by Index of Multiple Deprivation), physical environment quality, proportion of beds in single rooms, locked doors, show of force, manual restrain, and the proportion of male staff. Only organisational factors included in the final combined model for total conflict are presented here. All achieved statistical significance.

b Final model adjusted for the following variables: % of service users admitted for harm to self, service users' mean score on the Attitude Toward Containment Measures Questionnaire (ACMQ), whether ward is served by crisis intervention team, whether ward is served by early intervention team, verbal aggression, smoking in a no-smoking area, refusing to eat, refusing to drink, refusing to attend to personal hygiene, refusing to get up out of bed, reusing to go to bed, refusing to see workers, attempting to abscond, refusing PRN medication, demanding PRN medication, door locking status, total restrictions on patients, whether service users were given PRN medication, whether service users were given intramuscular medication, intermittent special observation, special observation with and without engagement, show of force, time out, proportion of regular qualified staff, and proportion of regular unqualified staff. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variables 'door locked <1h', 'door locked 1-3h' and 'door locked >3h' were reported as not significant. Only organisational factors included in the final combined model are presented here.

3.5.2.2 Containment Outcomes

Ward structure and other organisation factors as measured by the WAS were significantly associated with a reduction in total containment scores (e.g. coerced medication, sent to intensive care, seclusion, special observation, manual restraint, show of force, etc.) (coefficient= -0.092 [SE 0.031], p=0.007) (Bowers 2009a). The same study found that

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Aspects of quality of ward leadership as measured by the MLQ were also associated with a reduction in total containment (coefficient= -0.064 [SE 0.025], p=0.016).

Multidisciplinary team cohesion using the Vision, and Participative Safety subscales from the Team Climate inventory (TCI) were significantly associated with lower rates of constant special observation (IRR= 0.616 [95% CI 0.420 to 0.902], p=0.013). (Stewart and Bowers 2012).

Attitude to personality disorder was significantly associated with lower rates of seclusion (IRR=0.781 (95% CI 0.620-0.984), p=<0.05[).] (Bowers et al 2010).

In summary effective ward structures and other organisational factors are associated with a reduction in overall levels of containment. Greater team cohesion is associated with lower rates of constant observation. A positive attitude to personality disorder is associated with lower rates of seclusion.

Table 19: Organisational factors and containment outcomes

Study/Paper reference	Outcomes	Statistical analysis	Organisational factor	Results
City-128: Bowers (2009a)	Total containment	Hierarchical multi-level modelling	Ward Atmosphere Scale (WAS) (program clarity subscale)	Coefficient= -0.092 (SE 0.031), p=0.007[a]
	Total containment		Multifactor Leadership Questionnaire MLQ) (transactional leadership subscale)	Coefficient= -0.064 (SE 0.025), p=0.016[a]
City-128: Bowers et al (2010)	Seclusion	Hierarchical multi-level modelling	Attitude to Personality Disorder Questionnaire (APDQ)	IRR=0.781 (95% CI 0.620-0.984), p=<0.05[c]
City-128: Stewart and Bowers (2012)	Constant special observation	Hierarchical multi-level modelling	Team Climate Inventory (TCI)	IRR= 0.616 (95% CI 0.420 to 0.902), p=0.013[b]

Abbreviations used: ACMQ, Attitudes to Containment Measures Questionnaire; IRR, incident rate ratio; NS, not significant; SE, standard error.

a Final model adjusted for the following variables: medication-related conflict, the number of occupational therapists and proportion of British white staff., Only organisational factors included in the final combined model for total containment are presented here. All variables achieved statistical significance. .

b Final combined model for constant special observation adjusted for the following variables: number of admission during shift, windows in the ward, verbal aggression, aggression against objects, aggression against others, refusing to drink, refusing to attend to personal hygiene, attempting to abscond, absconding (missing without permission), absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, banned items score, locked door status, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, intermittent special observation (SO), show of force, proportion of regular qualified staff, proportion of regular unqualified staff, proportion of Bank/Agency qualified staff, and proportions of Bank/Agency unqualified staff.. All of these variables achieved statistical significance in the final model with the exception of door locking status: the variable 'locked doors (compared to open) less than an hour' was reported as not significant. Only organisational factors included in the final combined model for constant SO are presented here.

c Final combined model for seclusion adjusted for the following variables: number of admission during shift, access to specialist PICU, seclusion availability, verbal aggression, aggression against objects, alcohol use, absconding, refusal of PRN, main ward door locked (<1 hour), main ward door locked (1-3 hours, main ward door locked (>3hour, main ward door locked (whole shift), door security total, IM medication, sent to PICU or ICA, special observation, show of force, physically restrained, time-out, qualified staff, proportion of males staff. All of these variables achieved statistical significance in the final model with the exception of admission during shift, and seclusion availability. Only organisational factors included in the final combined model seclusion are presented here.

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3.5.2.3 Other adverse outcomes

One study from the USA analysed the association between psychiatric work nurse environments and nurse burnout in acute care general hospitals (Hanrahan et al 2010). Organisational factors of the nurse practice environment were measured using the Practice Environment Scale-Nurse Work Index (PES-NWI), and nurse burnout was measured using aspects of the Maslach Burnout Inventory (MBI). Better organisational factors significantly predicted lower emotional exhaustion (adjusted β= -10.34 [SE 2.23], p<0.000) and depersonalisation (adjusted β= -2.70 [SE 0.99], p=0.008). Every unit increase in the PES-NWI was predictive of a 10 point reduction on the MBI emotional exhaustion subscale and a nearly three point reduction on the MBI depersonalisation scale. Organisational factors were not shown to predict personal accomplishment scores.

In summary, effective organisational factors are predictive of improved emotional exhaustion and depersonalisation scores on the MBI.

Table 20: Organisational factors and other outcomes

Study/Paper reference	Outcomes	Statistical analysis	Organisational factor	Results
Hanrahan et al (2010b)	Emotional exhaustion	Adjusted general linear regression	Composite Practice Environment Scale - Nurse Work Index (PES-NWI)	Adjusted β= -10.34 (SE 2.23), p=0.000[a]
	Depersonalization			Adjusted β= -2.70 (SE 0.99), p=0.01[a]
	Personal Accomplishment			Adjusted β= 1.03 (SE 1.32), p=0.442

Abbreviations used: SE, standard error

a These results were adjusted for the patient to nurse staffing ratio, and other aspects of the PES-NWI (Nurse Participation in Hospital Affairs; Foundations for Quality of Care; Manager skill at Leadership; and, Nurse-Physician Relationship). None of the control variables were significantly related to the outcomes.

3.5.3 Evidence Statements

Evidence from a large prospective UK study (Bowers 2009a, [+]) found that effective ward structures (i.e. order, organisation) are associated with reduced overall conflict rates (coefficient= -0.48 [SE 0.023], p=0.048).

Evidence from a large prospective UK study (Baker et al 2009, [+]) found that effective ward structure and other organisation factors are associated with reduced rates of refusal of regular medication (IRR= 0.923 [95% CI 0.885 to 0.996], p<0.05).

Evidence from a large prospective UK study (Bowers 2009a, [+]) found that effective ward structures (i.e. order, organisation, programme clarity) are associated reduced overall containment rates (coefficient = -0.092 [SE 0.031], p=0.007).

Evidence from a large prospective UK study (Stewart and Bowers 2012, [+]) found that effective multidisciplinary team cohesion is associated with reduced constant special observation rates (IRR= -0.092 [SE 0.031], p=0.007).

Evidence from a large prospective UK study (Bowers et al 2010, [+]) found that positive attitudes to personality disorder are associated reduced seclusion rates (IRR=0.781 [95% CI 0.620-0.984], p<0.05).

Evidence from a large USA study (Hanrahan 2010b, [-]) shows that effective organisation of the nurse practice environment are predictive of both improvements to nurse emotional

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exhaustion scores (adjusted β= -10.34 [SE 2.23], p<0.000), and nurse depersonalisation scores (adjusted β= - 2.70 [SE 0.99], p=0.008).

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3.6 Review Question 6

This review question assesses the evidence regarding the types of activities and key tasks undertaken by nursing staff in UK inpatient mental health settings. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 22 below. Results are reported in Tables 23 to 28. No economic evaluations were identified for this review question.

3.6.1 Review Question

What core nursing care activities should be considered when determining nursing staff requirements in inpatient mental health settings?

3.6.2 Evidence

Two studies were identified for this review (Bee et al 2006, Sabes-Figuera et al 2012) that presented data on core nursing care activities in inpatient mental health settings.

An existing literature review of nursing activities was also identified (Sharac et al 2010); this included thirteen studies. However, the inclusion criteria for the Sharac review were different from the inclusion criteria used for this current review. For example, Sharac and colleagues included studies conducted outside the UK and studies that reported data collected before 2005. The Sharac review was not included in the current review, but each of its included studies were considered individually for inclusion in the current review. Only 1 study (Bee et al 2006) from the Sharac review met the inclusion criteria for the current review; however this paper had already been identified by the database searches described in Section 2.2.

Both of the included studies were prospective cross-sectional studies performed in the UK. One study included 3 acute inpatient mental health wards (Bee et al 2006). The other study included patients from inpatient psychiatric wards within 1 hospital, although it is not clear how many wards were included (Sabes-Figuera et al 2012).

Limitations of these studies include a relatively small sample size with no power calculation. Neither study considered potential confounders in their analyses. In addition, one study (Bee et al 2006) used a convenience sample and self-reported data. The study also collected data using tools that had not been validated and only collected data on weekdays. The other study (Sabes-Figuera et al 2012) did not clearly report the methods used for selecting patients.

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Table 22: Summary of included studies

Reference	Study Design, Country & Setting	Data collection method and participants	Nursing Team	Limitations	Quality Score
Bee et al (2006)	Prospective cross-sectional 3 acute inpatient mental health wards in UK	Interview 40 staff (15 registered nurses, 1 student nurse, 24 unqualified nursing assistants)	Forty nurses participated: • 15 Registered nurses • 1 Student nurse • 24 Unqualified nursing assistants	Relatively small sample size, no power calculation Potential confounders not considered Convenience sample and self-reported data Non-validated data collection tools	-
Sabes-Figuera et al (2012)	Prospective cross-sectional Inpatient psychiatric ward in 1 UK hospital	Survey 41 patients	Nursing staff not further described.	Relatively small sample size, no power calculation Potential confounders not considered Methods for selecting patients not clearly reported	-

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3.6.2.1 Key activities currently carried out by nursing staff

One study (Bee et al 2006) identified 55 different nursing activities and grouped them into 5 categories – patient contact, administrative tasks, communications, domestic tasks and staff breaks. When looking at both qualified and unqualified nursing staff, the most predominant activity was patient contact (47.7% of all activities). Administrative tasks and communications made up around a quarter of activities each (23.6% and 23.0% respectively). Domestic tasks and staff breaks were the least frequent activities (4.1% and 1.7% respectively). Within the patient contact category, over half of the activities were related to containment (54.3%), with the remaining activities being social care (15.1%), social interaction (14.3%), medical/health care (11.8%), and therapeutic care (4.5%).

One study (Sabes-Figuera et al 2012) found that the average number of one-to-one contacts with nursing staff reported by patients was 2.8 (standard deviation 2.7). The average number of one-to-one patient contacts with nursing staff reported by occupational therapists and written in case notes was 3.2 (standard deviation 3.9). This difference was not statistically significant (T -0.501, p=0.619).

3.6.2.2 Differences in activities carried out by registered nurses, healthcare assistants and assistant practitioners

One study (Bee et al 2006) found unqualified staff had significantly more minutes of patient contact per hour than qualified staff (mean 31.73 minutes vs. 18.48 minutes, $p<0.001$). Patient contact was the most frequent activity for unqualified staff (63.5% of activities) but only the third most frequent activity for qualified staff (29.2%) after administrative tasks (34.0%) and communications (35.5%). Administrative tasks and communications were the second and third most frequent activities for unqualified staff (14.6% and 12.2% respectively). The least frequent activities for both qualified and unqualified staff were domestic tasks (0.6% of qualified staff activities and 7.0% of unqualified staff activities) and staff breaks (0.6% of qualified staff activities and 2.6% of unqualified staff activities).

One study listed the responsibilities of qualified and unqualified nursing staff and whether these tasks were done by qualified or unqualified staff (Bee et al 2006). A summary of these responsibilities are presented in Tables 23 to 26.

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Table 23: Tasks and responsibilities in the patient contact category as reported in Bee et al (2006)

Sub-category	Task	Responsible for the task		Task done by	
		QS	UQS	QS	UQS
Social care	Self-care/hygiene	Yes	Yes	Yes	Yes
	Answering questions/giving advice	Yes	Yes	Yes	Yes
	Assisting patients with menus/meals	Yes	Yes	Yes	Yes
Health care	Physical health checks	Yes	Yes	Yes	Yes
	Encouraging compliance	Yes	-	Yes	-
	Administering medication	Yes	-	Yes	-
Containment	Managing aggression	Yes	-	Yes	-
	Door duty	-	Yes		Yes
	Attendance checks	-	Yes		Yes
	15-minute observations	-	Yes		Yes
	1:1 observations	-	Yes		Yes
	Escorting	Yes	-	Yes	Yes
	Responding to alarms	Yes	-	Yes	Yes
	Searching for patients	Yes	-	Yes	Yes
	Other observations	Yes	-	Yes	Yes
Social interaction	Chatting/socialising	Yes	Yes	Yes	Yes
Therapeutic care	Providing reassurance	Yes	Yes	Yes	Yes
Abbreviations used: QS Qualified nursing staff, UQS Unqualified nursing staff					

Table 24: Tasks and responsibilities in the communications category as reported in Bee et al (2006)

Category	Task	Responsible for the task		Task done by	
		QS	UQS	QS	UQS
External	Relatives	Yes	-	Yes	-
	Social workers	Yes	-	Yes	-
	CMHTS	Yes	-	Yes	-
	Transfers/referrals	Yes	-	Yes	-
	Drug representative	Yes	-	Yes	-
	Other agencies	Yes	-	Yes	-
Internal	Colleagues (e.g. hand over)	Yes	-	Yes	-
	Ward managers	Yes	-	Yes	-
	Doctors/consultants (e.g. rounds)	Yes	-	Yes	-
	Occupational therapists	Yes	Yes	Yes	Yes
	Other departments (e.g. x-ray, ICU)	Yes	Yes	Yes	Yes
	Non-work-related communication	Yes	Yes	Yes	Yes
	Meetings (unspecified)	-	Yes	Yes	Yes
Abbreviations used: QS Qualified nursing staff, UQS Unqualified nursing staff					

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Table 25: Tasks and responsibilities in the administrative category as reported in Bee et al (2006)

Category	Task	Responsible for the task		Task done by	
		QS	UQS	QS	UQS
Patient-based	Writing/updating patient notes	Yes	-	Yes	-
	Ward round prep/follow-up	Yes	-	Yes	-
	Diary completion/follow-up	Yes	-	Yes	-
	Admission/discharge procedures	Yes	-	Yes	-
	Risk assessment procedures	Yes	-	Yes	-
	Sorting finance/accommodation	Yes	-	Yes	-
Ward-based	Ward maintenance	Yes	Yes	Yes	Yes
	Directing visitors	Yes	Yes	Yes	Yes
	Staff rotas/allocations	Yes	-	Yes	-
	Staff training and supervision	Yes	-	Yes	-
	General admin/checking post	Yes	-	Yes	-
	Taking/making phone calls	Yes	Yes	Yes	Yes
	Reviewing bed state	Yes	Yes	Yes	Yes
	Managing medication store	Yes	Yes	Yes	Yes
	Searching for equipment	Yes	Yes	Yes	Yes
Abbreviations used: QS Qualified nursing staff, UQS Unqualified nursing staff					

Table 26: Tasks and responsibilities in the domestic category as reported in Bee et al (2006)

Task	Responsible for the task		Task done by	
	QS	UQS	QS	UQS
Organising meals/refreshments	-	Yes	-	Yes
Tidying up/housekeeping	-	Yes	-	Yes
Making beds	-	Yes	-	Yes
Laundry	-	Yes	-	Yes
Abbreviations used: QS Qualified nursing staff, UQS Unqualified nursing staff				

3.6.2.3 Time needed for each activity

One study (Sabes-Figuera et al 2012) found that the average duration of one-to-one contacts with nursing staff reported by patients was 7.1 minutes (standard deviation 13.8). The study reported that the average duration of one-to-one contacts for patients with nursing staff reported by an independent observer was 29.8 minutes (standard deviation 23.0). These results were not compared with a statistical analysis.

3.6.2.4 Associations between activities that are carried out by nursing staff and outcomes

One study (Bee et al 2006) found that unqualified staff reported significantly higher levels of satisfaction with their work than qualified staff (mean 7.43 vs. 6.36, $p<0.001$). The study also reported a significant positive correlation between work satisfaction ratings and estimated patient contact time ($p<0.001$).

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3.6.2.5 Summary of included evidence

Table 27: Summary of included evidence – Bee et al (2006)

Reference	Outcome	Results			Statistical significance	Quality
		All staff	Qualified staff	Unqualified staff		
Bee et al (2006)	Number of nursing activities	55 different nursing activities in 5 categories			Not applicable	-
	Number of patient contact activities	47.7%	29.2%	63.5%	Not reported	
	Number of administrative activities	23.6%	34.0%	14.6%	Not reported	
	Number of communications activities	23.0%	35.5%	12.2%	Not reported	
	Number of domestic activities	4.1%	0.6%	7.0%	Not reported	
	Number of staff break activities	1.7%	0.6%	2.6%	Not reported	
	Minutes of patient contact per hour (mean)	Not reported	18.48 minutes	31.73 minutes	p<0.001	
	Satisfaction with work (mean)	Not reported	6.36	7.43	p<0.001	
	Correlation between work satisfaction and estimated patient contact time	r=0.35	-	-	p<0.001	

Table 28: Summary of included evidence – Sabes-Figuera (2012)

Reference	Outcome	Results		Statistical significance	Quality
		Reported by patients	Reported by others		
Sabes-Figuera et al 2012	Mean number of one-to-one contacts with nursing staff	2.8 contacts	3.2 contacts	p=0.619	-
	Mean duration of one-to-one contact time with nursing staff	7.1 minutes	29.8 minutes	Not reported	

No economic evidence was identified for this review question.

3.6.3 Evidence Statements

Evidence from 1 cross-sectional study (Bee et al 2006, [-]) suggests that there are 55 different nursing activities that can be grouped into 5 categories – patient contact, administrative tasks, communications, domestic tasks and staff breaks.

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Evidence from 1 cross-sectional study (Bee et al 2006, [-]) suggests that different nursing activities are performed by qualified and unqualified nursing staff. The evidence show trends indicating that qualified staff spend more time on communication activities than any other type of activity (35.5% of their time), whereas unqualified staff spend most of their time on patient contact activities (63.5% of their time). The evidence suggests that unqualified staff spend more time on patient contact activities, domestic activities and staff break activities than qualified staff and that qualified staff spend more time on administrative and communication activities than unqualified staff. The statistical significance of these differences was not reported.

Evidence from 1 cross-sectional study (Bee et al 2006, [-]) suggests that unqualified nursing staff spend statistically significantly more minutes per hour with patients than qualified staff (31.73 minutes vs. 18.48 minutes, $p<0.001$).

Evidence from 1 cross-sectional study (Bee et al 2006, [-]) suggests that unqualified nursing staff have a significantly higher mean satisfaction with work compared with qualified nursing staff (7.43 vs. 6.36, $p<0.001$). There was a statistically significant correlation between work satisfaction and estimated patient contact time ($p<0.001$).

Evidence from 1 cross-sectional study (Sabes-Figuera et al 2012, [-]) suggests that the mean number of one-to-one contacts with nursing staff reported by patients was 2.8, whilst the mean number reported by others was 3.2. This difference was not statistically significant (T -0.501, $p=0.619$).

Evidence from 1 cross-sectional study (Sabes-Figuera et al 2012, [-]) suggests that the mean one-to-one contact time with nursing staff reported by patients was 7.1 minutes, whilst the mean contact time reported by others was 29.8 minutes. The statistical significance of this difference was not reported.

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3.7 Review Question 7

This section of the evidence review examines the effectiveness of approaches for identifying safe staffing for nursing and/or skill mix, including tool kits, in inpatient mental health settings. Details of the included studies are reported in the evidence tables in Appendix D. A summary of the included studies is provided in Table 29 below. Results are reported in Table 30. No economic evidence was identified for this review question.

3.7.1 Review Question

What approaches for identifying safe staffing for nursing and/or skill mix, including tool kits, are effective in inpatient mental health settings and how frequently should they be used?

3.7.2 Evidence

Three studies were identified (Anderson et al 2012; Carter & Cox 2000; Mincsovics 2009) that presented approaches for identifying safe staffing for nursing in inpatient mental health settings.

One study took place in 6 psychiatric units of a children's hospital in the US (Anderson et al 2012), 1 study took place in 2 units of a psychiatric hospital in the US (Carter & Cox 2000) and 1 study took place in 1 inpatient psychiatric ward of a hospital in the UK.

One study used a patient classification system to classify patient by acuity to replace a fixed ratio based on census data (Anderson et al 2012). One study used a computer decision support system to replace a 'manual method' of identifying staffing levels (Carter & Cox 2000). One study used a quality loss function to replace manager's decisions on staffing levels (Mincsovics 2009).

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Table 29: Summary of included studies

Reference	Study Design, Country & Setting	Length of Study	New System/Tool	Previous System/Tool	Quality Score
Anderson et al 2012	**Study design**: Before and after study **Country**: USA **Setting:** 6 psychiatric units of a children's hospital	21 months	Patient classification system (81 indicators of 11 categories, e.g. nutrition, hygiene, monitoring. No further details provided)	Fixed ratio based on census data (no further details provided)	-
Carter & Cox 2000	**Study design**: Non-randomised controlled study **Country**: USA **Setting**: 2 units of a psychiatric hospital	3 months	Computer decision support system (spreadsheet with an assumption sheet, a labour table, a daily hours-worked sheet, and a summary sheet. No further details provided)	'Manual method' (no further details provided)	-
Mincsovics 2009	**Study design**: Simulation study using data from Ridley et al (2007) **Country**: Netherlands/UK **Setting**: 1 inpatient psychiatric unit of a hospital	Ridley (2007) - 1000 days (approx. 2 years and 9 months)	Quality loss function (calculated by fitting function to the collected data for workload and nursing capacity. No further details provided)	Manager's decisions (no further details provided)	-

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3.7.2.1 Hours of nursing staff time required

One study (Anderson et al 2012) reported that the hours of nursing staff time required for patients on imminent danger precautions and constant observation status had decreased by 24% from 167 hours per day to 127 hours per day across 6 units with the use of a patient classification system.

One study (Carter & Cox 2000) reported that the total nursing hours per patient day decreased by 0.2 hours (1%, from 5.1 hours at baseline to 4.9 hours at end) with the use of a computer decision support system and increased by 0.3 hours (1%, from 5.8 hours at baseline to 6.1 hours at end) with the use of a manual method.

One study (Anderson et al 2012) reported 'improved management decision making related to the appropriate allocation of nursing labour resources' with the use of a patient classification system. No numerical data were provided to support this claim.

3.7.2.2 Nursing cost per patient day

One study (Carter & Cox 2000) reported that the total nursing labour cost in relation to budget decreased by 53% in the unit using a computerised decision support unit (from $1929 below budget to $2959 below budget) and had increased by 61% in the unit using manual methods (from $2608 over budget to $4202 over budget).

One study (Carter & Cox 2000) reported a reduction of $1.17 (3%, from $44.66 at baseline to $43.60 at end) with the use of a computerised decision support system and an increase of $2.48 (1%, from $51.49 at baseline to $53.97 at end) with the use of a manual method. This was a monthly reduction of $1030 for the unit using the computerised decision support system and a monthly increase above budgeted level of $1594 for the unit using manual methods.

3.7.2.3 Service quality

One study (Mincsovics 2009) found a 0.27% improvement in service quality with the use of a quality loss function compared with using staffing decisions made my managers.

One study (Anderson et al 2012) reported that the patient classification system enabled managers to 'continually monitor and improve the effectiveness of unit staffing levels to achieve optimal patient outcomes'. No numerical data were provided to support this claim.

3.7.2.4 Productivity

One study (Anderson et al 2012) reports that productivity trends fell within the 'acceptable range' of 85% to 115% with the use of a patient classification system. The productivity trends prior to the patient classification system were not reported, and no further data or statistical analyses were presented.

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3.7.2.5 Summary of included evidence

Table 30: Summary of included evidence

Reference	Results	Limitations of results
Anderson et al 2012	24% decrease with patient classification system for nursing time required for patients with imminent danger and constant observation status	Details of patient classification system not provided. Lack of numerical data and statistical analyses. Statistical significance of results not reported.
Carter & Cox	Nursing cost per patient day: Computerised decision support system=$1.17 reduction Manual method=$2.48 increase	Details of computerised decision support system not provided. Results from computerised decision support system and manual method not compared in the paper. Statistical significance of differences in results not reported. Small sample size.
	Nursing hours per patient day: Computerised decision support system=0.2 decrease Manual method=0.3 increase	
Mincsovics	0.27% improvement in service quality with quality loss function vs. manager's decisions	Details of quality loss function calculation not provided. Statistical significance not reported.

No economic evaluations were identified for this review question.

3.7.3 Evidence Statements

Evidence from 1 before and after study (Anderson et al 2010, [-]) suggests a trend showing decreased nursing time for patients on imminent danger precautions and constant observation status when using a patient classification system compared with using fixed ratios based on census data (167 hours per day vs. 127 hours per day). No statistical analyses were reported.

Evidence from 1 non-randomised controlled study (Carter & Cox 2000, [-]) suggests a trend showing reduced nursing hours per patient day with a computerised decision support unit (5.1 hours before implementation vs. 4.9 hours after implementation). No statistical analyses were reported.

Evidence from 1 before and after study (Anderson et al 2010, [-]) suggests improved decision making for allocating nursing labour resources. No numerical data or statistical analyses were reported.

Evidence from 1 non-randomised controlled study (Carter & Cox 2000, [-]) suggests a trend showing reduced total nursing labour costs ($44.66 before implementation vs. $43.60 after implementation) and reduced total nursing labour cost in relation to budget with a computerised decision support unit ($1929 below budget before implementation vs. $2959 below budget after implementation). No statistical analyses were reported.

Evidence from 1 simulation study (Mincsovics 2009, [-]) suggests that a quality loss function can improve service quality by 0.27% compared with decisions made by a manager. No statistical analyses were reported.

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Evidence from 1 before and after study (Anderson et al 2010, [-]) suggests that managers could achieve optimal patient outcomes with the use of a patient classification system. No numerical data or statistical analyses were reported.

Evidence from 1 before and after study (Anderson et al 2010, [-]) suggests that productivity trends fell within the 'acceptable range' of 85% to 115% with the use of a patient classification system. No statistical analyses were reported.

The evidence included for this review question is only partially applicable to inpatient mental health units in the UK. This is because 2 of the studies (Anderson et al 2012; Carter & Cox 2000) used data from the US which has a health care system that is significantly different to the health care system in the UK.

None of the studies included enough detail to replicate the approach that they used to identify safe staffing levels.

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4 Conclusions

4.1 Gaps in the evidence

This review found that there was:

- no evidence that specifically describes how minimum staffing levels or ratios may support safer nursing in inpatient mental health settings.
- a lack of high quality intervention studies demonstrating the direction of the relationship between nurse staffing and key outcomes.
- no evidence on service user factors which may need to be taken into account when setting nurse staffing establishments.
- very little evidence on environmental and organisational factors which may need to be taken into account when setting nurse staffing establishments.
- no robust evidence to support the use of particular approaches or toolkits for identifying safe staffing requirements for nursing and/or skill mix.
- no evidence from economic evaluations regarding the cost effectiveness of different nurse staffing models or approaches.

Unpublished draft

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Appendices

Appendix A: Search Strategies

A.1 Search strategies for questions 1- 6

A.1.1 Database: British Nursing Index

Host: ProQuest

Data Parameters: 1994-Current

Date Searched: 8 December 2014

Set#	Searched for	Results
S1	SU.EXACT("Secure Psychiatric Hospitals") OR SU.EXACT("Psychiatric Rehabilitation")	1261°
S2	TI,AB((psychiatr* AND (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)))	2120°
S3	s1 or s2	3168°
S4	TI,AB(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*)	17343*
S5	TI,AB((acute or secure or rehab* or "tier 4") AND (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts or picu or section 136 or s136 or "place* of safety"))	6997*
S6	s4 or s5	22290*
S7	SU.EXACT("Psychiatric Nursing") OR SU.EXACT("Mental Health") OR SU.EXACT.EXPLODE("Psychiatric Disorders") OR SU.EXACT("Mental Health : Services")	4624*
S8	TI,AB(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	23567*

S9	s7 or s8	24128*
S10	s6 and s9	3745°
S11	s3 OR s10	5704*
S12	SU.EXACT.EXPLODE("Personnel Management") OR SU.EXACT.EXPLODE("Staffing Levels") OR SU.EXACT.EXPLODE("Occupational Stress") OR SU.EXACT("Health Service Planning") OR SU.EXACT("Hospital Planning and Design")	20428*
S13	SU.EXACT("Decision Making Process") OR SU.EXACT("Ward Organisation") OR SU.EXACT("Unit Management")	4769*
S14	TI(staffing*)	371°
S15	TI,AB(safe* near/3 staff*)	319°
S16	TI,AB(skill* near/1 mix*) OR TI,AB(skillmix*) OR TI,AB(staff* near/1 mix*) OR TI,AB(staffmix*) OR TI,AB(under* near/1 staff*) OR TI,AB(understaff*) OR TI,AB(work* near/1 hours)	755°
S17	TI,AB((job* or occupation* or employ*) near/3 (satisf* or dissatisf*))	968°
S18	TI,AB((organiz* or organis*) near/3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*))	781°
S19	TI,AB((patient* or user*) near/3 (volume* or occupanc* or ratio or ratios or acuit* or turnover* or caseload* or casemix* or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or multimorbid* or denominat*))	7080*
S20	TI,AB((ward or wards or unit* or department* or facility or facilities) near/3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat*))	1782°
S21	TI,AB((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*))	13659*

S22	TI,AB((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/3 (rota* or roster* or rosta* or schedul* or overtime* or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*))	7769*
S23	TI,AB((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or turnover* or caseload* or casemix* or configur* or reconfigur* or locat* or relocat*))	4661*
S24	TI,AB((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout*))	1264°
S25	TI,AB((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/3 (action* or duty or duties or activity or assign* or function* or remit* or activities or task* or responsibilit* or role*))	12052*
S26	s12 OR s13 OR s14 OR s15 OR s16 OR s17 OR s18 OR s19 OR s20 OR s21 OR s22 OR s23 OR s24 OR s25	54784*
S27	s11 AND s26	1650°
S28	(s11 AND s26) AND pd(19980101-20141231)	1583°

Unpu

A.1.2 Database: CINAHL

Host: EBSCO

Data Parameters: EBSCOhost Research Databases - Search Screen - Advanced Search - Database - CINAHL with Full Text

Date Searched: December 2014

#	Query	Results
S1	(MH "Hospitals, Psychiatric")	3,272
S2	(MH "Emergency Services, Psychiatric") OR (MH "Psychiatric Emergencies")	798
S3	(MH "Psychiatric Units")	1,687
S4	(MH "Involuntary Commitment")	1,106
S5	TI (psychiatr* N3 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment))	2,497
S6	AB (psychiatr* N3 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment))	5,236
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6	11,354
S8	(MH "Inpatients")	56,208
S9	(MH "Infant, Hospitalized") OR (MH "Child, Hospitalized") OR (MH "Adolescent, Hospitalized") OR (MH "Aged, Hospitalized")	5,372
S10	(MH "Child, Institutionalized") OR (MH "Institutionalization+") OR (MH "Hospitalization+")	73,416
S11	TI (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*)	96,365
S12	AB (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*)	178,077
S13	TI ((acute or secure or rehab* or "tier 4") N3 (ward* or clinic* or unit*	11,435

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	or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts))	
S14	AB ((acute or secure or rehab* or "tier 4") N3 (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts))	28,045
S15	TI (picu) or AB (picu)	744
S16	TI (section 136 or s136 or "place* of safety")	30
S17	AB (section 136 or s136 or "place* of safety")	54
S18	S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17	331,386
S19	(MH "Mental Disorders+")	251,053
S20	(MH "Mental Health Services") OR (MH "Mental Health Organizations+")	18,169
S21	(MH "Psychiatric Patients+")	8,459
S22	(MH "Psychiatry+") OR (MH "Child Psychiatry") OR (MH "Psychiatric Technicians") OR (MH "Adolescent Psychiatry") OR (MH "Geriatric Psychiatry") OR (MH "Psychiatric Service")	7,755
S23	(MH "Psychiatric Nursing+") OR (MH "Geropsychiatric Nursing")	15,244
S24	TI (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	84,611
S25	AB (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	101,795
S26	S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25	328,781
S27	S18 and S26	46,682
S28	S7 OR S27	52,321
S29	(MH "Personnel Management+")	167,887

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S30	(MH "Health Manpower") OR (MH "Administrative Personnel") OR (MH "Health Facility Administrators")	11,201
S31	(MH "Stress, Occupational+")	13,234
S32	(MH "Psychology, Occupational+")	53,794
S33	(MH "Organizational Culture+") OR (MH "Organizational Development+") OR (MH "Organizational Efficiency+") OR (MH "Organizational Policies+") OR (MH "Organizational Structure+")	54,046
S34	(MH "Decision Making, Organizational") OR (MH "Decision Making")	22,008
S35	(MH "Planning Techniques+")	6,156
S36	(MH "Bed Occupancy")	2,320
S37	(MH "Health Facility Administration+")	12,423
S38	(MH "Health Facility Environment")	3,949
S39	(MH "Health Facility Merger")	2,124
S40	(MH "Hospital Restructuring") OR (MH "Organizational Restructuring+")	3,675
S41	(MH "Hospital Information Systems")	1,819
S42	TI staffing*	4,457
S43	TI (safe* N3 staff*)	774
S44	TI ((skill* N1 mix*) or skillmix*)	315
S45	TI ((staff* N1 mix*) or staffmix*)	62
S46	TI ((under* N1 staff*) or understaff*)	234
S47	TI (work* N1 hours)	366
S48	TI ((job* or occupation* or employ*) N3 (satisf* or dissatisf*))	1,907
S49	TI ((organiz* or organis*) N3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*))	1,089

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S50	TI ((patient* or (service* N1 user*)) N3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*))	7,874
S51	TI ((ward or wards or unit*1 or department* or facility or facilities) N3 (admin* or manag* or layout* or access* or environ* or locat* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*"))	1,594
S52	TI (workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent")	5,753
S53	AB (safe* N3 staff*)	630
S54	AB ((skill* N1 mix*) or skillmix*)	534
S55	AB ((staff* N1 mix*) or staffmix*)	200
S56	AB ((under* N1 staff*) or understaff*)	596
S57	AB (work* N1 hours)	1,675
S58	AB ((job* or occupation* or employ*) N3 (satisf* or dissatisf*))	4,106
S59	AB ((organiz* or organis*) N3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*))	6,307
S60	AB ((patient* or (service* N1 user*)) N3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*))	36,251
S61	AB ((ward or wards or unit*1 or department* or facility or facilities) N3 (admin* or manag* or layout* or access* or environ* or locat* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*"))	5,397
S62	AB (workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-	11,570

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	power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent")	
S63	S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62	332,848
S64	(MH "Nurses+") OR (MH "Nursing Assistants")	154,665
S65	(MH "Nursing Role")	37,124
S66	TI (nurse* or nursing*)	234,231
S67	TI ((psychiatric* or mental* or health* or care*) N3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*))	1,118
S68	TI (assistant N1 practitioner*)	68
S69	AB (nurse* or nursing*)	181,073
S70	AB ((psychiatric* or mental* or health* or care*) N3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*))	1,705
S71	AB (assistant N1 practitioner*)	80
S72	S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71	410,835
S73	S63 AND S72	108,727
S74	S28 AND S73	2,528
S75	TI ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*))	23,446
S76	TI ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*))	9,698

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S77	TI ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*"))	7,270
S78	TI ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*"))	2,331
S79	TI ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*))	11,825
S80	AB ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*))	39,844
S81	AB ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*))	20,600
S82	AB ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*"))	19,376
S83	AB ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*"))	3,749
S84	AB ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) N3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*))	23,640
S85	S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84	118,638

Unpublished draft

S86	S28 AND S85	3,842
S87	S74 OR S86	5,173
S88	S74 OR S86 Limiters - English Language	4,796
S89	S74 OR S86 Limiters - Published Date: 19980101-20141231; English Language	3,780

Unpublished draft

A.1.3 Database: Cochrane Library

Host: Wiley

Data Parameters:

- Cochrane Database of Systematic Reviews : Issue 12 of 12, December 2014
- Cochrane Central Register of Controlled Trials : Issue 11 of 12, November 2014
- Database of Abstracts of Reviews of Effect : Issue 4 of 4, October 2014
- NHS Economic Evaluation Database : Issue 4 of 4, October 2014

Date Searched: 5 December 2014

ID Search Hits

#1 [mh "Psychiatric Department, Hospital"] or [mh "Hospitals, Psychiatric"] or [mh "Emergency Services, Psychiatric"] or [mh "commitment of mentally ill"] 402

#2 (psychiatr* near/4 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)):ti,ab 1901

#3 #1 or #2 2119

#4 [mh Inpatients] or [mh "Adolescent, Hospitalized"] or [mh "Child, Hospitalized"] or [mh Hospitalization] or [mh "Adolescent, Institutionalized"] or [mh "Child, Institutionalized"] or [mh Institutionalization] 13150

#5 (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*):ti,ab 184156

#6 ((acute or secure or rehab* or "tier 4") near/4 (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)):ti,ab 9042

#7 (section 136 or s136 or "place* of safety" or picu):ti,ab 138

#8 {or #4-#7} 193756

#9 [mh "mental disorders"] or [mh "mental health services"] or [mh "mentally ill persons"] or [mh psychiatry] or [mh "adolescent psychiatry"] or [mh "child psychiatry"] or [mh "geriatric psychiatry"] or [mh "psychiatric nursing"] 46865

#10 (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS):ti,ab 59960

#11 #9 or #10 86232

#12 #8 and #11 20482

#13 #3 or #12 21390

#14 [mh "Personnel management"] or [mh "health manpower"] or [mh "health manpower"] or [mh "health manpower"] or [mh "Psychology, Industrial"] 4246

#15 [mh "organizational culture"] or [mh "models, organizational"] or [mh "models, organizational"] or [mh "models, organizational"] or [mh "Efficiency, Organizational"] 409

#16 [mh "Planning techniques"] or [mh "Patient Care Planning"] or [mh "bed occupancy"] or [mh "health facility administration"] or [mh "health facility environment"] or [mh "health facility merger"] 1634

#17 [mh "health facility moving"] or [mh "health facility size"] or [mh "hospital administration"] or [mh "hospital restructuring"] or [mh "hospital communication systems"] or [mh "health facility administrators"] or [mh "capacity building"] 3780

Unpublished draft

#18 [mh /MA] 378

#19 staffing*:ti 32

#20 (safe* near/4 staff*):ti,ab 38

#21 ((skill* near/2 mix*) or skillmix*):ti,ab 30

#22 ((staff* near/2 mix*) or staffmix*):ti,ab 8

#23 ((under* near/2 staff*) or understaff*):ti,ab 35

#24 (work* near/2 hours):ti,ab 305

#25 ((job* or occupation* or employ*) near/4 (satisf* or dissatisf*)):ti,ab 215

#26 ((organiz* or organis*) near/4 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)):ti,ab 655

#27 ((patient* or (service* near/2 user*)) near/4 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)):ti,ab 17316

#28 ((ward or wards or unit* or department* or facility or facilities) near/4 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")):ti,ab 2241

#29 (workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent"):ti,ab 2275

#30 {or #14-#29} 31434

#31 [mh nurses] or [mh "nursing staff"] or [mh nursing] or [mh "psychiatric nursing"] or [mh "nurses' aides"] or [mh "psychiatric aides"] or [mh "Nurse Administrators"] or [mh "Nurse's role"] or [mh "Nursing, Practical"] 4209

#32 [mh /NU] 3235

#33 (nurse* or nursing*):ti,ab 13771

#34 ((psychiatric* or mental* or health* or care*) near/4 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)):ti,ab 230

#35 (assistant near/1 practitioner*):ti,ab 1

#36 {or #31-#35} 16326

#37 #30 and #36 2705

#38 #13 and #37 317

#39 ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/4 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)):ti,ab 2132

#40 ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/4 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)):ti,ab 1276

#41 ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/4 (level* or ratio or ratios* or resourc* or model* or

Unpublished draft

number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")):ti,ab 1559

#42 ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/4 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")):ti,ab 424

#43 ((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) near/4 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)):ti,ab 1273

#44 {or #39-#43} 5627

#45 #13 and #44 374

#46 #38 or #45 594

#47 #38 or #45 Publication Year from 1998 to 2014 487

Unpublished draft

A.1.4 Database: Embase

Host: Ovid

Data Parameters: **Embase** 1974 to 2014 December 04

Date Searched: 5 December 2014 2014

#	Searches	Results
1	psychiatric department/	6103
2	mental hospital/	27072
3	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).tw.	37823
4	or/1-3	57783
5	exp hospital patient/	89147
6	hospitalization/	215751
7	institutionalization/	7073
8	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).tw.	2382368
9	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	92984
10	picu.tw.	4834
11	(section 136 or s136 or "place* of safety").tw.	545
12	or/5-11	2520415
13	exp mental disease/	1586913
14	mental health care/ or mental health service/	60741
15	mental patient/	19406
16	psychiatry/ or child psychiatry/ or gerontopsychiatry/ or psychiatric nursing/	90540
17	psychiatric treatment/ or crisis intervention/ or involuntary commitment/	11780

Unpublished draft

18	psychiatric diagnosis/	14785
19	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	1014467
20	or/13-19	2018299
21	12 and 20	310951
22	4 or 21	343045
23	exp personnel management/	69744
24	health care manpower/	9971
25	occupational psychology/	99
26	organization/ or organizational development/ or organizational efficiency/ or organizational structure/	115022
27	planning/ or health care planning/ or manpower planning/ or patient care planning/	132277
28	exp work/	250637
29	hospital bed utilization/	2831
30	hospital bed capacity/	18096
31	administrative personnel/	15971
32	hospital management/ or hospital information system/ or hospital planning/ or staff training/	80282
33	health care facility/	53930
34	hospital organization/	9980
35	capacity building/	1436
36	staffing*.ti.	3590
37	(safe* adj3 staff*).tw.	1199
38	((skill* adj1 mix*) or skillmix*).tw.	827
39	((staff* adj1 mix*) or staffmix*).tw.	170

Unpublished draft

40	((under* adj1 staff*) or understaff*).tw.	1012
41	(work* adj1 hours).tw.	7102
42	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).tw.	8344
43	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).tw.	49144
44	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).tw.	217573
45	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	38558
46	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").tw.	52222
47	or/23-46	935879
48	exp nurse/	117789
49	exp nursing/	336031
50	exp nursing staff/	56876
51	psychiatric nursing/	14378
52	nursing assistant/	3839
53	nurse attitude/	33640
54	nurse patient ratio/ or nursing shortage/ or nurse training/ or nursing organization/	21228
55	(nurse* or nursing*).tw.	386296
56	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)).tw.	3485

Unpublished draft

57	(assistant adj1 practitioner*).tw.	53
58	or/48-57	604532
59	47 and 58	125311
60	22 and 59	4894
61	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).tw.	55543
62	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).tw.	32424
63	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	33586
64	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	6328
65	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).tw.	37572
66	or/61-65	141735
67	22 and 66	5558
68	60 or 67	9105
69	limit 68 to english language	7838
70	(comment or editorial or news or letter).pt.	1318639
71	69 not 70	7794
72	nonhuman/ not (nonhuman/ and human/)	3499338

Unpublished draft

73	71 not 72	7790
74	limit 73 to yr="1998-Current"	5555
75	limit 74 to embase	3342
76	limit 75 to (conference abstract or conference paper or conference proceeding or "conference review")	1444
77	75 not 76	1898

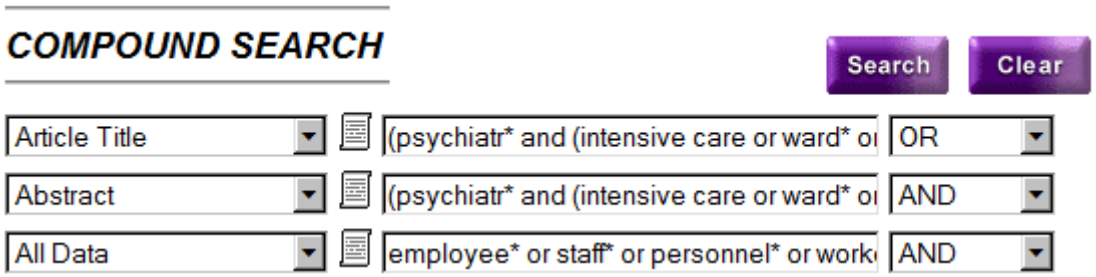
A.1.5 Database: HEED

Host: Wiley

Data Parameters: no restrictions

Date Searched: 8 December 2014

HEED 1



Line 1 - title

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

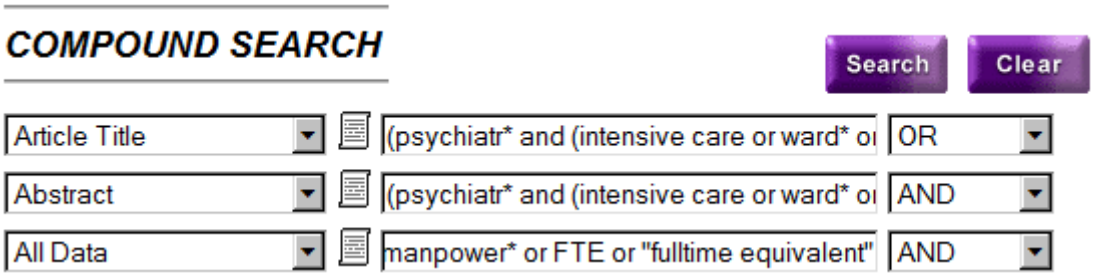
Line 3 - all data

employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*

n=52

HEED 2

Unpublished draft



Line 1 - title

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

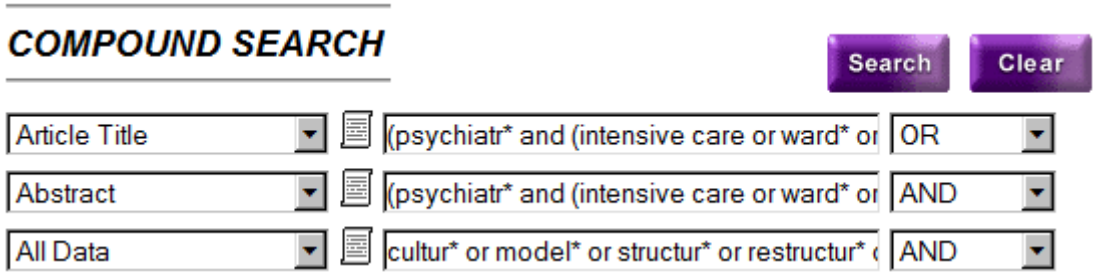
(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 3 - all data

safe* or skill* or understaff* or work hours or working hours or job satisfaction or job dissatisfaction or workload* or workforce* or manpower* or FTE

n=14

HEED 3



Line 1 - title

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

Published draft

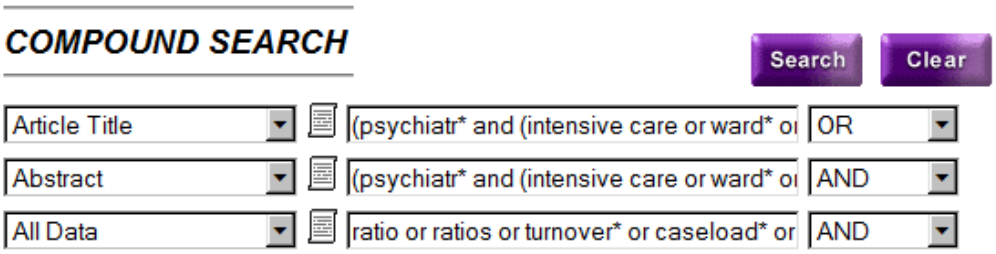
(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 3 - all data

cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien* or organiz* or organis*

n=119

HEED 4



Line 1 - title

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

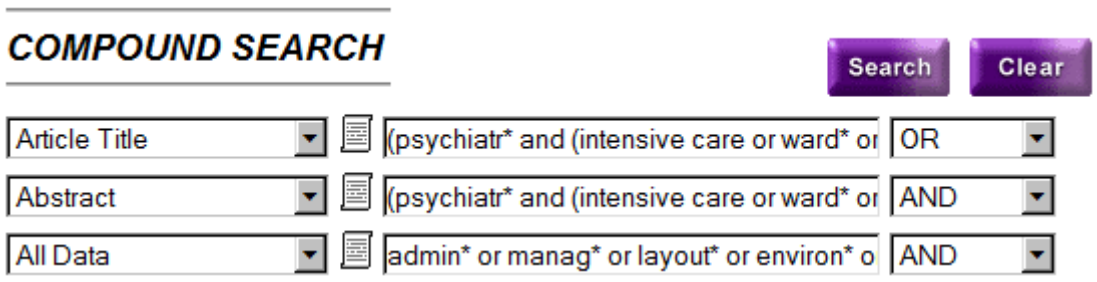
(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 3 - all data

ratio or ratios or turnover* or caseload* or casemix* or comorbid* or multimorbid* or denominat*

n=37

HEED 5



Line 1 - title

Unpublished draft

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 3 - all data

admin* or manag* or layout* or environ* or locat* or relocat* or size* or merger* or structur* or restructur* or configur* or reconfigur* or proximity or closure*

n=68

Unpublished draft

A.1.6 Database: HMIC

Host: Ovid

Data Parameters: **HMIC Health Management Information Consortium** 1979 to September 2014

Date Searched: 5 December 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).mp.	2417
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).mp.	27670
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).mp.	8644
4	picu.mp.	54
5	(section 136 or s136 or "place* of safety").mp.	95
6	or/2-5	33613
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).mp.	37541
8	6 and 7	6700
9	1 or 8	7777
10	staffing*.ti.	618
11	(safe* adj3 staff*).mp.	242
12	((skill* adj1 mix*) or skillmix*).mp.	868
13	((staff* adj1 mix*) or staffmix*).mp.	36
14	((under* adj1 staff*) or understaff*).mp.	206
15	(work* adj1 hours).mp.	1389
16	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).mp.	1567

Unpublished draft

17	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).mp.	4389
18	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).mp.	5924
19	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).mp.	3855
20	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").mp.	10502
21	or/10-20	26789
22	(nurse* or nursing*).mp.	44394
23	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)).mp.	955
24	(assistant adj1 practitioner*).mp.	39
25	or/22-24	44889
26	21 and 25	7267
27	9 and 26	292
28	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).mp.	8898
29	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).mp.	5772
30	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or	5396

Unpublished draft

	attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).mp.	
31	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	923
32	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).mp.	4999
33	or/28-32	21196
34	9 and 33	775
35	27 or 34	917
36	limit 35 to yr="1998-Current"	453

Unpublished draft

A.1.7 Database: Medline

Host: Ovid

Data Parameters: **Ovid MEDLINE(R)** 1946 to November Week 3 2014

Date Searched: 5 December 2014

Database(s): **Ovid MEDLINE(R)** 1946 to November Week 3 2014 Search Strategy:#	**Searches**	**Results**
1	Psychiatric Department, Hospital/	5984
2	Hospitals, Psychiatric/	22735
3	Emergency Services, Psychiatric/	2176
4	commitment of mentally ill/	6315
5	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).tw.	24838
6	or/1-5	49798
7	Inpatients/	13881
8	Adolescent, Hospitalized/ or Child, Hospitalized/ or Hospitalization/	81913
9	Adolescent, Institutionalized/ or Child, Institutionalized/ or Institutionalization/	6794
10	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).tw.	1667687
11	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	62331
12	picu.tw.	1927
13	(section 136 or s136 or "place* of safety").tw.	353

Unpublished draft.

14	or/7-13	1733007
15	exp mental disorders/	1004816
16	mental health services/	26507
17	mentally ill persons/	4483
18	psychiatry/ or adolescent psychiatry/ or child psychiatry/ or geriatric psychiatry/ or psychiatric nursing/	55558
19	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	772857
20	or/15-19	1421747
21	14 and 20	195482
22	6 or 21	223430
23	exp Personnel management/	132034
24	health manpower/	11778
25	burnout, professional/	7767
26	exp Psychology, Industrial/	71926
27	organizational culture/	13495
28	models, organizational/	15686
29	Decision Making, Organizational/	10631
30	Efficiency, Organizational/	18435
31	Planning techniques/ or Patient Care Planning/	47795
32	bed occupancy/	2320
33	exp health facility administration/	30155
34	exp health facility environment/	5966
35	health facility merger/	4548

Unpublished draft

36	health facility moving/	253
37	exp health facility size/	25539
38	hospital administration/	28563
39	hospital restructuring/	4609
40	hospital communication systems/	1525
41	exp health facility administrators/	10690
42	capacity building/	870
43	manpower.fs.	58590
44	staffing*.ti.	3215
45	(safe* adj3 staff*).tw.	853
46	((skill* adj1 mix*) or skillmix*).tw.	666
47	((staff* adj1 mix*) or staffmix*).tw.	149
48	((under* adj1 staff*) or understaff*).tw.	738
49	(work* adj1 hours).tw.	5047
50	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).tw.	6710
51	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).tw.	41849
52	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).tw.	143148
53	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	28183

Unpublished draft

54	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").tw.	40239
55	or/23-54	614782
56	exp nurses/ or exp nursing staff/	124475
57	exp nursing/ or psychiatric nursing/	229145
58	nurses' aides/ or psychiatric aides/	4035
59	Nurse Administrators/	11698
60	Nurse's role/	34291
61	Nursing, Practical/	3428
62	nu.fs.	119226
63	(nurse* or nursing*).tw.	335726
64	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)).tw.	2980
65	(assistant adj1 practitioner*).tw.	37
66	or/56-65	540780
67	55 and 66	106003
68	22 and 67	3411
69	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).tw.	48163
70	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).tw.	26005

Unpublished draft

71	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	26505
72	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	5105
73	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).tw.	32303
74	or/69-73	118556
75	22 and 74	3889
76	68 or 75	6247
77	limit 76 to english language	5374
78	limit 77 to (comment or editorial or news or letter)	44
79	77 not 78	5330
80	Animals/ not Humans/	4004886
81	79 not 80	5329
82	limit 81 to yr="1998-Current"	3457
83	remove duplicates from 82	3291

Unpublished draft

A.1.8 Database: Medline in Process

Host: Ovid

Data Parameters: **Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations** December 04, 2014

Date Searched: 5 December 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).tw.	1879
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).tw.	129237
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	5354
4	picu.tw.	284
5	(section 136 or s136 or "place* of safety").tw.	27
6	or/2-5	131855
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	56978
8	6 and 7	10366
9	1 or 8	11241
10	staffing*.ti.	175
11	(safe* adj3 staff*).tw.	92
12	((skill* adj1 mix*) or skillmix*).tw.	54
13	((staff* adj1 mix*) or staffmix*).tw.	6
14	((under* adj1 staff*) or understaff*).tw.	59
15	(work* adj1 hours).tw.	489
16	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).tw.	575

Unpublished draft

17	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).tw.	4117
18	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).tw.	12484
19	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	3480
20	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").tw.	3386
21	or/10-20	24205
22	(nurse* or nursing*).tw.	16176
23	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)).tw.	270
24	(assistant adj1 practitioner*).tw.	5
25	or/22-24	16337
26	21 and 25	2164
27	9 and 26	93
28	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).tw.	3022
29	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).tw.	2136
30	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or	2034

Unpublished draft

	attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	
31	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	443
32	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).tw.	1678
33	or/28-32	7737
34	9 and 33	197
35	27 or 34	253
36	limit 35 to english language	242
37	limit 36 to yr="1998-Current"	229

Unpublished draft

A.1.9 Database: PsychINFO

Host: Ovid

Data Parameters: **PsycINFO** 1806 to December Week 1 2014

Date Searched: 5 December 2014

#	Searches	Results
1	psychiatric hospitals/ or psychiatric units/	8529
2	psychiatric hospital programs/	1859
3	psychiatric hospitalization/	6248
4	psychiatric hospital admission/ or psychiatric hospital discharge/ or psychiatric hospital readmission/	3144
5	"commitment (psychiatric)"/	1540
6	psychiatric hospital staff/ or psychiatric aides/	1201
7	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).tw.	33232
8	or/1-7	42657
9	hospitalized patients/	10687
10	hospitalization/	5179
11	institutionalization/	3283
12	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).tw.	242303
13	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	19759
14	picu.tw.	261
15	(section 136 or s136 or "place* of safety").tw.	100
16	or/9-15	256847

Unpublished draft

17	Psychiatric patients/	27273
18	Psychiatric Clinics/	1361
19	mental health services/	27335
20	exp mental disorders/	453588
21	psychiatry/ or adolescent psychiatry/ or child psychiatry/ or geriatric psychiatry/	29051
22	Psychiatric Nurses/	2791
23	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	752042
24	or/17-23	901657
25	16 and 24	133636
26	8 or 25	151678
27	exp human resource management/	34603
28	exp personnel supply/	599
29	occupational stress/	16357
30	"industrial and organizational psychology"/	5138
31	Employee Absenteeism/ or exp Employee Characteristics/ or exp Employee Interaction/ or Employee Turnover/	44938
32	Employer Attitudes/ or exp Job Performance/ or Reemployment/ or Retirement/	22758
33	"Work (Attitudes Toward)"/	5625
34	exp Job Characteristics/ or Quality of Work Life/ or exp Working Conditions/ or Work Scheduling/ or exp Employee Attitudes/	51788
35	exp Organizational Behavior/ or Organizational Commitment/ or Organizational Structure/ or Organizational Climate/	49565
36	decision making/ or management decision making/	54041
37	management planning/	1195

Unpublished draft

38	exp health care administration/	1649
39	facility environment/ or hospital environment/	2217
40	(safe* adj3 staff*).tw.	275
41	((skill* adj1 mix*) or skillmix*).tw.	168
42	((staff* adj1 mix*) or staffmix*).tw.	42
43	((under* adj1 staff*) or understaff*).tw.	392
44	(work* adj1 hours).tw.	2799
45	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).tw.	18439
46	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).tw.	25467
47	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).tw.	37782
48	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	8161
49	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").tw.	17296
50	or/27-49	276135
51	nurses/ or psychiatric nurses/	21943
52	nursing/	14769
53	psychiatric aides/	137
54	(nurse* or nursing*).tw.	74568
55	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or	1265

Unpublished draft

	orderlies or auxiliar*)).tw.	
56	(assistant adj1 practitioner*).tw.	7
57	or/51-56	75632
58	50 and 57	15324
59	26 and 58	1519
60	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).tw.	28081
61	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).tw.	15656
62	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).tw.	15725
63	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	5289
64	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).tw.	14925
65	or/60-64	67302
66	26 and 65	3961
67	59 or 66	4865
68	limit 67 to english language	4493
69	limit 68 to yr="1998-Current"	2556

Unpublished draft

Unpublished draft

A.1.10 Database: Social Policy & Practice

Host: Ovid

Data Parameters: **Social Policy and Practice** 201410

Date Searched: 5 December 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment)).mp.	1569
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain* or seclusion or seclud*).mp.	15565
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).mp.	4856
4	picu.mp.	13
5	(section 136 or s136 or "place* of safety").mp.	114
6	or/2-5	18997
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).mp.	53451
8	6 and 7	6217
9	1 or 8	6871
10	staffing*.ti.	118
11	(safe* adj3 staff*).mp.	187
12	((skill* adj1 mix*) or skillmix*).mp.	77
13	((staff* adj1 mix*) or staffmix*).mp.	12
14	((under* adj1 staff*) or understaff*).mp.	147
15	(work* adj1 hours).mp.	752
16	((job* or occupation* or employ*) adj3 (satisf* or dissatisf*)).mp.	901

Unpublished draft

17	((organiz* or organis*) adj3 (cultur* or model* or structur* or restructur* or capacit* or policy or policies or procedur* or efficien*)).mp.	4710
18	((patient* or (service* adj1 user*)) adj3 (volume* or occupanc* or ratio or ratios or acuit* or turn over* or turnover* or caseload* or "case load*" or casemix* or "case mix*" or dependenc* or famil* or support* or carer* or relative* or medicat* or comorbid* or "co morbid*" or "co-morbid*" or multimorbid* or "multi morbid*" or "multi-morbid*" or denominat*)).mp.	3178
19	((ward or wards or unit*1 or department* or facility or facilities) adj3 (admin* or manag* or layout* or access* or environ* or size* or merger* or structur* or restructur* or capacit* or rule* or configur* or reconfigur* or close* or proximity or closure* or custom* or practice* or leader* or locat* or relocat* or "re-locat*" or "re locat*")).mp.	2305
20	(workload* or workforce* or manpower* or "work load*" or "work force*" or "man power*" or "work-load*" or "work-force*" or "man-power*" or FTE or "fulltime equivalent" or "full time equivalent" or "full-time equivalent").mp.	6000
21	or/10-20	17427
22	(nurse* or nursing*).mp.	17157
23	((psychiatric* or mental* or health* or care*) adj3 (assistant* or aide* or attendant* or orderly or orderlies or auxiliar*)).mp.	437
24	(assistant adj1 practitioner*).mp.	8
25	or/22-24	17433
26	21 and 25	1355
27	9 and 26	97
28	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (issue* or problem* or sufficient* or sufficiency or adequate* or adequac* or target* or insufficien* or inadequa* or shortage* or short or efficient* or efficienc* or custom* or practice* or balanc* or denominat* or motivat*)).mp.	3402
29	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (rota* or roster* or rosta* or schedul* or overtime* or "over time" or shift or shiftwork* or shifts or temporary or availability or supervisi* or recruit* or retain* or retention* or competenc* or morale* or experience*)).mp.	4370
30	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or	2741

Unpublished draft

	attendant* or orderly or orderlies or auxiliar*) adj3 (level* or ratio or ratios* or resourc* or model* or number* or capacit* or "turn over*" or turnover* or caseload* or "case load*" or casemix* or "case mix*" or configur* or reconfigur* or locat* or relocat* or "re-locat*" or "re locat*")).mp.	
31	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (sickness or absence* or absent* or stress* or fatigue* or burnout* or burntout* or "burn* out*")).tw.	459
32	((employee* or staff* or personnel* or worker* or assistant* or nurse* or nursing* or aide* or attendant* or orderly or orderlies or auxiliar*) adj3 (action* or duty or duties or activity or assign* or function* or remit*1 or activities or task* or responsibilit* or role*)).mp.	2597
33	or/28-32	11938
34	9 and 33	334
35	27 or 34	405
36	limit 35 to yr="1998-Current"	347

Unpublished draft

A.2 Searches for question 7

A.2.1 Database: British Nursing Index

Host: ProQuest

Data Parameters: 1994-Current

Date Searched: 1 December 2014

Set#	Searched for	Results
S1	SU.EXACT("Psychiatric Nursing") OR SU.EXACT("Secure Psychiatric Hospitals") OR SU.EXACT("Psychiatric Rehabilitation")	4451*
S2	TI,AB((psychiatr* AND (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment)))	3623°
S3	s1 or s2	6386*
S4	TI,AB(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*)	17234*
S5	TI,AB((acute or secure or rehab* or "tier 4") AND (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts))	6997*
S6	TI,AB(picu)	92°
S7	TI,AB(section 136 or s136 or "place* of safety")	21°
S8	s4 or s5 or s6 or s7	22267*
S9	SU.EXACT("Mental Health")	1318°
S10	SU.EXACT.EXPLODE("Psychiatric Disorders")	21830*
S11	SU.EXACT("Mental Health : Services")	4108*
S12	TI,AB(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	23567*

S13	s9 or s10 or s11 or s12	35910*
S14	s8 and s13	4701*
S15	s3 or s14	9482*
S16	SU.EXACT("Care Plans and Planning") OR SU.EXACT("Management Information Systems")	4427*
S17	TI,AB("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard* or care pathway*)	1996°
S18	TI,AB((planning or staffing or acuity or severity or workload* or workforce*) NEAR/3 (approach* or model* or system* or judgement* or judgment* or algorithm*))	347°
S19	TI,AB((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) AND (tool*))	3004°
S20	TI,AB(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*")	17°
S21	s16 or s17 or s18 or s19 or s20	8509*
S22	s15 and s21	423°
S23	(s15 and s21) AND yr(1998-2014)	408°

* Duplicates are removed from your search, but included in your result count.

° Duplicates are removed from your search and from your result count.

A.2.2 Database: CINAHL

Host: EBSCO

Data Parameters: EBSCOhost Research Databases - Search Screen - Advanced Search - Database - CINAHL with Full Text

Date Searched: 1 December 2014

#	Query	Results
S1	(MH "Hospitals, Psychiatric")	3,272
S2	(MH "Emergency Services, Psychiatric") OR (MH "Psychiatric Emergencies")	798
S3	(MH "Psychiatric Nursing+") OR (MH "Geropsychiatric Nursing")	15,244
S4	(MH "Psychiatric Units")	1,687
S5	(MH "Involuntary Commitment")	1,106
S6	TI (psychiatr* N3 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))	4,856
S7	AB (psychiatr* N3 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))	7,327
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	25,255
S9	(MH "Inpatients")	56,208
S10	(MH "Infant, Hospitalized") OR (MH "Child, Hospitalized") OR (MH "Adolescent, Hospitalized") OR (MH "Aged, Hospitalized")	5,372
S11	(MH "Child, Institutionalized") OR (MH "Institutionalization+") OR (MH "Hospitalization+")	73,416
S12	TI (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*)	96,001
S13	AB (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*)	177,858
S14	TI ((acute or secure or rehab* or "tier 4") N3 (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts))	11,433

Unpublished draft

S15	AB ((acute or secure or rehab* or "tier 4") N3 (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts))	28,045
S16	ti (picu) or ab (picu)	200
S17	TI (section 136 or s136 or "place* of safety")	30
S18	AB (section 136 or s136 or "place* of safety")	54
S19	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18	330,924
S20	(MH "Mental Disorders+")	251,053
S21	(MH "Mental Health Services") OR (MH "Mental Health Organizations+")	18,169
S22	(MH "Psychiatric Patients+")	8,459
S23	(MH "Psychiatry+") OR (MH "Child Psychiatry") OR (MH "Psychiatric Technicians") OR (MH "Adolescent Psychiatry") OR (MH "Geriatric Psychiatry") OR (MH "Psychiatric Service")	7,755
S24	TI (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	84,585
S25	AB (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS)	101,795
S26	S20 OR S21 OR S22 OR S23 OR S24 OR S25	325,054
S27	S19 AND S26	46,267
S28	S8 OR S27	64,553
S29	(MH "Personnel Staffing and Scheduling Information Systems")	194
S30	(MH "Benchmarking")	4,188
S31	(MH "Critical Path")	3,264
S32	(MH "Patient Classification/MT")	144
S33	TI (care N3 pathway*)	938

Unpublished draft

S34	AB (care N3 pathway*)	1,254
S35	TI ("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*)	2,556
S36	AB ("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*)	3,486
S37	TI ((planning or staffing or acuity or severity or workload* or workforce*) N3 (approach* or model* or system* or judgement* or judgment* or algorithm*))	874
S38	AB ((planning or staffing or acuity or severity or workload* or workforce*) N3 (approach* or model* or system* or judgement* or judgment* or algorithm*))	2,569
S39	TI ((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) N3 tool*)	1,070
S40	AB ((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) N3 tool*)	2,650
S41	TI (Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*")	6
S42	AB (Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*")	48
S43	S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42	18,898
S44	S28 AND S43	609
S45	S28 AND S43 Limiters - English Language	547
S46	S28 AND S43 Limiters - Published Date: 19980101-20141231; English Language	536

Unpublished draft

Unpublished draft

A.2.3 Database: Cochrane Library

Host: Wiley

Data Parameters:

- Cochrane Database of Systematic Reviews : Issue 11 of 12, November 2014
- Cochrane Central Register of Controlled Trials : Issue 10 of 12, October 2014
- Database of Abstracts of Reviews of Effect : Issue 4 of 4, October 2014
- NHS Economic Evaluation Database : Issue 4 of 4, October 2014

Date Searched: 27 November 2014

ID Search Hits

#1 [mh "Psychiatric Department, Hospital"] 76

#2 [mh "Hospitals, Psychiatric"] 236

#3 [mh "Emergency Services, Psychiatric"] 49

#4 [mh "Psychiatric Nursing"] 169

#5 [mh "Psychiatric Aides"] 2

#6 [mh "commitment of mentally ill"] 69

#7 (psychiatr* near/4 (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment)):ti,ab 2037

#8 {or #1-#7} 2341

#9 [mh Inpatients] 690

#10 [mh "adolescent, Hospitalized"] or [mh "Child, Hospitalized"] or [mh Hospitalization] 12382

#11 [mh "Adolescent, Institutionalized"] or [mh "Child, Institutionalized"] or [mh Institutionalization] 245

#12 (inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*):ti,ab 183478

#13 ((acute or secure or rehab* or "tier 4") near/4 (ward* or clinic* or unit* or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)):ti,ab 8993

#14 picu:ti,ab 122

#15 (section 136 or s136 or "place* of safety"):ti,ab 15

#16 {or #9-#15} 193043

#17 [mh "mental disorders"] 43915

#18 [mh "mental health services"] 4539

#19 [mh "mentally ill persons"] 36

#20 [mh psychiatry] or [mh "adolescent psychiatry"] or [mh "child psychiatry"] or [mh "geriatric psychiatry"] 454

#21 (mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS):ti,ab 59791

Unpublished draft

#22 {or #17-#21} 86004

#23 #16 and #22 20424

#24 #8 or #23 21491

#25 [mh "Personnel Staffing and Scheduling Information Systems"] 1

#26 (care near/4 pathway*):ti,ab 184

#27 ("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*):ti,ab 458

#28 ((planning or staffing or acuity or severity or workload* or workforce*) near/4 (approach* or model* or system* or judgement* or judgment* or algorithm*)):ti,ab 756

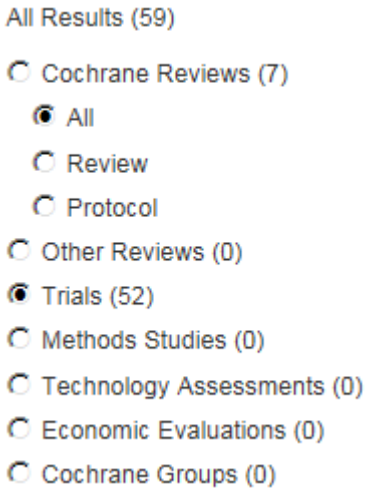
#29 ((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) near/4 tool*):ti,ab 211

#30 (Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*"):ti,ab 1

#31 {or #25-#30} 1597

#32 #24 and #31 68

#33 #24 and #31 Publication Year from 1998 to 2014 59



Unpublished draft

A.2.4 Database: Embase

Host: Ovid

Data Parameters: **Embase** 1974 to 2014 November 26

Date Searched: 27 November 2014

#	Searches	Results
1	psychiatric department/	6102
2	mental hospital/	27069
3	psychiatric nursing/	14378
4	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment)).tw.	42949
5	or/1-4	71960
6	exp hospital patient/	88941
7	hospitalization/	215409
8	institutionalization/	7064
9	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	2377708
10	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	92860
11	picu.tw.	4832
12	(section 136 or s136 or "place* of safety").tw.	544
13	or/6-12	2515664
14	exp mental disease/	1585146
15	mental health care/ or mental health service/	60708
16	mental patient/	19387

Unpublished draft

17	psychiatry/ or child psychiatry/ or gerontopsychiatry/	77006
18	psychiatric treatment/ or crisis intervention/ or involuntary commitment/	11773
19	psychiatric diagnosis/	14771
20	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	1013584
21	or/14-20	2012999
22	13 and 21	310092
23	5 or 22	355181
24	clinical pathway/	6051
25	(care adj3 pathway*).tw.	4260
26	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).tw.	27946
27	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).tw.	17996
28	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).tw.	8177
29	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*").tw.	77
30	or/24-29	62771
31	23 and 30	1645
32	limit 31 to english language	1495
33	(comment or editorial or news or letter).pt.	1317548
34	32 not 33	1492

Unpublished draft

35	nonhuman/ not (nonhuman/ and human/)	3495981
36	34 not 35	1489
37	limit 36 to yr="1998-Current"	1301
38	limit 37 to embase	1039
39	limit 38 to (conference abstract or conference paper or conference proceeding or "conference review")	441
40	38 not 39	598

Note: conference papers are excluded in the protocol. Downloaded line 40 into the main RefMan file. Also downloaded line 39 and kept in a separate RefMan file.

Unpublished draft

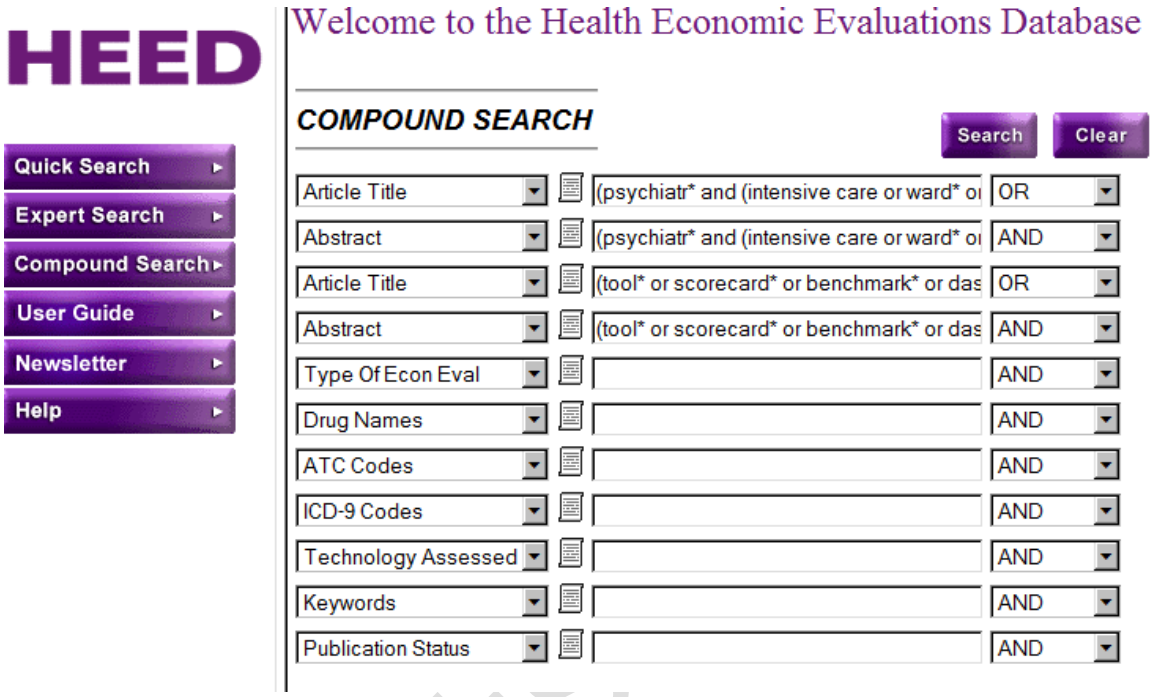
A.2.5 Database: HEED

Host: Wiley

Data Parameters: no restrictions

Date Searched: 1 December 2014

HEED search 1



Line 1 - title

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 2 - abstract

(psychiatr* and (intensive care or ward* or clinic* or unit* or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment))

Line 3 - title

(tool* or scorecard* or benchmark* or dashboard* or pathway* or approach* or model* or system* or judgement* or judgment* or algorithm*)

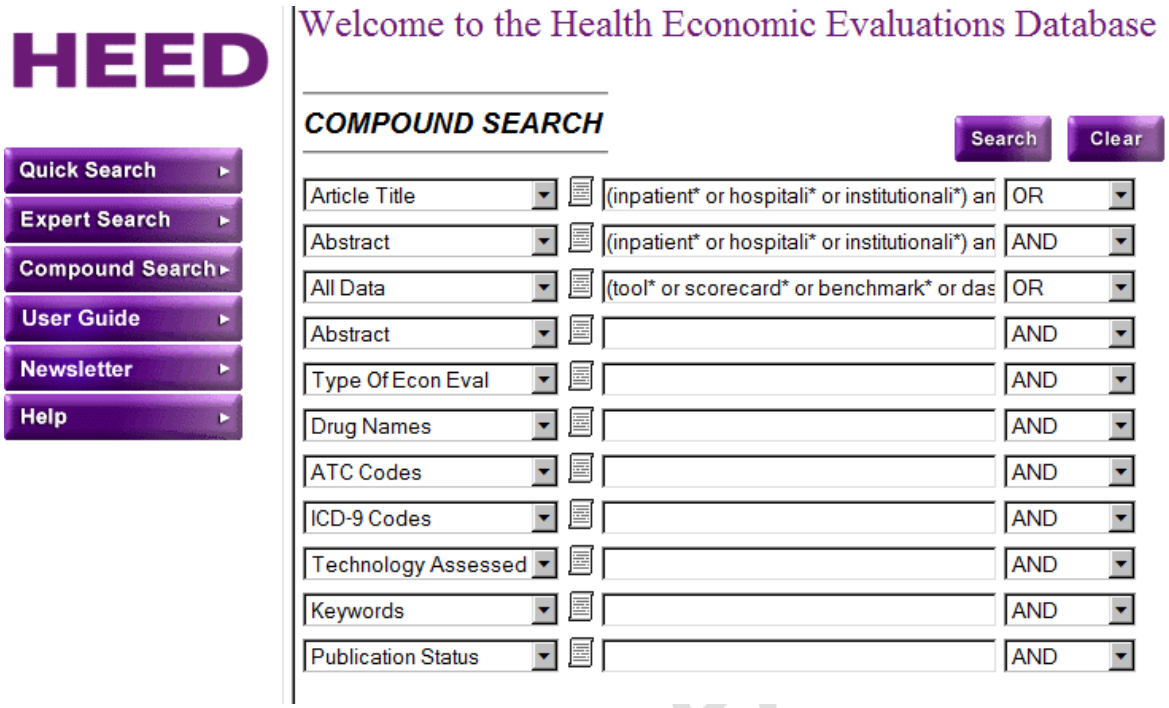
Line 4 - abstract

(tool* or scorecard* or benchmark* or dashboard* or pathway* or approach* or model* or system* or judgement* or judgment* or algorithm*)

Results n=73

Unpublished

HEED search 2



Line 1 - title

(inpatient* or hospitali* or institutionali*) and (mental or mentally or schizo* or psychiatr* or psychos*)

Line 2 - Abstract

(inpatient* or hospitali* or institutionali*) and (mental or mentally or schizo* or psychiatr* or psychos*)

Line 3 - All data

(tool* or scorecard* or benchmark* or dashboard* or pathway* or approach* or model* or system* or judgement* or judgment* or algorithm*)

Results n= 79

Unpublished

A.2.6 Database: HMIC

Host: Ovid

Data Parameters: **HMIC Health Management Information Consortium** 1979 to September 2014

Date Searched: 27 November 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or	3310

	center* or department* or institut* or accommodation* or commitment or aide* or nursing or nurse*)).mp.	
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	25129
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	7584
4	picu.mp.	54
5	(section 136 or s136 or "place* of safety").mp.	95
6	or/2-5	30362
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).mp.	37541
8	6 and 7	6119
9	1 or 8	8050
10	(care adj3 pathway*).mp.	1439
11	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).mp.	1812
12	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).mp.	1020
13	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).mp.	386
14	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*").mp.	19
15	or/10-14	4570

Unpublished draft

16	9 and 15	142
17	limit 16 to yr="1998-Current"	119

A.2.7 Database: Medline

Host: Ovid

Data Parameters: Ovid MEDLINE(R) 1946 to November Week 3 2014

Date Searched: 27 November 2014

#	Searches	Results
1	Psychiatric Department, Hospital/	5978
2	Hospitals, Psychiatric/	22719
3	Emergency Services, Psychiatric/	2175
4	Psychiatric Nursing/	15652
5	Psychiatric Aides/	382
6	commitment of mentally ill/	6313
7	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment)).tw.	29502
8	or/1-7	64073
9	Inpatients/	13829
10	Adolescent, Hospitalized/ or Child, Hospitalized/ or Hospitalization/	81649
11	Adolescent, Institutionalized/ or Child, Institutionalized/ or Institutionalization/	6781
12	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	1663471
13	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	61901

Unpublished draft

14	picu.tw.	1922
15	(section 136 or s136 or "place* of safety").tw.	352
16	or/9-15	1728585
17	exp mental disorders/	1002373
18	mental health services/	26458
19	mentally ill persons/	4476
20	psychiatry/ or adolescent psychiatry/ or child psychiatry/ or geriatric psychiatry/	40841
21	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	771203
22	or/17-21	1414697
23	16 and 22	194347
24	8 or 23	235720
25	"Personnel Staffing and Scheduling Information Systems"/	419
26	(care adj3 pathway*).tw.	2238
27	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).tw.	20034
28	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).tw.	12389
29	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).tw.	5889
30	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*").tw.	60
31	or/25-30	40445

Unpublished draft

32	24 and 31	788
33	limit 32 to english language	717
34	limit 33 to (comment or editorial or news or letter)	3
35	33 not 34	714
36	Animals/ not Humans/	4001991
37	35 not 36	714
38	limit 37 to yr="1998-Current"	594
39	remove duplicates from 38	560

A.2.8 Database: Medline in Process

Host: Ovid

Data Parameters: **Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations** November 26, 2014

Date Searched: 27 November 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse*)).tw.	2027
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	124887
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	5180
4	picu.tw.	277
5	(section 136 or s136 or "place* of safety").tw.	25
6	or/2-5	127438
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	55371

Unpublished draft

8	6 and 7	10024
9	1 or 8	11066
10	(care adj3 pathway*).tw.	327
11	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).tw.	4491
12	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).tw.	1072
13	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).tw.	694
14	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*").tw.	9
15	or/10-14	6523
16	9 and 15	68
17	limit 16 to english language	67
18	limit 17 to yr="1998-Current"	65

A.2.9 Database: PsychINFO

Host: Ovid

Data Parameters: **PsycINFO** 1806 to November Week 4 2014

Date Searched: 27 November 2014

#	Searches	Results
1	psychiatric hospitals/ or psychiatric units/	8527
2	psychiatric hospital programs/	1859
3	psychiatric hospitalization/	6246

Unpublished draft

4	psychiatric hospital admission/ or psychiatric hospital discharge/ or psychiatric hospital readmission/	3144
5	"commitment (psychiatric)"/	1540
6	psychiatric hospital staff/ or psychiatric aides/	1201
7	Psychiatric Nurses/	2790
8	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or aide* or nursing or nurse* or commitment)).tw.	37279
9	or/1-8	47139
10	hospitalized patients/	10678
11	hospitalization/	5177
12	institutionalization/	3282
13	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	241468
14	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	19740
15	picu.tw.	261
16	(section 136 or s136 or "place* of safety").tw.	100
17	or/10-16	256049
18	Psychiatric patients/	27268
19	Psychiatric Clinics/	1361
20	mental health services/	27326
21	exp mental disorders/	453112
22	psychiatry/ or adolescent psychiatry/ or child psychiatry/ or geriatric psychiatry/	29045

Unpublished draft

23	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).tw.	751478
24	or/18-23	900850
25	17 and 24	133209
26	9 or 25	155116
27	exp Work Scheduling/	1271
28	exp personnel supply/	599
29	(care adj3 pathway*).tw.	789
30	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).tw.	6718
31	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).tw.	4097
32	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).tw.	2138
33	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*" or "MHLD Workload Tool*").tw.	19
34	or/27-33	15441
35	26 and 34	723
36	limit 35 to english language	679
37	limit 36 to yr="1998-Current"	532

A.2.10 Database: Social Policy & Practice

Host: Ovid

Data Parameters: **Social Policy and Practice** 201410

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Date Searched: 27 November 2014

#	Searches	Results
1	(psychiatr* adj3 (intensive care or ward*1 or clinic*1 or unit*1 or setting* or hospital* or centre* or center* or department* or institut* or accommodation* or commitment or aide* or nursing or nurse*)).mp.	1879
2	(inpatient* or "in-patient*" or admission* or admitted or readmission* or re-admission* or readmitted or re-admitted or hospitali* or institutionali* or emergenc* or committed or sectioned or sectioning or detention* or detain*).tw.	13908
3	((acute or secure or rehab* or "tier 4") adj3 (ward*1 or clinic*1 or unit*1 or care or setting* or hospital* or centre* or center* or department* or institut* or service* or intervention* or healthcare* or accommodation* or residence* or trust or trusts)).tw.	3694
4	picu.mp.	13
5	(section 136 or s136 or "place* of safety").mp.	114
6	or/2-5	16658
7	(mental or mentally or schizo* or psychiatr* or psychosis or psychoses or psychotic* or suicid* or bipolar or mood disorder* or affective disorder* or depress* or CAMHS).mp.	53451
8	6 and 7	5508
9	1 or 8	6512
10	(care adj3 pathway*).mp.	610
11	("score card*" or scorecard* or "bench mark*" or benchmark* or "tool kit*" or toolkit* or "dash board*" or dashboard*).mp.	2000
12	((planning or staffing or acuity or severity or workload* or workforce*) adj3 (approach* or model* or system* or judgement* or judgment* or algorithm*)).mp.	1971
13	((personnel* or planning or staffing or acuity or severity or need* or patient* dependenc* or workload* or workforce* or nurse* or nursing*) adj3 tool*).mp.	342
14	(Shelford* or "Safer Nursing Care Tool*" or SNCT or "Nursing Hours Per Patient Day*" or NHPPD or "Ward Staff Per Occupied Bed" or "Professional Judgement Software*" or "Professional Judgment Software*" or "ward multiplier*" or "Nuffield Nursing Workforce Planning Tool*" or NMWWP or "Workforce Planning Project*" or "Nursing Observed Intensity Sickness Scale*" or "timed-clinical care activit*" or "Staffing Methodology Equalisation Tool*" or "Systematic Workload Implementation Tool*"	2

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or "MHLD Workload Tool*").mp.	
15 or/10-14	4798
16 9 and 15	123
17 limit 16 to yr="1998-Current"	106

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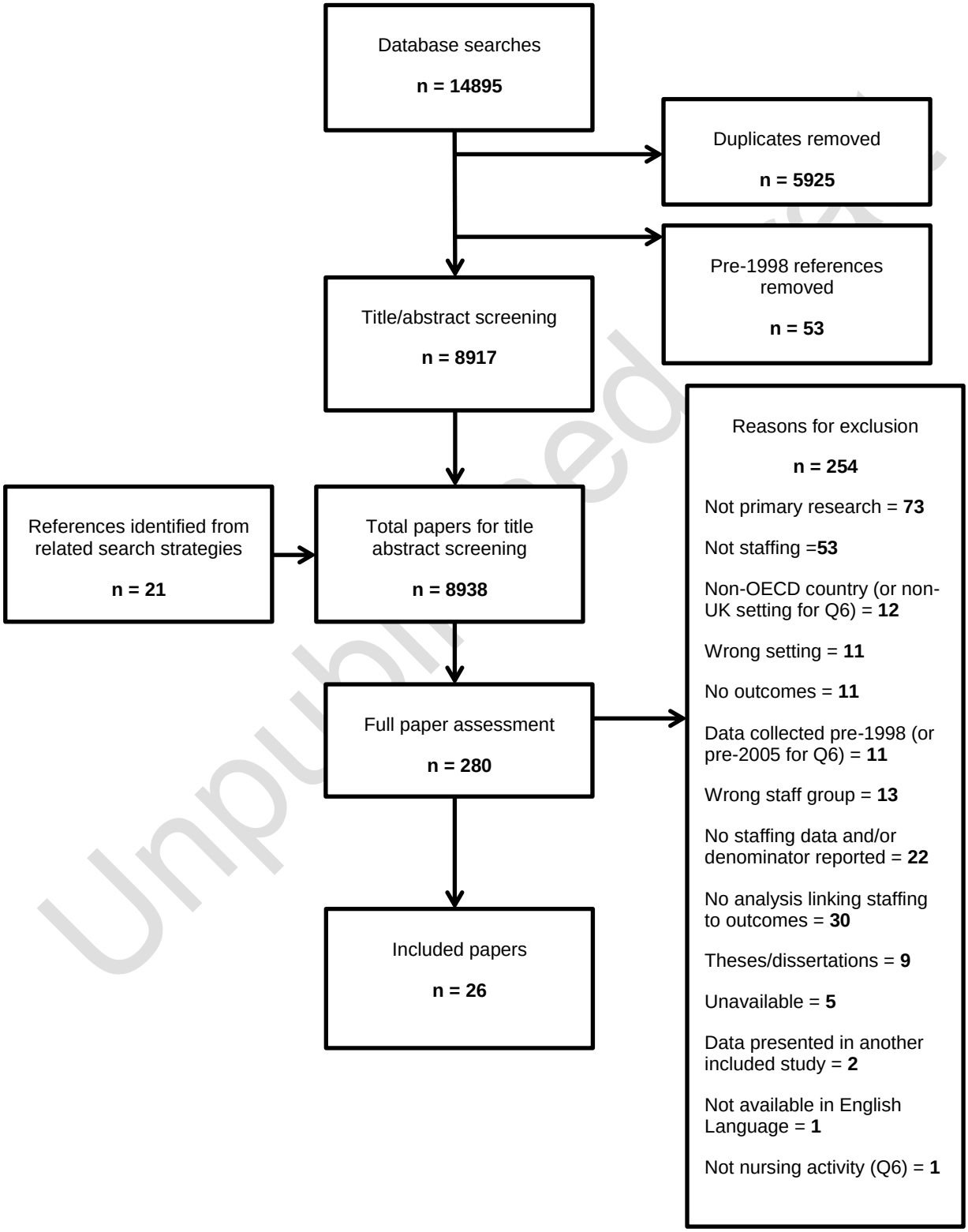
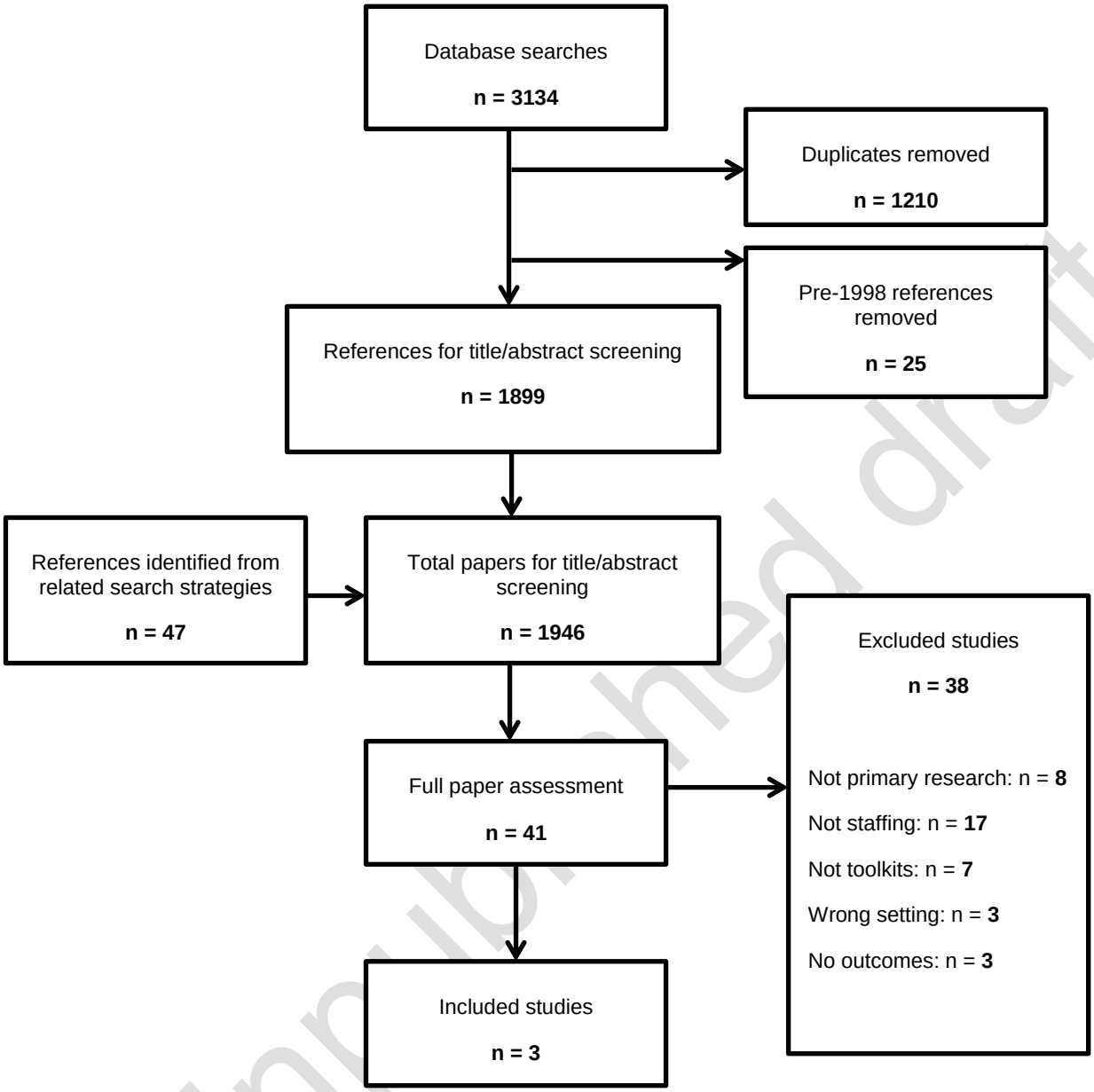
Appendix B: Included studies flow charts

B.1 Flow chart for review questions 1-6



Unpublished

B.2 Flow chart for review question 7



Unpublished draft

Appendix C: Review protocols

C.1 Review protocol for review questions 1-5 (Factors and indicators)

		Status
Review questions 1-5	What service user and other outcomes are associated with safe staffing for nursing in inpatient mental health settings? What service user, environmental, staffing and organisational factors affect nursing staff requirements in inpatient mental health settings?	This initially examined service user outcomes alone but was extended to cover all outcomes during the development of the guideline.

Context and objectives	• Is there evidence of a relationship between nursing staff levels or skill mix and increased risk of harm?
	• Do nursing staff levels or staff to service user ratios impact on outcomes?
	• Which outcomes should be used as indicators of safe staffing?
	• Identify whether any of the following factors affect nursing staff requirements and outcomes;
	  ○ Service user factors (such as case mix and volume, acuity (how ill the patent is), comorbid conditions, medication use, risk of crisis, turnover, availability of support [family, carers, relatives] and level of dependency on nursing care)
	  ○ Environmental factors (such as ward size and physical layout, ease of access to key specialties and the existence of other teams [such as crisis teams and acute day units] and how near they are to the ward)
	  ○ Staffing factors (such as the division and balance of tasks between registered nurses and healthcare assistants, experience, skill mix and specialisms, proportion of temporary staff, staff turnover, availability of and care and services provided by other multidisciplinary team members, management and administrative factors, staff and student teaching and supervision) arrangements)	

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		Status
	○ Organisational factors at a departmental level (such as organisational management structures and approaches, organisational culture, organisational policies and procedures, including staff training, policies and procedures for preventing self-harm and 'blanket rules' [these are rules whether written or matters of custom or practice that are applied to everyone at the service and are generally inflexible; an example of this may be the use of mobile phones]). • Identify how important each factor is in determining safe staffing requirements	
Searches	Sources to be searched: British Nursing Index (ProQuest), CINAHL (Ebsco), Cochrane Library (Wiley): CDSR, Central, DARE, HTA, NHS EED, Embase (Ovid), Health Management Information Consortium (HMIC) (Ovid), HEED (Wiley), Medline (Ovid), Medline-in-Process (Ovid), PsychINFO (Ovid) and Social Policy & Practice (Ovid). Supplementary search techniques: web searching for grey literature If any relevant systematic reviews are identified during the sifting process these will be used to identify any additional, relevant primary research by carrying out (backwards) citation searching using Web of Science Limits: date restriction of 1998 onwards (this is because practice and standards used within healthcare settings before 1998 differ compared with recent practice, making these studies of limited relevance) This specific cut-off date was selected based on topic specialist input The following publication types will be filtered out at the searching stage: news articles; commentaries; editorials; letters; "notes"; animal studies. Non-English language publications will also be excluded. Database results will be downloaded and de-duplicated in Reference Manager (version 12).	
Types of study to be included	Comparative studies (e.g. RCTs, before and after trials, cohort studies, cross sectional, case-control and simulation studies), economic evaluations (e.g. cost-utility analyses, cost-effectiveness studies, cost benefit studies, cost-consequences studies) and qualitative studies (interviews, surveys, focus groups, if associated with staffing). NB: Included studies within systematic reviews will also be included	

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		Status

Setting	• Inpatient mental health settings for adults and older adults. This includes:
	  ○ psychiatric intensive care units (PICUs)
	  ○ acute wards
	  ○ designated section 136 units or places of safety that are staffed by the nursing establishment of inpatient mental health settings
	  ○ rehabilitation units
	  ○ low and medium secure units
	• Tier 4 child and adolescent mental health services (CAMHS) inpatient settings.	

Patient group of interest	Adults, children and young people	
Staffing group of interest	Nursing staff who are part of the nursing staff establishment in inpatient mental health settings. This includes: • Registered nurses • Non registered nursing staff such as healthcare assistants or assistant practitioners	
Exposures(s)	This may be staffing levels of registered nurses, healthcare assistants and assistant practitioners (this measurement will include the denominator of activity which accounts for the size of the ward and the number of patients. For example this may be staff to patient ratio or staff per patient)	
Comparator(s)	This may be different staffing levels (e.g. this may be different staff to service user ratios compared against each other)	

Potential confounders or effect modifiers	Factors that potentially confound or modify the association between staffing levels and outcomes including;
	  ○ Service user factors
	  ○ Environmental factors
	  ○ Staffing factors
	  ○ Organisational factors at a departmental level	

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		Status
Outcome(s)	• Serious incidents, delivery of nursing care, reported feedback or other (see scope for examples of each category) • Economic outcomes (such as incremental costs, or incremental outcome/effects, and ICERS) • Cost and resource use	
Inclusion criteria	• Studies with comparative analysis (e.g. RCTs, before and after trials, cohort studies, cross sectional or case-control and simulation studies) examining the association between staffing levels and outcomes or staffing levels and factors (service user, environmental, staffing or organisational) • Economic evaluations (e.g. cost-utility analyses, cost-effectiveness studies, cost benefit studies, cost-consequences studies) examining staffing levels or skill mix. • Qualitative studies (interviews, surveys, focus groups, if associated with staffing)	
Exclusion criteria	• Staff requirements for other member of the wider multidisciplinary team (except as a confounder and/or modifier) • Measurement of staff levels that does not include an appropriate patient denominator • Conference abstracts and theses • Non-primary study publication (e.g. editorials) • Non-comparative studies • Non-English studies and studies carried out in non-OECD countries • Studies comparing effectiveness of different models of care • Studies carried out before 1998 (this includes data collection which is limited to before 1998) • No outcomes of interest reported • Any studies that do not relate to staffing (e.g. examining the association between factors and outcomes without considering staffing)	
Data extraction and quality assessment	Data extraction: Study information (including reference, study quality, study type, number of characteristics of participants, length of follow-up, data collection methods, staffing	

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		Status
	measurement, statistical methods used, outcome measures including definitions, results, author's conclusions and additional comments)) will be extracted into evidence tables. Data on serious incidents, delivery of nursing care, reported feedback or other will be extracted as outcomes of interest. Modified GRADE tables may be used to present the results. Quality assessment: A quality appraisal checklist appropriate for the study design will be used from the developing NICE guidelines manual. For economic evaluations: the economic evaluation checklist in the NICE guideline – the manual Appendix H, will be used to assess study quality. Deviations from unified manual: None identified	
Strategy for data synthesis	Results from all included studies may be reported using modified GRADE. Meta-analysis techniques will be considered if appropriate.	A narrative approach was taken for this evidence review as there is no published guidance for using modified GRADE.
Analysis of subgroups	The following patient subgroups may need to be considered; • People under section • Children and young people • Older adults • People involved with the criminal justice system In addition, results may be reported separately for registered nurses, healthcare assistants and assistant practitioners	
Other information	None	

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C.2 Review protocol for review question 6 (Nursing care activities)

		Status
Review question 6	What core nursing care activities should be considered when determining nursing staff requirements in inpatient mental health settings?	
Context and objectives	• What key activities are currently carried out by nursing staff? • Do the activities carried out by registered nurses, healthcare assistants and assistant practitioners differ? • How much time is needed for each activity? • Are activities that are carried out by nursing staff associated with service user outcomes?	
Searches	Sources to be searched: British Nursing Index (ProQuest), CINAHL (Ebsco), Cochrane Library (Wiley): CDSR, Central, DARE, HTA, NHS EED, Embase (Ovid), Health Management Information Consortium (HMIC) (Ovid), HEED (Wiley), Medline (Ovid), Medline-in-Process (Ovid), PsychINFO (Ovid) and Social Policy & Practice (Ovid). Supplementary search techniques: web searching for grey literature If any relevant systematic reviews are identified during the sifting process these will be used to identify any additional, relevant primary research by carrying out (backwards) citation searching using Web of Science Limits: date restriction of 1998 onwards (this is because practice and standards used within healthcare settings before 1998 differ compared with recent practice, making these studies of limited relevance) This specific cut-off date was selected based on topic specialist input The following publication types will be filtered out at the searching stage: news articles; commentaries; editorials; letters; “notes”; animal studies. Non-English language publications will also be excluded. Database results will be downloaded and de-duplicated in Reference Manager (version 12).	
Types of study to be included	Qualitative studies (e.g. cross-sectional surveys, interviews, focus groups, questionnaires) and studies reporting comparative analyses (e.g. RCTs, before and after trials, cohort studies, cross sectional, case-control) will be included	

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		Status

Setting	• Inpatient mental health settings for adults and older adults. This includes:
	  ○ psychiatric intensive care units (PICUs)
	  ○ acute wards
	  ○ designated section 136 units or places of safety that are staffed by the nursing establishment of inpatient mental health settings
	  ○ rehabilitation units
	  ○ low and medium secure units
	• Tier 4 child and adolescent mental health services (CAMHS) inpatient settings.	

Patient group of interest	Adults, children and young people	
Staffing group of interest	• Registered nurses working in inpatient mental health settings who are part of the nursing establishment (this is the number of registered nurse, healthcare assistant and assistant practitioner posts funded to work in a particular ward, department or hospital). This includes mental health nurses (including paediatric mental health nurses) • Healthcare assistants and assistant practitioners working in inpatient mental health settings	
Exposures(s)	For comparative studies this may be activities carried out by registered nurse (this could also relate to different levels of registered nurses)	
Comparator(s)	For comparative studies this may be activities carried out by healthcare assistant or assistant practitioner	
Potential confounders or effect modifiers	These may include factors that may impact on staffing requirements or the ability to carry out activities (e.g. ward size, acuity, staff sickness)	
Outcome(s)	• Activities and tasks carried out by registered nurses and healthcare assistants working on acute wards in mental health inpatient settings • Time taken to carry out key activities and tasks • Serious incidents, delivery of nursing care, reported feedback or other (see scope for examples of each category)	

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		Status
Inclusion criteria	• Qualitative (e.g. cross-sectional surveys, interviews, focus groups, questionnaires) or comparative studies focusing on key activities and tasks carried out by registered nurses and healthcare assistants which were carried out the UK in 2005 or after (this is because the aim of the review question is to examine current practice and it is assumed that practice and standards used within healthcare settings over 10 years ago differ compared with recent practice making these studies of limited relevance). The inclusion criteria will also be restricted to UK only as this review question aims to identify current practice within NHS settings.	
Exclusion criteria	• Opinions on what activities should be carried out by registered nurses, healthcare assistants or assistant practitioners • Conference abstracts and theses • Non-primary study publication (e.g. editorials) • Study design not of interest • Studies that are not reported in English • Studies carried out before 2005 (this includes data collection which is limited to before 2005) • Studies that were carried out outside of the UK • No outcomes reported	
Data extraction and quality assessment	Data extraction: Study information (including reference, study quality, research question, theoretical approach, data collection methods, methods of analysis, sample details, results and author's conclusions) will be extracted into evidence tables. Data on activities and tasks and time taken to carry these out will be extracted as outcomes of interest. For comparative studies serious incidents, delivery of nursing care, reported feedback or other outcomes will be extracted. Applicability will not be assessed as only studies carried out in the UK will be included. Quality assessment: CASP will be used to assess study quality Deviations from unified manual: None identified	
Strategy for data synthesis	If multiple studies are included, results from all included studies will be reported in table format with study details, study quality and results for nursing and healthcare assistant activities. No further analysis will be carried out.	

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		Status
Analysis of subgroups	Papers may report results for registered nurses, healthcare assistants and assistant practitioners separately. Where results have been reported for subgroups of the population, these will be extracted.	
Other information	References found: Bee et al (2006). Mapping nursing activity in acute inpatient mental healthcare settings. Journal of mental health 15 (2); 217-226	

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C.3 Review protocol for review question 7 (Approaches and toolkits)

		Status
Review question 7	What approaches for identifying safe staffing for nursing and/or skill mix, including toolkits, are effective in inpatient mental health settings and how frequently should they be used?	
Context and objectives	• To assess whether a systematic approach to calculate staffing requirements and skill mix is associated with better outcomes compared with alternative approaches (e.g. professional judgement) • What evidence is available on the reliability and/or validity of any identified toolkits? • To assess how often they should be used	
Searches	Sources to be searched: British Nursing Index (ProQuest), CINAHL (Ebsco), Cochrane Library (Wiley): CDSR, Central, DARE, HTA, NHS EED, Embase (Ovid), Health Management Information Consortium (HMIC) (Ovid), HEED (Wiley), Medline (Ovid), Medline-in-Process (Ovid), PsychINFO (Ovid) and Social Policy & Practice (Ovid). Supplementary search techniques: web searching for grey literature If any relevant systematic reviews are identified during the sifting process these will be used to identify any additional, relevant primary research by carrying out (backwards) citation searching using Web of Science Limits: date restriction of 1998 onwards (this is because practice and standards used within healthcare settings before 1998 differ compared with recent practice, making these studies of limited relevance) This specific cut-off date was selected based on topic specialist input The following publication types will be filtered out at the searching stage: news articles; commentaries; editorials; letters; “notes”; animal studies. Non-English language publications will also be excluded. Database results will be downloaded and de-duplicated in Reference Manager (version 12).	

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		Status
Types of study to be included	Studies with comparative analysis (e.g. RCTs, before and after trials, cohort studies, cross sectional, or case-control and simulation studies), economic evaluations (e.g. cost-utility analyses, cost-effectiveness studies, cost benefit studies, cost-consequences studies) and qualitative studies (interviews, surveys, focus groups, if associated with staffing levels). NB: Included studies within systematic reviews will also be included	

Setting	• Inpatient mental health settings for adults and older adults. This includes:
	  ○ psychiatric intensive care units (PICUs)
	  ○ acute wards
	  ○ designated section 136 units or places of safety that are staffed by the nursing establishment of inpatient mental health settings
	  ○ rehabilitation units
	  ○ low and medium secure units
	• Tier 4 child and adolescent mental health services (CAMHS) inpatient settings.	

Patient group of interest	Adults, children and young people	
Staffing group of interest	• Registered nurses working in inpatient mental health settings who are part of the nursing establishment (this is the number of registered nurse, healthcare assistant and assistant practitioner posts funded to work in a particular ward, department or hospital). This includes mental health nurses (including paediatric mental health nurses) • Healthcare assistants and assistant practitioners working in inpatient mental health settings	
Intervention(s)	Any approach/method/process/toolkit for identifying registered nurse and healthcare assistant staffing requirements such as professional judgement, the MHLD workload tool and nursing hours per patient day	
Comparator(s)	• Professional judgement • Any approach/method/toolkit used for determining staffing requirement	

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		Status
Potential confounders or effect modifiers	N/A	
Outcome(s)	• Serious incidents, delivery of nursing care, reported feedback or other (see scope for examples of each category) • Economic outcomes (such as incremental costs, or incremental outcome/effects, and ICERS) • Cost and resource use	
Inclusion criteria	• Studies with comparative analysis (e.g. RCTs, before and after trials, cohort studies, cross sectional or case-control and simulation studies) examining the association between toolkits/approaches/processes/methods to determine staffing levels and outcomes • Economic evaluations (e.g. cost-utility analyses, cost-effectiveness studies, cost benefit studies, cost-consequences studies) examining toolkits/approaches/processes/methods to determine staffing levels and outcomes • Qualitative studies (interviews, surveys, focus groups, if associated with staffing)	
Exclusion criteria	• Studies that look solely at the reliability and validity of tools to assess factors and do not link the tool to staffing decisions (e.g. patient dependency tools) • Conference abstracts and theses • Non-primary study publication (e.g. editorials) • Studies that do not report comparative analysis • Non-English studies and those carried out in non-OECD countries • Studies comparing effectiveness of different models of care • Studies carried out before 1998 (this includes data collection which is limited to before 1998) • No outcomes reported • Toolkits or processes evaluated in non-mental health inpatient settings	

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		Status
Data extraction and quality assessment	Data extraction: Study information (including reference details, study type, quality, description of intervention, comparator, methods, setting, participants, follow-up, analysis, results and quality) will be extracted into evidence tables. Data on the outcomes listed will be extracted. Applicability will be assessed using GRADE. Quality assessment: A quality appraisal checklist appropriate for the study design will be used from the developing NICE guidelines manual. For economic evaluations: the economic evaluation checklist in the NICE guideline – the manual Appendix H, will be used to assess study quality. Deviations from unified manual: None identified	
Strategy for data synthesis	If multiple studies are included, results from all included studies may be reported using modified GRADE tables.	A narrative approach was taken for this evidence review as there is no published guidance for using modified GRADE.
Analysis of subgroups	The following patient subgroups may need to be considered; • People under section • Children and young people • Older adults In addition, results may be reported separately for registered nurses, healthcare assistants and assistant practitioners	
Other information	None	

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Appendix D: Evidence tables

D.1 Evidence Table 1: The City-128 Study

The **City-128 Study** was designed to test which factors help create a calmer ward. The hypothesis being that these wards would be those where the staff positively appreciated patients, could contain their natural emotional responses to difficult patient behaviour, and provided an effective structure of rules and routines for those in their care. The study has become one of the largest cross sectional studies of acute psychiatric inpatient services yet undertaken. Due to its size and uniqueness, the City-128 dataset has also been used to explore a number of related issues. The majority of these analyses have been cross-sectional and have utilised multi-level modelling with Poisson regression. This is a technique that provides accurate estimates of associations with hierarchically structured data (shifts, within wards, within NHS Trusts).

These analyses have been published in a large number of journal papers. To avoid duplication and for ease of understanding, methods and processes for all these papers are reported below. Any differences in methods and statistical analyses are reported in tables for each individual paper.

Overall aim: The City-128 study was designed to assess the contribution of patient characteristics, service environment, physical environment, staff demographics, staffing characteristics, containment usage, and staff attitudes to a wide range of patient outcomes (including self-harm, suicide, aggression, observational techniques and medication issues).

Country where the study was carried out: UK

Study design: A prospective multivariate cross-sectional survey.

Overall Risk of Bias: [+]

Setting: Acute adult inpatient psychiatric wards

Study dates: Data were collected over a period of six months between 2005 and 2006.

Source of funding: National Institute for Health Research (NIHR).

Sampling frame: All (n=551) existing acute psychiatric wards in England at the beginning of the study period.

Sampling procedure: Sample size calculations designed to achieve 80% power and 5% significance level with 20 independent variables and incorporating intra-cluster correlations (ICC) to account for between ward variation, and regional variation were conducted. This resulted in a target sample size of 128 acute NHS psychiatric wards situated in three distinct geographical centres (London, Central England, Northern England). The initial plan was to randomly sample wards to obtain just over 40 wards per regional research base. However to achieve the requisite sample size the Northern and central England centres had to recruit all available wards within reasonable travelling distance of their research base. In London it was possible to randomly sample from a list of 112 wards.

Number and characteristics of participants: A total of 136 wards participated (representing 25% of the estimated total of 551 wards in England).
The 136 wards of the sample were situated in 67 hospitals within 26 NHS Trusts. The mean number of beds per ward was 21, with a range of 11 to 30, with an average of 51% of these beds in single rooms. All were equipped with a separate smoking room, but only 82% had a quiet room, and even fewer (60%) had a secure outdoor space for

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patients.

Sample size: Final dataset consisted of 46,000 end of shift reports on conflict and containment frequencies, 8,000 staff questionnaires, 1,000 patient questionnaires, plus data on multidisciplinary staffing complements and deployment, ward physical environments, and service contexts within which they operated.

Exclusion criteria: Wards that were organised on a speciality basis, or that planned to change population served, location, function, or which were scheduled for refurbishment during the course of the study were excluded.

Inclusion criteria: Acute psychiatric wards were defined as those that primarily serve acutely mentally disordered adults, taking admissions in the main directly from the community, and not offering long-term care or accommodation.

Data collection method: Data were collected over a period of six months on each ward. Commencement of data collection by selected wards was staggered over an 18 month period, for logistical reasons. In essence this meant that at each research centre groups of wards started the study in four or five cohorts.
Four methods of data collection:

1. Information on the **ward physical environment** and the **policies** in operation was collected on a site visit by a researcher and a form completed by the ward manager: Ward data collected on 2 forms, one completed by the visiting researcher with the ward manager, the second completed by manager alone. The replies enabled the calculation of composite scores for physical environment quality, ward observability, actual staff establishments for all relevant disciplines, levels of security (banned items, restrictions on patients, searching, drug and alcohol monitoring, presence of security guards, cctv, door security, etc.), as well as many other variables.
2. Data on the main outcome measures were collected by **end of shift reports** by the nurses in charge: shift report version of the Patient-Staff Conflict Checklist (PCC-SR) was used to log the frequency of patient conflict behaviours (e.g. self-harm, absconding, violence, medication refusal, etc.), and the staff containment measures used to maintain safety (e.g. intermittent special observation, constant special observation, seclusion, physical restraint etc.), and was compiled using strict definitions at the end of every nursing shift. Incorporates aspects of the Bongar Lethality Score. It has an IRR score of 0.69.
3. The ward multidisciplinary team were required to complete a selection of standardised questionnaires: Attitude to Personality Disorder Questionnaire (APDQ) - staff attitude to difficult patients. Order and Organisation, Programme Clarity and Staff Control subscales of the Ward Atmosphere Scale (WAS) - ward structure. Multifactor Leadership Questionnaire (MLQ) - quality of ward leadership. Team Climate Inventory (multidisciplinary team cohesion). Maslach Burnout Inventory - staff burnout.
4. Smaller samples of patients and staff were asked to complete questionnaires or participate in interviews: Attitude to Containment Measures Questionnaire (ACMQ) - measures views on acceptability, efficacy, dignity, safety of patients and safety for staff of different forms of containment for disturbed behaviour. The Conflict and Containment Economic Interview - staff time costs of conflict and containment events.

How was staffing measured/defined?

Staffing levels: Mean number of nursing staff in post per bed. Full-time equivalent (FTE) nursing staff in post per bed (mean 0.99, SD 0.22). **Staffing mix:** the mean proportion of staff who were qualified nurses was 0.61 (s.d. 0.12), and the mean vacancy rate was high, at 15%. Of the Ward Managers, 37% only worked from 9am to 5pm, with the rest doing shifts occasionally or on a regular basis. A minority of wards (18%) employed permanent night staff only, whereas the rest operated some form of internal shift rotation of staff. Male-only and female-only wards were in the minority, 13% and 14% respectively, with most (73%) being for both genders. A significant proportion of wards (41%) had no establishment Occupational Therapists allocated to them, and the vast majority (87%) had no dedicated Clinical Psychologist time at all. Where they were available, the actual numbers of these staff in post were even lower.

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Statistical analysis:
Mean daily rate of outcome events was standardised to 20 beds so that variation due to the size of the wards was removed.

Random effects modelling allows for the fact that the wards were only a sample of all possible wards and similarly Trusts were only a sample from all possible Trusts. A three level model was explored with shifts at the lowest level (1), wards at level 2 and Trusts at level 3. That is, shifts were nested in wards, which were nested within Trusts. Shifts were chosen as a level because of clustering effects within AM, PM and Night shifts; wards for similar reasons, and Trusts because they represent organisational units with single local policies and operational procedures. The penalised quasilikelihood method of estimation (PQL) was used with second order linearisation, since this method does not tend to underestimate variance estimates. The model was produced through a staged process of backward selection, deselecting the least significant at each stage. Each group of variables (domain) described above was used to build a separate initial model, then the significant variables were used to construct a final comprehensive model using the same process of backward selection. While there were significant associations between some of the independent variables in our study, sometimes to the extent of multicollinearity, there was no logical reason why any particular variables should be considered to be intervening, rather than potentially causal in their own right. However it is possible that some variables might play that role, perhaps particularly conflict behaviours other than self-harm. We therefore present the results of the separate domain analyses, as well as the final complete models. Two methods were used to assess whether multicollinearity among the independent variables had influenced our resulting models. Firstly, pair wise correlations of continuous variables in the models were examined. All were less than 0.4, indicating that there is no multicollinearity. The second test for multicollinearity was using the Variance Inflation Factor (VIF). The VIF indicates the increase in variance when multicollinearity exists in the independent variables. VIF values should be close to one a value exceeding ten shows unacceptable multicollinearity. Our VIF values are no larger than 1.4 for the all self-harm, 1.5 for the minor self-harm, and 1.1 for the moderate self-harm models.

Limitations: Although the City-128 study employed a prospective design and robust analysis methods, there is a risk that certain apparently significant findings may have arisen by chance. This is because a very large number of statistical analyses were conducted to test associations between multiple combinations of factors and outcomes. Another potential limitation of the City-128 study is that some analyses report outcomes inconsistently and thus it is not always clear whether certain factors were significantly associated with certain outcomes or not.

Many of the variables are analysed using domain and then combined stepwise regression analyses (final analysis). Only the final analyses adjust for all other variables. As such it is these data which are used to inform the evidence review.

Study details	Outcomes and control variables Statistical analysis	Results	Overall risk of bias Comments
Author (year) Bowers et al 2007a **Study type** A prospective multivariate cross-sectional survey. **Aim of the study**	**Outcomes** All self-harm **Control variables** Characteristics of patients; service environment; physical environment; patient routine; conflict;	**Results** There were 4062 shifts during which a self-harm incident occurred, representing 8.7% of the total. Descriptive statistics and univariate association of 14 different staffing variables with self-harm presented in Table 9 of the paper. **Results from multilevel models:** Number of qualified nurses on duty, number of student nurses on duty, and proportion of white staff on duty were all shown to be significantly associated with **all self-harm**,	**Overall risk of bias** + **Reviewer conclusion** Likelihood of self-harm incidents decreased slightly as the number of qualified

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To examine the link between special observation and self-harm in the context of other containment methods and conflict behaviours, controlling for the potential confounding effects of patient characteristics and environment quality. **Data included in:** Q4	containment; **staff demographics**; staff attitudes. **Statistical analysis** Multi-level random effects modelling. Mean daily rate of outcome events were standardised to 20 beds so that variation due to the size of the wards was removed. Multilevel random effects modelling on total Bongar Lethality Scale score for the shift dichotomised into “no incidents” and “incidents”. Variance partitioning methods were used to explore what levels of the model(shift, ward, hospital) were associated with self-harm. Sensitivity analyses were conducted to assess the impact of different ways of dealing with missing data (lowest 10 responding wards, excluding lowest 10 wards with steepest decline in response rates, excluding admissions with more than 3 data items missing). The majority of findings from the modelling exercise must be considered robust, as they were reproduced repeatedly across sensitivity analyses.	however this only remained significant for **number of qualified nurses on duty** (OR 0.941, 95% CI 09.01 to 0.982, $p<0.01$)* and **number of student nurses** on duty (OR 1.05, 95% CI 1.012 to 1.090, $p<0.01$) in the final combined model.** Number of qualified nurses on duty, number of unqualified nurses on duty, number of student nurses on duty, and proportion of white staff on duty were all shown to be significantly associated with **minor self-harm**, however this only remained significant for **number of qualified nurses on duty** (OR 0.943, 95% CI 0.899 to 0.988, $p<0.05$), number of **unqualified nurses on duty** (OR 1.058, 95% CI 1.009 to 1.109, $p<0.05$) and **number of student nurses** on duty(OR 1.057, 95% CI 1.016 to 1.099, $p<0.01$) in the final combined model. Proportion of white staff on duty was shown to be significantly associated with **moderate self-harm** (OR 0.696, 95% CI 0.494 to 0.981, $p<0.05$), however this did not remain significant in the final combined model. *Level of effect measured at Trust level. **Final model adjusted for the following variables: % of service users with schizophrenia, % of service users under 35, % of Caribbean service users, service users’ socioeconomic status (as measured by the IMD), number of admissions during the shift, number of admissions per day, incidents of aggression towards others, incidents of refusing to see workers, absconding (officially reported), door locking status, PRN administration of medication, seclusion, intermittent observation, manual restraint and the number of student nurses on duty. All these variables retained significance in the final model ($p\leq0.05$), apart from door locked for less than 1 to 3 hours. The proportion of white staff was only included as a significant factor in domain level analyses.	nurses on duty increased. **Author's conclusions** “For staff demographics, 'qualified nursing staff on duty' seems to be associated with self-harm at the level of Trust, perhaps indicating that this variable represents some underlying dimension of Trust functioning."

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Study details Population and setting Statistical analysis	Outcomes and control variables Statistical analysis	Results	Comments
Author (year) Baker et al 2009 **Study type** A multivariate cross-sectional survey **Aim of the study** To explore the relationship of medication-related conflict to other conflict behaviours, the use of containment methods, service environment, physical environment, patient routines, staff demographics and staff group variables. **Data included in:** Q4, Q5	**Outcomes** **Medication related conflict behaviours** Refusal of regular medication, refusal of PRN medication, demanding PRN. **Control variables** Containment methods, service environment, physical environment, patient routines, **staff demographics** (regular qualified nurses on duty, regular unqualified nurses on duty, bank/agency qualified nurses on duty, bank/agency unqualified nurses on duty, student nurses on duty) and staff group variables. **Statistical analysis** Multilevel random effects modelling on regular medication refusal, PRN medication refusal, demanding PRN medication utilising Poisson regression, with number of beds on each ward as the exposure or offset variable.	**Results** The mean daily rate (at ward level standardised to 20 beds) of incidents of regular medication level refusal was 0.89 (SD 0.52), PRN medication refusal 0.30 (SD 0.19), and demanding PRN medication 1.09 (SD 063). **Results from multilevel models:** Number of qualified nurses on duty, number of unqualified staff, number of bank/agency unqualified staff, and number of consultant psychiatrists were all shown be significantly associated with **the refusal of regular medication**, however this only remained significant for **number of qualified nurses on duty** (IRR 0.941, 95% CI 09.21 to 0.961, p<0.001) and **number of unqualified nurses** on duty (IRR 0.963, 95% CI 0.944 to 0.982, p<0.01) in the final combined model[a]. Numbers of **qualified and unqualified bank/agency staff, demadning PRN medication, MBI subscales measuring emotional exhaustion and personal accomplishment, depersonalisation, and WAS subscales measuring, order, organisation and program clarity** were shown to be significantly associated with **refusal of PRN medication** however, these variables did not remain significant in the final combined model. No staff factors (MBI personal accomplishment, MBI emotional exhaustion and depersonalisation, WAS order, organisation, program clarity) were significantly associated with demanding PRN at either the domain or final model. Number of qualified nurses on duty, number of bank/agency unqualified staff, and number of student nurses were all shown be significantly associated with **demanding PRN medication**, however this only remained significant for **number of qualified nurses on duty** (OR 0.897, 95% CI 0.879 to 0.914, p<0.001) and **number of student nurses** on duty (OR 0.967, 95% CI 0.950 to 0.984, p<0.001) in the final combined model.[b] Organisational factors measured using the WAS (for order, organisation and program clarity) were significantly associated with refusal of regular medication in the final combined model (IRR 0.923, 95% CI 0.885 to 0.996, p<0.05)[a].	**Overall Risk of Bias** + **Other information** **Reviewer conclusions** Provision of an effective structure for the ward was accompanied by reduced rates of refusal of regular medication. Higher regular staffing levels (i.e. not the use of temporary staff) were associated with lower rates of medication refusal. **Author's conclusions** "Higher regular staffing levels (not the use of temporary staff) were associated with lower rates of [regular] medication refusal." p84 Nurse staffing levels were shown to have a 'strong relationship' with demanding PRN medication.

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		[a] Final model adjusted for the following variables: % of service users admitted for harm to self, service users' mean score on the Attitude Toward Containment Measures Questionnaire (ACMQ), whether ward is served by crisis intervention team, whether ward is served by early intervention team, verbal aggression, smoking in a no-smoking area, refusing to eat, refusing to drink, refusing to attend to personal hygiene, refusing to get up out of bed, reusing to go to bed, refusing to see workers, attempting to abscond, refusing PRN medication, demanding PRN medication, door locking status, total restrictions on patients, whether service users were given PRN medication, whether service users were given intramuscular medication, intermittent special observation, special observation with and without engagement, show of force, time out, Ward Atmosphere Scale (WAS) scores (for order, organisation and program clarity). All these variables retained significance in the final model ($p \leq 0.05$), apart from door locked intermittently and for less than a full shift. Only staffing factors and organisational factors as measured by the WAS included in the final combined model are presented here. The number of bank/agency unqualified staff were only included as a significant factor in domain level analyses. [b] Final model adjusted for the following variables: seclusion availability, verbal aggression, smoking in a no-smoking area, refusing to eat, refusing to attend to personal hygiene, refusing to go to bed, refusing to see workers, alcohol use, other substance misuse, attempting to abscond, absconding (missing without permission), refusing regular medication, refusing PRN medication, door locking status, whether service users were given PRN medication, whether service users were given intramuscular medication, intermittent special observation, special observation with and without engagement, show of force, time out, and the number of student nurses. All these variables retained significance in the final model ($p \leq 0.05$), apart from door locked intermittently and for less than one hour or more than 3 hours. Only staffing factors included in the final combined model are presented here. The number of bank/agency unqualified staff were only included as a significant factor in domain level analyses.	
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Bowers 2009a	**Outcomes** **Conflict** (e.g. aggression,	**Results** The proportion of male staff, and number of nurses per bed were significantly	**Overall Risk of Bias**

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Study type Multivariate cross sectional **Aim of the study** To test the hypothesis that staff factors have a significant influence on conflict and containment rates on wards. **Data included in:** Q4, Q5	substance use, absconding, rule breaking, self-harm, medication related) and **containment** (PRN, coerced medication, sent to intensive care, seclusion, observation x3, manual restraint, show of force, time out). **Control variables** **Staff demographics:** FTE nursing staff in post per bed, proportion white, proportion African, proportion other, proportion male. **Statistical analysis** Hierarchical multi-level modelling	associated with **total conflict,** however this only remained significant for proportion of male staff in the final model (coefficient 0.381, SE 0.120, p=0.004).[a] The proportion of white staff was shown to be significantly related to **total containment rates** in the final model (coefficient 0.13, SE 0.124, p=0.018).[b] Ward structure and other **organisational factors** measured using the WAS order and organisation subscale were significantly associated with **total conflict** (e.g. aggression, substance use, absconding, rule breaking etc.) (coefficient -0.48, SE 0.023, p=0.048, r^2 0.184).[a] Ward structure and other organisational factors as measured by the WAS were significantly associated with a reduction in total containment scores (e.g. coerced medication, sent to intensive care, seclusion, special observation, manual restraint, show of force, etc.) (coefficient -0.092, SE 0.031, p=0.007).[b] Aspects of quality of ward leadership as measured by the Multifactor Leadership Questionnaire (MLQ) (transactional leadership subscale) were also associated with a reduction in total containment (coefficient -0.064, SE 0.025, p=0.016).[b] [a] Final model adjusted for service users' socioeconomic status (measured by Index of Multiple Deprivation; IMD), physical environment quality, proportion of beds in single rooms, locked doors, show of force, manual restraint, and the Ward Atmosphere Scale (WAS) order and organization subscale. All these variables retained significance in the final model (p≤0.05). Only staffing factors included in the final combined model for total conflict are presented here. Staff attitudes and burnout (as measured by the Team Climate Inventory [TCI] scale and the Maslach Burnout Inventory [MBI]) were only included as significant factors in domain-level models. Staff ethnicity was analysed in the univariate analyses but was not included in either the domain or final combined models for total conflict. [b] Final model adjusted for the following variables: medication-related conflict, the number of occupational therapists, Ward Atmosphere Scale (WAS) score on the program clarity subscale, and score on the transactional leadership subscale of the Multifactor Leadership Questionnaire (MLQ). All these variables retained significance in the final model (p≤0.05). Only staffing factors included in the final combined model for total containment are presented here.	+ **Reviewer conclusions** Increased episodes of conflict were associated with higher numbers of male nursing staff. Increased episodes of containment were associated with higher numbers of white nursing staff on shift. Provision of an effective structure for the ward was associated with a reduction in overall conflict. Effective ward structures and other organisation factors are associated with a reduction in overall levels of containment. Greater team cohesion is associated with lower rates of constant observation. **Author's conclusions** "Staff factors are significantly related to total conflict and containment rates on wards. Staff ethnicity retained a significant association with containment rates in the final model, however this relationship is complex and the racial ethnic concordance of staff and

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			patients may be more important than simple proportions in the production of conflict events on the wards." "There are a number of ways in which conflict on the wards might be reduced, including a greater emphasis on the production of effective structure and order on the ward."
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Bowers et al 2013 **Study type** Secondary analysis of cross-sectional data. **Aim of the study** Previous analysis of City-128 data had found that the correlation between conflict and containment was weak, albeit statistically significant (r 0.25, *p*=0.003). Given that this finding was considered to be counterintuitive further analysis was considered necessary to illuminate this result. This study therefore aimed to determine which variables from City-128	**Outcomes** **Conflict and containment levels x 4** (based on a typology of wards) 1. Low conflict & low containment 2. Low conflict & high containment 3. High conflict & high containment 4. High conflict & low containment **Control variables** **Staff demographics -** male staff, white staff, total staff on duty, temporary staff on duty, qualified staff, unqualified staff. **Statistical analysis** Ward level analysis was	**Results** Statistically significant staffing features: **<u>High conflict/high containment wards</u>** Higher levels of temporary staff[1] Higher levels of unqualified staff[2] **<u>High conflict/low containment</u>** Higher levels of male staff[3] Higher levels of white staff[4] [1] Compared with low conflict/high containment wards (*p*<0.01), low conflict/low containment wards (*p*<0.01) and low conflict/high containment wards (*p*<0.001). [2] Compared with low conflict/high containment wards (*p*<0.01), low conflict/low containment wards (*p*<0.01) and low conflict/high containment wards (*p*<0.001) [3] Compared with low conflict/high containment wards and low conflict/low containment wards (*p*<0.001) and high conflict/high containment wards (*p*<0.01) [4] *p*<0.01 compared with high conflict/high containment wards	**Overall Risk of Bias** + **Other information** High conflict/high containment wards were found to have relatively high levels of unqualified staff and use of high levels of temporary staff. High conflict/low containment wards had a greater proportion of male staff than the other types of wards. No staffing-related features were noted as particularly significant features of low conflict/high containment wards or low conflict/low containment wards.

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dataset were associated with high and low conflict and containment, particularly in wards with high conflict and low containment, or low conflict and high containment. **Data included in:** Q4	conducted, with data organized as 136 cases or rows, each representing 1 ward. Mean rates of conflict and containment per ward per day across the 6 month sample period were standardized to wards of 20 beds to adjust for patient numbers and were equally weighted for a.m., p.m., and night shifts. Staff questionnaires were scored, and mean scores were calculated for each ward. Variables that were significantly different (p<0.05) between the four types of wards were identified by using 1-way analysis of variance or chi square tests. These items were included in a multivariate analysis of variance with post hoc Tukey multiple comparisons of differences among the conflict and containment groups.		**Author's conclusions** High conflict, low containment wards had **higher rates of male staff** and lower-quality environments than other wards. Low conflict, high containment wards had higher numbers of beds. High conflict, high containment wards utilized **more temporary staff** as well as **more unqualified staff**. No overall differences were associated with low conflict, low containment wards. "These findings point to the considerable challenges faced by services that wish to act to reduce levels of conflict and containment, especially large, relatively run-down wards in areas of deprivation. **Maintaining a workforce of permanent and qualified staff would appear to be a high priority because it would facilitate improving the structure and clarity of the ward regime, which is also necessary. The use of large numbers of temporary and unqualified staff is clearly**

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			not an effective solution. Good-quality, secure staffing and decent physical environments are in the hands of management rather than the nurses on the wards, indicating that to some degree, low conflict and containment are outcomes of effective hospital management."
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Bowers et al 2009b **Study type** Multivariate cross-sectional **Aim of the study** To assess the relationship of patient aggression to other conflict behaviours, the use of containment methods, service environment, physical environment, patient routines, staff demographics, and staff group variables. **Data included in:** Q4	**Outcomes** **Aggression** - 3 types: • Verbal abuse • Aggression to objects • Physical violence to others **Control variables** **Staff demographics:** Regular qualified nurses on duty Regular unqualified nurses on duty Ban/ agency qualified nurses on duty Bank/ agency unqualified nurses on duty Proportion of staff white	**Results** **Multivariate analyses** Number of qualified nurses on duty, number of unqualified nurses on duty, number of bank/agency qualified staff on duty and number of bank/agency unqualified staff on duty, were all shown to be significantly associated with **verbal aggression**, however this only remained significant for **number of qualified nurses on duty** (IRR 1.028, 95% CI 1.018 to 1.039, p<0.001), **number of bank/agency qualified staff on duty** (IRR 1.018, 95% CI 1.010 to 1.026, p<0.001), and **number of bank/agency unqualified staff on duty** (IRR 1.017, 95% CI 1.009 to 1.025, p<0.001) in the final combined model.[a] Number of qualified nurses on duty, number of unqualified nurses on duty, number of bank/agency qualified staff on duty, number of bank/agency unqualified staff on duty, proportion of white staff, and proportion of male staff on duty were all shown to be significantly associated with **physical aggression to objects**, however this only remained significant for **number of qualified nurses on duty** (IRR 1.123, 95% CI 1.088 to 1.159, p<0.001), **number of bank/agency qualified staff on duty** (IRR 1.071, 95% CI 1.040 to 1.103, p<0.001), and **number of bank/agency unqualified staff on duty** (IRR 1.037, 95% CI 1.009 to 1.065, p<0.01) in the final combined model.[b]	**Overall Risk of Bias** + **Reviewer conclusion** Overall, analyses indicated strong positive associations between number of regular qualified staff working on a shift and aggressive behaviours. **Author's conclusions** Both the univariate and multivariate analyses showed strong positive associations between nurse staffing numbers and aggressive behaviour. These were most consistent for numbers of qualified nurses on duty, and the

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	Proportion of staff male Student nurses on duty **Statistical analysis** Multilevel random effects modelling was carried out with aggressive behaviours as the dependent variables, utilising Poisson regression, with number of beds on each ward as the exposure or offset variable.	Number of qualified nurses on duty, number of unqualified nurses on duty, number of bank/agency qualified staff on duty, number of bank/agency unqualified staff on duty were shown to be significantly associated with **physical aggression to others**, however this only remained significant for **number of qualified nurses on duty** (IRR 1.145, 95% CI 1.105 to 1.186, $p<0.001$) and **number of bank/agency qualified staff on duty** (IRR 1.075, 95% CI 1.039 to 1.111, $p<0.001$), in the final combined model. [a] Final model adjusted for the following variables: % of service users compulsorily admitted, violence to objects, violence to others, smoking in a no smoking area, refusing to eat, refusing to attend to personal hygiene, refusing to get up and out of bed, refusing to go to bed, refusing to see workers, alcohol use, substance use, attempting to abscond, refusal of regular/PRN medication, demanding PRN medication, door locked status, total restrictions on service users, administration of PRN medication, administration of intramuscular medication, seclusion, intermittent special observation, continuous special observation with engagement, show of force, manual restraint, time out and numbers of student nurses. All these variables retained significance in the final model ($p\leq0.05$), apart from door locked from more than 3 hours, or full shift. Only staffing factors included in the final combined models for verbal aggression are presented here. [b] Final model adjusted for the following variables: number of admissions during shift, verbal abuse, smoking in a no smoking area, refusing to eat, refusing to go to bed, refusing to see workers, alcohol use, attempting to abscond, absconding (officially reported), refusal of PRN medication, demanding PRN medication, self-harm, door locked status, searching, total restrictions on service users, administration of PRN medication, administration of intramuscular medication, seclusion, continuous special observation with engagement, show of force, time out and numbers of student nurses. All these variables retained significance in the final model ($p\leq0.05$). Only staffing factors included in the final combined models for verbal aggression are presented here. [C] Final model adjusted for the following variables: number of admissions during shift, verbal abuse, aggression to objects, smoking in a no smoking area, refusing to eat, refusing to wash, refusing to go to bed, refusing to see workers, alcohol use, attempting to abscond, absconding (missing), refusal of PRN medication, demanding PRN medication, self-harm, door locked status, administration of PRN medication, administration of intramuscular medication, seclusion, continuous special observation with engagement, show of force and manual restraint. All these variables retained	level of these associations were at both shift and ward level, that is, even individual shifts within wards showed higher levels of aggressive behaviour when more staff were on duty."

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		significance in the final model ($p \leq 0.05$), apart from door locked for more than 3 hours. Only staffing factors included in the final combined models for physical aggression towards others are presented here. Numbers of regular unqualified staff and bank/agency unqualified staff were only included as significant factors in domain level analyses.	
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Bowers et al 2012 **Study type** Multivariate cross-sectional **Aim of the study** To assess the relationship of show of force and manual restraint to other conflict behaviours, containment methods, service environment, physical environment, patient routines, staff characteristics, and staff group variables. **Data included in:** Q4	**Outcomes** Manual restraint and shows of force **Control variables** Conflict behaviours, containment methods, service environment, physical environment, patient routines, **staff characteristics** (FTE nursing staff in post per bed, proportion white staff, proportion African staff, proportion staff aged 30 and over, bank/agency qualified staff, bank/agency unqualified staff, student nurses, proportion Irish staff, proportion Asian staff, proportion Caribbean staff, actual other doctors, number of consultants psychiatrists who are locums), and staff group variables. **Statistical analysis** Multilevel random effects	**Results** **Multivariate analyses** Number of qualified nurses, number of unqualified nurses, number of bank/agency qualified nurses, number of bank/agency unqualified nurses, proportion of Irish staff, and proportion of African staff were all shown be significantly associated with **show of force**, however this only remained significant for number of qualified nurses (IRR 1.088, 95% CI 1.046 to 1.131, $p<0.001$), proportion of Irish staff (IRR 0.854, 95% CI 0.756 to 0.964, $p<0.05$), and proportion of African staff (IRR 0.820, 95% CI 0.703 to 0.955, $p<0.05$) in the final combined model.[a] Number of qualified nurses, number of unqualified nurses, number of bank/agency qualified nurses, number of bank/agency unqualified nurses, proportion of Irish staff, proportion of Caribbean staff and proportion of African staff were all shown be significantly associated with **manual restraint,** however this only remained significant for number of qualified nurses (IRR 1.121, 95% CI 1.071 to 1.172, $p<0.001$) in the final combined model.[b] [a] Final combined model for show of force adjusted for the following variables: number of admissions during shift, verbal aggression, aggression against others, refusing to eat, refusing to attend to personal hygiene, alcohol use, attempting to abscond, absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, locked door status, total restrictions on service users, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, intermittent special observation, special observation with engagement, manual restraint, time out and the number of student nurses. All these variables retained significance in the final model ($p \leq 0.05$). Only staffing factors included in the final combined model for show of force are presented here. Regular unqualified staff, bank/agency qualified staff and bank/agency unqualified staff were each significantly	**Overall Risk of Bias** + **Reviewer conclusions** Numbers of qualified staff were positively associated with both restraint and shows of force with the effect being observed at ward level: this indicates that better-staffed wards used more coercive measures. Staff ethnicity was also associated with these outcomes such that greater proportions of staff from ethnic minorities were linked to lower use. **Author's conclusions** **"**Numbers of qualified staff were associated at ward level indicating that better and more richly-staffed wards used greater amounts of these coercive measures. While the ethnicity of the patient groups was not linked to the use of coercive

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	modelling was carried out on show of force and manual restraint, utilising Poisson regression, with number of beds on each ward as the exposure or offset variable.	associated with shows of force in domain level analyses. [b] Final combined model for manual restraint adjusted for the following variables: number of admissions during shift, verbal aggression, aggression against objects, aggression against others, refusing to drink, refusing to attend to personal hygiene, alcohol use, attempting to abscond, absconding (missing without permission), absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, locked door status, availability of security guards, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, special observation with and without engagement, show of force, time out, the number of student nurses and the number of doctors other than consultant psychiatrists. All these variables retained significance in the final model ($p \leq 0.05$), apart from door locked for 3 or more hours or for whole shift. Only staffing factors included in the final combined model for manual restraint are presented here. Regular unqualified staff, bank/agency qualified staff, bank/agency unqualified staff, and the proportions of Irish/Caribbean/Asian staff were each significantly associated with manual restraint in domain level analyses.	measures, the ethnicity of the staff group was, with indications that greater proportions of ethnic minority staff were associated with less use." "Nursing staff numbers, particularly those in positions of decision making authority (qualified nurse), do appear to have an adverse impact, and are associated with greater use of show of force and manual restraint. Other analyses of this same dataset have shown associations between greater qualified staff numbers and aggression, but inverse associations with self-harm."
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Bowers et al 2010 **Study type** Multivariate cross-sectional **Aim of the study** To assess the relationship of seclusion and time-out to conflict behaviours, containment methods, service environment,	**Outcomes** Seclusion, and time-out **Control variables** Staff demographics: WTE nursing staff in post per bed, proportion qualified/total nursing staff in post, proportion staff male, proportion staff African. **Statistical analysis**	**Results** **Multivariate analyses:** Numbers of qualified staff on duty, and the proportion of male staff were significantly associated with **seclusion rates**, however this only remained significant for the numbers of qualified staff on duty (IRR 1.104, 95% CI 1.011 to 1.206, $p<0.05$) in the final combined model.[a] Numbers of qualified staff on duty (IRR 1.284, 95% CI 1.232 to 1.338, $p<0.001$), numbers of unqualified staff on duty (IRR 1.073, 95% CI 1.035 to 1.111, $p<0.001$), the proportion of white staff (IRR 1.791, 95% CI 1.244 to 2.579, $p<0.01$), and the proportion of African staff (IRR 1.636, 95% CI 1.145 to 2.337, $p<0.01$), were all significantly associated with **time out** in the final combined model.[b]	**Overall Risk of Bias** + **Other information** Seclusion was associated with greater numbers of qualified staff on duty during a shift and also with higher numbers of male staff. Better attitudes towards patients (as measured by the APDQ) were associated with lower

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physical environment, patient routines, staff characteristics and staff group variables. **Data included in:** Q4	Multilevel random effects modelling on seclusions and time-out utilising Poisson regression, with number of beds on each ward as the exposure or offset variable.	[a] The final model for seclusion adjusted for the following variables: number of admissions during shift, access to specialist PICU, availability of seclusion, aggression against objects, alcohol use, attempting to abscond, absconding (officially reported), refusal of PRN medication, door locked status, administration of intramuscular medication, service users sent to PICU or ICA, special observation with engagement, show or force, physical restraint and time out. All these variables retained significance in the final model ($p \leq 0.05$), apart from door locked for 3 or more hours or for whole shift. Only staffing factors included in the final combined model for seclusion are presented here: the proportion of male staff was only included as a significant factor in domain level analyses. [b] The final model for time out adjusted for the following variables: % of service users sectioned, whether ward is served by crisis intervention team, verbal aggression, aggression against objects, refusing to eat, refusing to drink, refusing to attend to personal hygiene, refusing to see workers, other substance misuse, attempting to abscond, refusal of regular/PRN medication, demanding PRN medication, locked door status, total restrictions on service users, administration of PRN/intramuscular medication, seclusion, intermittent special observation, show of force, physical restraint, number of student nurses, number of consultant psychiatrists and other doctors. All these variables retained significance in the final model ($p \leq 0.05$), apart from door locked for less than 1 hour or more than 3 hours. Only staffing factors included in the final combined model for time out are presented here: the number of bank/agency unqualified staff was only included as a significant factor in domain level analyses.	seclusion rates. No significant associations were observed between the use of time out and either skill mix or gender. Time out was also associated with larger numbers of staff on duty but not as strongly with higher numbers of qualified staff as was observed for seclusion. **Author's conclusions** Like seclusions, time-out was associated with larger numbers of staff on duty. However, comparing both univariate and multivariate results, it would appear that time-out was associated with larger numbers of staff across the board, whereas seclusions was more strongly associated with qualified staff numbers in particular." p280
Study details	**Outcomes and control variables** **Statistical analysis**	**Results**	**Comments**
Author (year) Stewart and Bowers (2012) **Study type** Multivariate cross-sectional **Aim of the study** The necessity and effectiveness of special observation (SO) remains	**Outcomes** Intermittent special observation (SO), and constant SO. **Control variables** Staff characteristics (including numbers of nurse and allied staff , numbers of	**Results** Intermittent was the most common form of SO, with a mean of 1.70 (SD 2.40) events per shift on a standardized 20-bed ward. The mean for constant SO with engagement was 0.35 (SD 0.73) per shift. Very few shifts utilized constant SO without engagement (mean 0.09; SD 0.51), so this form of SO was included only as an independent variable in further analysis. No staffing factors were included in the final combined model for intermittent special observation. Numbers of bank/agency unqualified staff and staff burnout (as measured by the MBI positive appreciation subscale) were significant related to intermittent SO in	**Overall Risk of Bias** + **Reviewer conclusions** Staffing variables were more closely associated with levels of constant SO than intermittent SO but both were significantly associated with

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uncertain. This study aims to better understand the circumstances of SO use by assessing the relationship of SO to a range of factors including patient characteristics and behaviours, the use of other containment methods, service environment, patient routines, and staffing variables. **Data included in:** Q4	qualified and unqualified staff, numbers of qualified and unqualified bank/agency staff), and staff demographics (proportion of Asian staff). **Statistical analysis** Multilevel random-effects modelling was conducted to control for clustering by Trust, ward, and shift. Counts of intermittent and constant special observation were dependent variables, with number of beds on each ward used as the exposure variable. Models were produced through a process of backward selection, dropping the least significant variable at each stage and leaving only variables significant at $p<0.05$.	domain level analyses. Multivariate regression analysis showed that the number of regular qualified, regular unqualified, bank/agency qualified, bank/agency unqualified staff on duty was significantly associated with incidences of **constant SO**. For all 4 characteristics the association remained significant in the final model[a]: regular qualified (IRR 0.911, 95% CI 0.894 to 0.929, $p<0.001$), regular unqualified (IRR 1.051, 95% CI 1.034 to 1.069, $p<0.001$), bank/agency qualified (IRR 0.842, 95% CI 0.823 to 0.862, $p<0.001$), bank/agency unqualified staff (IRR 1.240, 95% CI 1.219 to 1.260, $p<0.001$). The proportion of Asian staff on duty was also shown to be significantly associated with **constant SO** (IRR 0.105, 95% CI 0.012 to 0.953, $p=0.045$), however this did not remain significant in the final model. Multidisciplinary team cohesion using the Vision and Participative Safety subscales from the Team Climate inventory (TCI) were significantly associated with lower rates of constant observation (IRR 0.616, 95% CI 0.420 to 0.902, $p=0.013$).[a] [a] Final combined model for constant special observation adjusted for the following variables: number of admission during shift, windows in the ward, verbal aggression, aggression against objects, aggression against others, refusing to drink, refusing to attend to personal hygiene, attempting to abscond, absconding (missing without permission), absconding (officially reported), refusal of regular/PRN medication, demanding PRN medication, banned items score, locked door status, administration of PRN/forced intramuscular medication, service users sent to PICU/ICA, seclusion, intermittent SO, show of force and team climate (as measured by the team climate inventory, TCI). All these variables retained significance in the final model ($p\leq0.05$), apart from door locked for less than 1 hour. Only staffing factors included in the final combined model for constant SO are presented here. The proportion of Asian staff and the mean staff score on the Attitudes towards Personality Disorder Questionnaire (APDQ) were significantly associated with constant SO in domain level analyses.	higher numbers of unqualified staff. **Author's conclusions** "The preference for intermittent SO may have been influenced by resource constraints. Higher staffing levels were more strongly associated with constant rather than intermittent SO; probably because the former is much more resource intensive. The unit cost of constant SO has been estimated to be around three times higher than intermittent SO. The results indicate that SO is frequently conducted by less qualified staff. Greater numbers of unqualified staff were correlated with more SO. It did not make a difference whether qualified nurses were regular or bank staff, as both of these variables were negatively correlated with constant SO. Previous research has found SO to be regarded as an unpleasant and low status activity that can be delegated to junior or untrained staff, sometimes against official hospital policy."
Study details	**Outcomes and control variables**	**Results**	**Comments**

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	Statistical analysis		
Author (year) Bowers and Crowder 2012 **Study type** Repeat cross-sectional time series analysis. **Aim of the study** To assess whether rises in staffing numbers precede or follow levels of adverse incidents on the wards of psychiatric hospitals. **Data included in:** Q4	**Outcomes** Analysis 1) Dependent variables = total conflict and total containment Analysis 2) Dependent variable = nurse staffing numbers (regular qualified, regular unqualified, bank/agency qualified, bank/agency unqualified, student nurses). **Control variables** Analysis 1) Nurse staffing numbers in the 9 shifts preceding conflict and containment measure Analysis 2) Total conflict and containment in the 9 shifts preceding nurse staffing measures. **Statistical analysis** A cross-sectional time series mixed effects Poisson regression used to construct models based on a subset of 32 wards from the City-128 dataset: 1) relating nurse staffing numbers in the preceding 9 shifts with total conflict and containment rates; 2) total conflict and containment rates for previous 9 shifts with nurse staffing numbers.	**Results** Results show that numbers of regular qualified staff were systematically and consistently related to total conflict rates over time. Moreover, rises in the numbers of nurses preceded rather than followed increases in conflict and containment. For example, the number of **regular qualified staff** working up to 9 shifts earlier was significantly associated with **total conflict rates** with an incident rate ratio (IRR) of 1.03 (p<0.001). This indicates that for every 1 extra member of regular qualified staff on duty 9 shifts prior, 1 additional conflict incident was 3% more likely. However, the relationship was stronger between regular qualified staff and total conflict levels when assessed at the same point in time (IRR 1.04, p<0.001). Data are also available for the shifts preceding conflict events from 2 shifts preceding up to 9 shifts preceding. The analyses adjusted for NHS trust and ward-level characteristics, the shift type (am, pm, or night), day of the week, and number of admissions during the shift.	**Overall Risk of Bias** + **Other information** No clear trend emerges between levels of either regular unqualified staff or bank/agency qualified staff and total conflict levels. The association between unqualified bank/agency staff and subsequent conflict was patchy: positive, inverse and no relationship with conflict was observed at different lag times. The results reported in this paper undermine the explanation that rises in conflict rates lead to deployment of more staff to affected wards. Instead they suggest that higher nurse numbers lead to more conflict events. **Author's conclusions** **"**The results showed that only numbers of regular qualified staff were systematically related to conflict and containment rates over time. Moreover rises in the numbers of nurses preceded rather than followed increases in conflict and containment. Previous cross-sectional

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	NHS Trust and ward were accounted for as nested hierarchical levels in the regression equation, and the number of beds on the ward was used as an indicator of the number of patients, and set as the exposure variable. All variables were entered and significant results reported; no stepwise elimination was applied. Total conflict, total containment and number of nurses on duty were all associated with shift time, day of week and number of admissions during the shift. These 3 variables were entered in all the models constructed to control for their effects. Comparisons between groups were conducted using Kruskal-Wallis tests, and correlations using Spearman's test, as most of the data were skewed.		analysis had shown positive correlation between qualified nurse numbers and many conflict and containment items. The results reported in this paper undermine the explanation that rises in conflict and containment rates lead to the deployment of more staff to the wards concerned. Instead they suggest that higher nurse numbers leas to more of these adverse events." p19

D.2 Evidence table 2 (Hanrahan et al 2010a)

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Study name N/A **Author (year)** Hanrahan et al 2010a **Study type** Retrospective observational. Secondary analysis of 2 separate datasets. **Aim of the study** To determine the occurrence of adverse events and examine the extent to which organising factors of inpatient psychiatric care environments were associated with the occurrence of these events. **Study dates** Secondary analysis of nurses survey linked to data from American Hospital Association (AHA) survey conducted in 1999. **Source of funding** This work was supported by grant R01-NR-004513, "Outcomes of Hospital	**Country/ies where the study was carried out** USA **Setting** Psychiatric wards in general hospitals. **Sampling frame** **Nurse sample:** 43,000 registered nurses from Pennsylvania, USA who had participated in a 1999 nursing survey. **Hospital sample:** All general hospitals in the 1999 AHA survey. **Sampling procedure** **Nurses:** A subset sample of psychiatric registered nurses who had declared in the 1999 nurse survey that they were permanently assigned to the direct care of psychiatric patients in hospitals defined as non-federally funded acute care hospitals. **Hospitals:** Subset of general hospitals from 1999 AHA survey with a minimum of 6 licensed psychiatric beds.	**Data collection method** **Nurse** data from a previous survey, (data collection methods not reported). Nurse data was linked to **hospital** data from a previous survey (data collection methods not reported). **Length of follow up** N/A **Details** Using a cross-sectional design, psychiatric nurse survey data and hospital data were linked to examine associations between organizational factors and adverse event outcomes. A secondary analysis of 1999 nurse survey data obtained from a large random sample of registered nurses. Nurses' employing hospital was linked with the American Hospital Association (AHA) survey data for information about the hospital. Psychiatric nurses' responses were aggregated to the hospital level to create measures of the care environment and staffing in	**Outcomes** Frequency of adverse events (wrong medication or dose, patient falls with injuries, complaints from patients or families, work-related injuries to staff, and verbal abuse directed toward nurses) over the past year were used as the outcome variables. These data are all self-report in the nurses' survey. Patient-to-nurse staffing ratio was used as an explanatory variable. **Control variables** Explanatory variables: Patient-to-nurse staffing ratio Nurse demographic and work characteristics Hospital characteristics **Statistical analysis** Multivariate regression models clustered by hospitals analysed the extent to which organizational factors of the inpatient psychiatric care environment were associated with adverse events.	**Results** The mean patient-to-nurse staffing ratio was 7.09 (SD 3.50) patients to 1 registered nurse. **Work related injuries to staff** The patient-to-nurse staffing ratio was strongly and significantly related to work-related injuries to staff in both the unadjusted (beta -1.72, SE 0.66, $p<0.01$) and adjusted models (beta -1.34, SE 0.60, $p<0.05$). The final model included the following significant variables; manager and leadership skill ($p<0.01$), nurse-physician relationship ($p<0.05$). The following variables were non-significant ($p>0.05$): nurse participation in hospital affairs, foundations for quality of care. **Wrong medication or dose** Patient to nurse staffing ratio adjusted beta -0.02 (SE 0.61, $p>0.05$). The final model contained the following variables which	**Overall quality score** - **Other information** Adverse event data all self-report by nurses - possibility of under/over-reporting. **Author's conclusions** Organizational factors, such as better management skill, were strongly and significantly associated with fewer reports of patient falls. Better manager skill level, nurse-physician relationship, and staffing were all highly significant and associated with fewer work-related injuries. Although statistically significant ($p=0.019$) in the unadjusted models, verbal abuse directed toward nurses became only marginally significant ($p=0.053$) when nurse and hospital characteristics were added in the adjusted models. The patient-to-nurse staffing ratio was 7.09 (SD 3.50) patients to 1 registered nurse. The patient-to-nurse staffing ratio was strongly and significantly related to work-related injuries to staff

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Staffing," to Dr. Aiken, principal investigator. **Full citation** Hanrahan, Nancy P., Kumar, Aparna, Aiken, Linda H., Adverse events associated with organizational factors of general hospital inpatient psychiatric care environments, Psychiatric services (Washington, D.C.)Psychiatr Serv, 61, 569-574, 2010.	**Number and characteristics of participants** **Nurse (N=335) characteristics:** Mean age: 45 (SD 10.5) Mean years' experience as a registered nurse: 16.5 (SD 11.6) Mean years at current hospital: 10.1 (SD 12.7) Mean years working on unit: 6.6 (SD 5.6) **Hospital (N=67) characteristics:** Teaching hospitals n=31 (46%) Use of advanced technology n=31 (46%) Bed capacity: ≤100 beds n=6 (9%) 101-249 beds n=36 (54%) ≥250 beds n=25 (37%) **Sample size** N/A **Exclusion criteria** N/A **Inclusion criteria** Psychiatric registered nurses affiliated with	each hospital. The nurse survey posed questions about the quality of the patient care, organizational factors that facilitated or undermined nursing practice, and the presence of adverse events. **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** **Patient-to-nurse staffing ratio** Nurses asked to report the total number of patients on the unit and the total number of registered nurses during the last shift. A ratio of patients to registered nurses was computed for each nurse and then aggregated to the hospital level. The patient-to-nurse staffing ratio was mean 7.09, (SD 3.50) patients to 1 registered nurse.	"Descriptive estimates were generated for all psychiatric nurse respondents, hospitals, and outcomes. The nurse staffing variable was log-transformed because it formed a skewed distribution. Homoscedasticity was evaluated via Levine's tests, and normality was assessed with Shapiro-Wilk tests. Multicollinearity was determined before variables were entered in analytic models. Unadjusted and adjusted general linear regression models were used to examine the extent to which variables influenced the occurrence of adverse events. Practice Environment Scale-Nursing Work Index (PES-NWI) subscales and staffing were modelled continuously at the hospital level. Adjusted models included nurse-level characteristics of bachelors of science in nursing (yes or no) and years of experience and hospital-level characteristics of bed capacity (≤100 beds, 101-249 beds, and ≥250 beds), teaching status	were non-significant (p>0.05); nurse participation in hospital affairs, foundations for quality of care, manager and leadership skills and nurse-physician relationship. **Patient falls with injuries** Patient to nurse staffing ratio adjusted beta -0.64 (SE 0.72, p>0.05). The final model contained the following variables which were significant: manager and leadership skill (p<0.05). All other variables were non-significant. **Complaints from patients and families** Patient to nurse staffing ratio adjusted beta -1.14 (SE 0.68, p>0.05). All other variables were non-significant. **Verbal abuse directed towards nurses** Patient to nurse staffing ratio adjusted beta -1.30 (SE 0.89, p>0.05). All other variables were non-significant.	in both the unadjusted and adjusted models.

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
	hospitals defined as non-federally funded acute care hospitals. General hospitals with a minimum of 6 licensed psychiatric beds. (Hospitals meeting inclusion criteria represented 74% of all general hospitals with licensed psychiatric beds in Pennsylvania in 1999.)		(teaching or nonteaching), and use of advanced technology (yes or no). Clustering of psychiatric nurses within hospitals was accounted for with Huber-White (robust) procedures to adjust the standard errors of the estimated parameters .The Hosmer-Lemeshow statistic was used to assess the model fit."		

D.3 Evidence table 3 (Noda et al 2012)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name The SAKURA project **Author (year)** Noda et al (2012) **Study type** Prospective observational **Aim of the study** To consider what factors	**Country/ies where the study was carried out** Japan **Setting** 15 inpatient psychiatric wards in hospitals. **Sampling frame** Not stated.	**Data collection method** The aim was to assess the extent to which certain factors (patient characteristics, nurse characteristics and ward characteristics) contributed to the severity score assigned by nurses to aggressive incidents they	**Outcomes** The perceived severity of aggressive incidents as recorded on the VAS. **Control variables** See below for details of the variables that were included at each stage of regression modelling.	**Results** Summary **326** incidents were recorded and assessed using the SOAS-R and the VAS at a rate of **3.28** incidents per 1000 beds (**1.23** incidents per bed per year) • E type wards: **3.24**	**Overall quality score** + **Other information** Author-acknowledged limitations "The variables included in the study are rather crude and global" - suggests factors such as ward

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
influence the overall judgment made by ward nurses of the severity of aggressive incidents on inpatient psychiatric wards. **Study dates** The study was conducted over an 8 month period starting from November 2008. **Source of funding** The study was conducted with the aid of the Pfizer Health Research Foundation and was part of a wider research and development project on seclusion and restraint in psychiatric hospitals in Finland and in Japan (the SAKURA project). **Full citation** Noda, T., Nijman, H., Sugiyama, N., Tsujiwaki, K., Putkonen, H., Sailas, E., Kontio, R., Ito, H., Joffe, G., Factors affecting assessment of severity of aggressive incidents: using the Staff Observation Aggression Scale - Revised (SOAS-R) in Japan, Journal of psychiatric and mental health nursing. J Psychiatr	**Sampling procedure** Not stated. **Number and characteristics of participants** 15 inpatient psychiatric wards: 4 emergency wards (so-called 'E type' wards; average nurse allocation of 10 patients per nurse per day) 5 acute wards ('A type' wards; average nurse allocation of 13 patients per nurse per day) 6 wards with a nurse ratio of 15 service users to 1 nurse ('S type' wards) The average number of beds on the included wards was **53** (SD 10.8). The most frequent diagnoses were F20-29 (schizophrenia group disorders) as classified by ICD-10.	encountered on their wards. The implication, from a safety point of view, is that aggressive incidents are likely to lead to episodes of seclusion and/or restraint - the higher the perceived severity of the incident, the more likely a patient is to be secluded/restrained. Nurses on the included wards recorded and assessed aggressive incidents using the Japanese version of the SOAS-R instrument. The Staff Observation Aggression Scale-Revised (SOAS-R) was used to assess the severity of aggressive incidents which were defined as 'any verbal, non-verbal or physical behaviour that was threatening (to self, others or property), or any physical behaviour that did harm (to self, others or property)'. The theoretical range of total SOAS-R scores is from 0 to 22 points, with higher scores indicating greater incident severity. Nurses also rated the severity of aggressive incidents on a visual analogue scale (VAS); they	**Statistical analysis** Descriptive statistics were used to explore the characteristics of aggressive consumers and the nurses who rated the aggressive incidents. 4 regression analyses were then performed to assess the factors contributing towards overall VAS scores. VAS severity score was set as the dependent variable and the following characteristics were added cumulatively as independent variables in 4 stages of modelling: • Model 1: patient characteristics (gender, age, diagnosis) • Model 2: nurse characteristics (gender, years of psychiatric experience) • Model 3: ward characteristics (ward type) • Model 4: SOAS-R score	(**1.65** per bed per year) • A type wards: **3.27** (**0.96** per bed per year) • S type wards: **3.35** (**1.22** per bed per year) Mean SOAS-R score: **10.7** (SD 4.7) Mean VAS severity score: **52.8** (SD 26.2) <u>Multivariate analysis</u> Nurse gender was a significant explanatory factor for VAS severity score (adjusted R^2 **4.1%**) with male gender corresponding to higher VAS scores. The β value for gender in Model 4 is reported as -0.176 (p<0.01*).* In Model 4, VAS severity score was explained to a significant degree by nurse gender with male nurses tending to assign higher VAS severity scores than female patients.	environment/culture may be associated with psychological impact of aggressive incidents and thus these should ideally be included in the regression models. <u>Reviewer comments</u> As implied by the authors, not all relevant factors may have been accounted for in the analysis and thus there's a chance that variables which also affect nurses' perceptions of aggressive events were not included in the regression models and thus the findings should be interpreted with caution. Selection procedure not described - difficult to ascertain whether selection bias may be at play. Also not clear how many hospitals were included in the sample - ideally, wards within the sample should have been subjected to some degree of cluster analysis so that hospital-level characteristics could be accounted for. Statistical methods are

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Ment Health Nurs, 19, 770-775, 2012.	**13** wards provided care for adults aged 20 to 65 years; the other **2** wards served patients aged over 65. Average length of stay (LOS) in 2007 was less than **3 months** for 9 wards (all E and A type wards) and was over **10 years** for the remaining 6 wards (all S type wards). The mean number of days on which seclusion occurred (per 1000 patient days) in November 2007 were: • 401 days on E type wards • 83 days on A type wards • 47 days on S type wards The mean number of days on which mechanical restraint was used (per 1000 patients days) in November 2007 were: • 41 days on E type wards • 10 days on A type wards • 1 day on S type wards Not clear how many patient/nurse participants were included.	marked on a 100-mm line the perceived severity of the incident they observed, ranging from 'not severe at all' at the 0-mm end to 'extremely severe' at the 100-mm end. Nurses recorded details about the patients involved in aggressive incidents (gender, age and diagnosis). Information about the participating nurses was also recorded (age, gender, years of psychiatric nursing experience). **Length of follow up** Data collection took place over an 8 month period for 6 wards in 4 hospitals and for a 2 month period for 9 wards in 1 hospital. Both data collection periods began at the same time in November 2008. **Details** N/A **Interventions** N/A **Comparator** N/A **How was staffing**			reported quite briefly and Table 1 is not labelled very clearly - difficult to know how to interpret the data in the table (e.g. are the β values still in log form?). Difficult to see how findings could help inform any decision-making about gender mix - don't offer a plausible explanation as to *why* male staff reported higher scores on the VAS especially given that this finding looks contradictory to other research in this area. Also, not clear how important the outcome of 'perceived severity' is - authors state that this 'may be' connected to decisions about the use of coercive measures but data on these more tangible outcomes are not collected nor is there much literature quoted to support this link. **Author's conclusions** "One could argue that male nurses might be psychologically and physically more prepared to face violence and thus should be less cautious of

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	Sample size See above. **Exclusion criteria** None stated. **Inclusion criteria** None stated.	**measured/defined?** Staff gender was considered as a predictor variable in the analysis. Staff ratios were expressed as the number of patients per nurse per day but they were not considered in the analysis.			the potential risks of underestimation of aggression and hence of the risks of earlier discontinuation of seclusion/restraint. In some studies, nurses and physicians appeared to rely heavily on workforce, especially on male nurses, in aggressive situations in order to avoid seclusion or restraint. Interestingly, our results showed quite the opposite, as male nurses in general tended to assign higher VAS severity score than female nurses [...] In the present study, it may be difficult to speculate how gender alone played a role in judging the severity of aggressive behaviours".

D.4 Evidence table 4 (O'Malley et al 2007)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)**	**Country/ies where the study was carried out** New Zealand	**Data collection method** Data were collected over 3 time periods: • 1-2 weeks prior to split	**Outcomes** Seclusion: Total patient hours in seclusion as a percentage of the total	**Results** **Descriptive data:** From Table 1 in paper: Period 1: Number of shifts	**Overall quality score** - **Author's conclusions**

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
O'Malley et al (2007) **Study type** Naturalistic before and after study **Aim of the study** To examine the effect of a change in unit size and other variables (time of day, nursing workload, skill mix, gender mix, period) on the rates of seclusion in an intensive care inpatient psychiatric unit. **Study dates** Feb 2002 - Oct 2003. **Source of funding** A Canterbury (NZ) District Health Board research grant of $11,000 supported data collection. **Full citation** O'Malley, Jane E., Frampton, Christopher, Wijnveld, Anne Marie, Porter, Richard J., Bowers, Bowers, Bowers, Convertino, D'Orio, Donat, Donat, Donovan, Duxbury, El-Badri, Freuh, Hafner, Haller, Kaltiala-Heino, Khadivi, Kirkpatrick, Mason, Morrison, Morrison, O'Brien, Robins, Salib, Smith,	**Setting** A psychiatric intensive care inpatient unit (PICU). Patients are judged to be at significant harm to self or others. Unit is locked at all times. **Sampling frame** A 20 bed PICU in a major metropolitan 64 bed acute care psychiatric inpatient service in Canterbury, NZ. **Sampling procedure** Data were collected over 3 time periods: • 1-2 weeks prior to split • 1-12 weeks post split • 6 months beginning 1 year after split **Number and characteristics of participants** PICU care provided by 32 FTE registered nurses, a 0.5 FTE occupational therapist. Plus 5 multidisciplinary teams (psychiatrists, doctors, 2 clinical psychologists, 1 Maori mental health worker and 3 social workers) responsible for assessment and treatment	• 1-12 weeks post split • 6 months beginning 1 year after split Data collected retrospectively for periods 1 and 2, and prospectively for period 3. Individual shifts for which seclusion rates were calculated were randomly selected by computer from shift and day of week strata across the 3 time periods to ensure an equal mix of shifts and days of the week. **Length of follow up** 12 weeks and 1 year. **Details** **Interventions** Change to new PICU which is split into 2 10-bed units from 1 unit of 20 single rooms. **Comparator** PICU with 20 single rooms. **How was staffing measured/defined?** Total nurse hours per shift. Fewer than 2 male nurses per shift. Nurse experience as a	patient hours in the unit was calculated per shift. **Control variables** **Temporal variables:** • Time period: 1,2 or 3 • Shift: Morning, afternoon or night • Day of week **Nursing staff variables:** Total nurse hours per shift: Whether all nurses on shift had a case load Gender: Whether fewer than 2 male nurses on the shift Skill mix: Whether mean experience score of nurses on shift was 3 or more (based on years of experience in nursing - coded from 1 to 4). Nurses on duty without a caseload: Those without a caseload are in dedicated management or nursing development roles but are available for consultation and clinical involvement as necessary. **Statistical analysis**	21, number of episodes of seclusion 89 Period 2: Number of shifts 21, number of episodes of seclusion 126 Period 3: Number of shifts 126, number of episodes of seclusion 631 **Univariate analysis:** Statistically significant reduction in rates of seclusion after the ward was split into 2 10-bed units (8.2% 1-2 weeks before split; 4.4% 1-12 weeks after split; 3.6% 1 year after split; F=4.8; df=2,165; p=0.001). Statistically significant negative association between **number of nursing staff** (nurse hours) and seclusion rates (r_s -0.25; p=0.001). No significant difference if there were more **experienced staff** on shift (F=0.3; df=1,166; p=0.56). Seclusion rates significantly lower (3.9% vs. 5.7%) when 2 or more male nurses present on a shift (F=7.3;	Smaller units may allow for better management of disturbed behaviour.

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Tunde-Ayinmode, Visalli, Vittengl, Factors influencing seclusion rates in an adult psychiatric intensive care unit, Journal of Psychiatric Intensive Care, 3, 93-100, 2007.	across entire acute service, but not dedicated to PICU. Numbers of patients not reported. Period 1: Number of shifts 21, number of episodes of seclusion 89 Period 2: Number of shifts 21, number of episodes of seclusion 126 Period 3: Number of shifts 126, number of episodes of seclusion 631 **Sample size** N/A **Exclusion criteria** N/A **Inclusion criteria** N/A	weighted skill mix, scored 1 to 4 based on 13 different characteristics of experience. Period 1 (before the split into 2 units): 8 registered nurses, 1 critical care nurse and 1 clinical nurse specialist in the AM, 8 registered nurses in the PM, 5 registered nurses at night. Periods 2 and 3 (after the split into 2 units) 8 registered nurses, 1 critical care nurse and 2 clinical nurse specialists in the AM, 8 registered nurses (4 in each unit) in the PM, 5 registered nurses (over both units) at night.	**Univariate** associations between temporal and staffing and seclusion analysed using 1-way ANOVA and Spearman's correlation coefficients. Variables showing significant univariate associations ($p<0.05$) entered into a **multivariate analysis** using general linear model to assess combined and independent contributions of variables to seclusions rates.	*df*=1,166; $p=0.009$). **Multivariate analysis:** Period, shift and nurse hours all showed independent statistically significant ($p<0.05$) associations with seclusion rates. Adjusted R^2 for this model was 0.23. Period, shift and nurse hours together explained 23% of variance in seclusion. Period alone explains 15% of variance Shift alone explains 5% of variance. Nurse hours explains 3% of variance.	

D.5 Evidence table 5 (Sawamura et al 2005)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)**	**Country/ies where the study was carried out** Japan	**Data collection method** Incident reports were prepared by clinical staff, including psychiatrists,	**Outcomes** A logistic regression analysis was performed using the interception of	**Results** Of the 221 reported incidents, 55 (24.9%) were intercepted before reaching	**Overall quality score** -

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Sawamura et al 2005 **Study type** Prospective observational survey **Aim of the study** The aim of the present study was to clarify factors associated with the interception of potential adverse drug events (PADE) in long-term psychiatric care units. **Study dates** 1st October to 30th November 2000. **Source of funding** This study was supported by a Health Sciences Research Grant from the Ministry of Health, Labour and Welfare, Japan. **Full citation** Sawamura, Kanae, Ito, Hiroto, Yamazumi, Syun, Kurita, Hiroshi, Interception of potential adverse drug events in long-term psychiatric care units, Psychiatry and clinical neurosciences. Psychiatry Clin Neurosci, 59, 379-384, 2005.	**Setting** Long-term private psychiatric care inpatient units. **Sampling frame** 162 private psychiatric hospitals all of which were members of the Kaiseikai Association of Psychiatric Hospitals. **Sampling procedure** 162 hospitals invited to participate, 44 hospital Directors agreed, and 3 representative units selected from each. **Number and characteristics of participants** 132 units. 47 units reported no PADE and were excluded from the analysis. 221 incident reports were retrieved from 85 units. **Sample size** 85 units – 221 incident reports **Exclusion criteria** N/A **Inclusion criteria** N/A	pharmacists, and nurses who were responsible for potential adverse drug events (PADE) during the research period. Each PADE was rated for potential severity, classified as intercepted or not intercepted, and where appropriate, outcome data were collected. **Length of follow up** 2 months **Details** A survey was conducted of medication-related errors in 132 Japanese long-term psychiatric care units for 2 months using an incident reporting system. The relationship was analysed between the reported potential adverse drug events and the characteristics of the units and the staff, as well as those of the patients involved. A multivariate logistic regression analysis was performed with environmental, organizational, and human factors as independent variables to predict the interception of potential	PADE as a dependent variable and the characteristics of patients, staff, units, and PADE as independent variables. **Control variables** (see results for adjustments to final regression model) **Statistical analysis** For comparison between intercepted cases (intercepted group) and non-intercepted cases (non-intercepted group), the authors conducted a Mann-Whitney test for rank data, and employed the chi-squared test for categorical data. Logistic regression analysis was used to examine the relationship between the failure to intercept PADE and related factors. The significance level was set at $p<0.05$.	patients. A relatively high patient-staff ratio in the evening was significantly related to a decreased possibility of intercepting a potential adverse drug event (PADE). The patient–staff ratio in the evening, which was significantly larger in the nonintercepted group than the intercepted group ($Z = -1.247$, $P < 0.01$). Multivariate logistic regression of variables predicting the failure to intercept PADE for patient-staff ratio (beta=0.054, $p=0.04$. OR 1.055, 95% CI 1.002 to 1.111) showed a relatively high patient-staff ratio in the evening was significantly related to a decreased possibility of intercepting PADE. The final model was adjusted for number of tablets, frequency of admission and schizophrenia.	**Other information** N/A **Author's conclusions** “Higher patient-staff ratios in the evening were associated with a decrease in the possibility of intercepting a PADE. According to our data, the average patient-staff ratio was 25.3:1 during the evening shift, whereas that ratio during the daytime was 5.6:1 on average. But the relationship between interception and patient-staff ratio in the evening was not clear because administration time was not associated with interception of PADE. Patient-staff ratio might represent other institutional characteristics that were directly associated with interception of PADE. To achieve an increase in the interception of PADE, it will be necessary to carry out organizational as well as clinical improvements. First, simpler prescriptions are crucial. In addition, organizational efforts, such as allocating enough staff

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
		adverse drug events. **Interventions** Patient staff ratio. **Comparator** N/A **How was staffing measured/defined?** The average number of patients per member of staff was 5.6 (range: 2.9 to 20.0) in the daytime, 25.3 (range: 14.3 to 56.0) in the evening, and 24.9 (range: 14.3 to 56.0) at night.			for drug administration in the evening, and educating the staff about medications will be required."

D.6 Evidence table 6 (Bee et al 2006)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Bee et al (2006) **Study type** Longitudinal descriptive study. **Aim of the study** • To identify and classify the range of occupational	**Country/ies where the study was carried out** UK **Setting** 3 acute inpatient mental health wards, each located in a different regional mental health trust in the North West UK. **Sampling frame**	**Data collection method** Ward-based activity was assessed through short, repeated interviews conducted on an hourly basis with all available staff: Each staff member reported all the activities that they had undertaken in the previous hour, irrespective of the amount of time they	**Outcomes** • Types of activities and tasks carried out by nurses and nursing assistants • Time spent in direct patient contact per hour • Work satisfaction • Differences in above outcomes between nurses and nursing assistants.	**Results** Participants provided data relating to **505 hours** of nursing activity. No significant differences were observed in the patterns of nursing activity reported before and after the external ward training programme (χ^2=1.19, *df*=4,***p*=0.879**). Data were therefore combined for all subsequent analyses.	**Overall quality score** - **Other information** <u>Author-acknowledged limitations:</u> Relatively small sample size The sample was a convenience sample (i.e. participants were not selected randomly) - risk of

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
activities undertaken by acute inpatient mental health nurses. • To compare the relative proportions of time dedicated to patient-centred and non-patient-centred activities. • To compare and contrast the occupational activity patterns of qualified and unqualified nurses. **Study dates** Data collection took place over the course of several months although the precise dates and duration of data collection are not stated. **Source of funding** The study was funded by 3 mental health trusts in the North West UK. **Full citation** Bee, P.E., Richards, D.A., Loftus, S.J., Baker, J.A., Bailey, L., Lovell, K., Woods, P., Cox, D., Mapping nursing activity in acute inpatient mental healthcare settings, Journal of Mental Health. J.Ment.Health, 15, 217-226, 2006.	Not stated. **Sampling procedure** Not stated. **Number and characteristics of participants** • Ward capacity on the 3 units ranged from **21** to **24** beds. • The majority of patients had diagnoses of severe and enduring mental illness (e.g. psychosis or bipolar disorder). • Each ward was staffed by **2** to **3** qualified nurses and up to **5** unqualified nursing assistants per day shift. All qualified mental health nurses and unqualified nursing assistants working on the 3 acute wards during the data collection period agreed to participate in the study - this included both permanent and agency staff. • **40** staff members participated in the study: ○ **15** registered nurses ○ **1** student nurse ○ **24** unqualified nursing assistants.	had spent doing each one. At the end of each interview, staff were asked to estimate the number of minutes that they had spent in direct contact with patients and to rate their level of work satisfaction on a scale from 1 (extremely low) to 10 (extremely high). To ensure consistency of the data within and between sites, researchers visited each ward on 5 different occasions. On each occasion data collection was separated by approximately 1 month, apart from the second and third data collection weeks. A period of 10 months separated these periods since during this time organisational commitments necessitated some ward staff (58%) attending an external training programme. In order to limit any temporary effects of this training on ward culture, it was decided that no data should be collected during this time. **Length of follow up**	**Control variables** Although no control variables were considered in the statistical analyses, the authors did compare data collected before and after the training event (attended by 58% of the participants) in order to assess whether the event may have influenced the results. **Statistical analysis** Theoretical approach/methods of analysis: Qualitative data from the staff activity interview were subjected to a thematic content analysis as described by Morse and Field (1996). Major types of nursing activities were established from participant responses and cross-validated by members of the research team. From this, conceptual maps of the nursing activity patterns of qualified and unqualified staff were produced. Statistical analysis: Quantitative data were subject to statistical analysis. Group differences	Types of activities undertaken: A total of **55** different nursing activities were identified, all of which could be classified into 1 of **5** distinct categories according to their underlying purpose: 1. administrative tasks (such as ward and patient-based paperwork) 2. domestic tasks (e.g. housekeeping) 3. professional communications (e.g. meetings and handovers) 4. direct patient contact (including health, social and therapeutic care*) 5. staff breaks *Therapeutic care was used to refer to any period of time in which the sole activity of staff was to provide structured or formal patient therapy. Although slight variation occurred between individual data collection visits, the most predominant activity	selection bias. All data collection occurred on weekdays, excluding night shifts and weekends - therefore might limit generalisability to all shifts (e.g. activities may be substantially different overnight). All data were self-reported, not based on time-and-motion observations - inaccuracies in the participants' recollections of their activities cannot be ruled out (although 'the repeated use of an open-ended instrument at relatively short intervals is likely to have minimised the occurrence of such errors'). The interview schedule itself was not a validated instrument (although 'based on conventional work sampling methods'). **Reviewer conclusions**: Not clear if any differences were found between wards - some difference in activities may have been as

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	Sample size See above. **Exclusion criteria** None stated. **Inclusion criteria** None stated.	N/A **Details** N/A **Interventions** The exposure (rather than the 'intervention') could be considered as those activities carried out by registered nurses. **Comparator** The comparator could be considered as activities carried out by nursing assistants. **How was staffing measured/defined?** Forty nurses participated: • 15 registered nurses • 1 student nurse • 24 unqualified nursing assistants.	in patient contact time and work satisfaction ratings were assessed by independent *t*-tests.	was always that of direct patient contact. This activity comprised almost half of all nursing activities reported (**47.7%**), the remainder primarily occupied by tasks associated with ward administration (23.6%) and professional communication (23.0%). Domestic tasks (4.1%) and staff breaks (1.7%) were the least frequent activities. Within the patient contact category, most activities were related to containment (54.3%). Other activities were social care (15.1%), social interaction (14.3%), medical/health care (11.8%), and therapeutic care (4.5%). Despite the large proportion of patient contact activities that were reported, the majority of staff-client interactions were found to relate solely to activities associated with the containment of patients. Within this context, "door duties", "specialing" and 15-minute patient observations were the most frequently reported	a result of individual hospital- or ward-level characteristics that don't appear to have been controlled for. Would have been helpful to report if results were consistent across the 3 wards - if so, could potentially have more confidence in how representative the findings are. **Author's conclusions** "This study has shown that irrespective of staff qualification level, the patterns of nursing activity observed on acute psychiatric wards are likely to be largely procedural-based with only a limited opportunity for the formal provision of structured therapeutic care." "In common with previously published work...nursing activity on the 3 acute inpatient wards fell into a distinct pattern. Whilst unqualified staff most frequently reported being engaged in activities involving non-therapeutic patient contact, the responses of qualified staff were more equally split

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				activities. By contrast, very few nurses reported undertaking formal therapeutic interventions such as CBT. On the rare occasions that such activity was reported, staff referred only to providing clients with general reassurance. No individual reported using psychosocial therapies or educating service-users about potentially effective coping strategies. <u>Comparison between qualified and unqualified staff:</u> There was a distinct difference in the patterns of work reported by qualified and unqualified staff. Although the actual frequencies with which the different activities were reported varied over time, unqualified staff consistently reported most frequently being engaged in activities requiring patient contact. In contrast, the responses of qualified staff were more equally split between activities requiring patient contact, professional	between patient interaction, professional communications and administrative tasks." "Although a substantial number of patient contact activities were reported, both qualified and unqualified staff were limited in their ability to engage in the more productive therapeutic work demanded by policy. Moreover qualified staff, who had the most training in clinical and interpersonal skills often spent much less time with service-users than their unqualified colleagues."

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				communications and administrative duties. **Unqualified staff activities:** Patient contact 63.5% Administrative tasks 14.6% Communications 12.2% Domestic tasks 7.0% Staff breaks 2.6% **Qualified staff activities:** Communications 35.5% Administrative tasks 34.0% Patient contact 29.2% Domestic tasks 0.6% Staff breaks 0.6% Qualified staff assumed the majority of responsibility for the administrative tasks associated with ward routines. Unqualified staff undertook all domestic duties and the vast majority of patient containment. Below is a list of who was responsible for each activity identified by the study authors. All tasks were undertaken by the staff that were responsible for them, with the exception of	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				meetings (unspecified), which were the responsibility of unqualified staff but were undertaken by qualified and unqualified staff, and escorting, responding to alarms, searching for patients, and other observations, which were the responsibility of qualified staff but were done by qualified and unqualified staff. **Patient contact activities** *Social care activities* Unqualified and qualified staff: • self-care/hygiene • answering questions/giving advice • assisting patients with menus/meals *Health care activities* Unqualified and qualified staff: • Physical health checks Qualified staff: • Encouraging compliance • Administering medication *Containment activities* Qualified staff: • Managing aggression	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				• Escorting • Responding to alarms • Searching for patients • Other observations Unqualified staff: • Door duty • Attendance checks • 5-minute observations • 1:1 observations *Social interaction activities* Qualified and unqualified staff • Chatting/socialising *Therapeutic care activities* Qualified and unqualified staff • Providing reassurance **Communications activities** *External activities* Qualified staff • Relatives • Social workers • CMHTS • Transfers/referrals • Drug representatives • Other agencies *Internal activities* Qualified staff and unqualified staff • Occupational therapists	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				• Other departments (e.g. x-ray, ICU) • Non-work-related communication Qualified staff • Colleagues (e.g. hand over) • Ward managers • Doctors/consultants Unqualified staff • Meetings (unspecified) **Administrative activities** *Patient-based* Qualified staff • Writing/updating patient notes • Ward round prep/follow-up • Diary completion/follow-up • Admission/discharge procedures • Risk assessment procedures • Sorting finance/accommodation *Ward-based* Qualified and unqualified staff • Ward maintenance • Directing visitors	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				• Taking/making phone calls • Reviewing bed state • Managing medication store • Searching for equipment Qualified staff • Staff rotas/allocations • Staff training and supervision • General admin/checking post **Domestic activities** Unqualified staff • Organising meals/refreshments • Tidying up/housekeeping • Making beds • Laundry Overall, unqualified staff reported a mean of **31.73** minutes (SD 22.83 mins) of patient contact per hour, significantly more than qualified staff who reported a mean of **18.48** minutes (SD 17.63 mins) per hour	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				(*t*=6.55, *df*=446, ***p*<0.001**) Unqualified staff also reported significantly higher levels of satisfaction with their work: mean **7.43** (SD 2.05) vs. **6.36** (SD 1.92); *t*=5.74, df=495, ***p*<0.001**. A significant correlation was observed between work satisfaction ratings and estimated patient contact time (***r*=0.35**, ***p*<0.001**).	

D.7 Evidence table 7 (Staggs 2013)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Staggs (2013) **Study type** Retrospective observational. **Aim of the study** • To test the hypotheses	**Country/ies where the study was carried out** USA **Setting** Adult inpatient psychiatric units. **Sampling frame** Over 1800 acute care hospitals participating in the American Nurses	**Data collection method** Monthly data on staffing and assaults were collected from the NDNQI. Not further specified. **Length of follow up** There were 9.7 months of data available for the average unit in the study. **Details**	**Outcomes** **Injury or Non-injury Assault:** Defined as any unwanted physical contact, including sexual contact, initiated by a patient toward any other person, regardless of intent to harm. Level of injury assault classified as: mild, moderate, severe, or death; and, as a non-repeat	**Linear model estimates for total assault rates** Total nursing hours per patient day (exponential beta 1.118, 95% CI 1.072 to 1.164, *p*<0.001) showed higher staffing levels were associated with higher total assault rates. A 1-unit increase in TNHPPD, with other predictors held	**Overall quality score** - **Other information** A difference of 1 nursing hour per patient day is a large difference: for the average unit in the study, a 1 unit change in TNHPPD would be a change of 18 nursing hours per day, or

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
that the overall association between nurse staffing and patient assault rates on psychiatric units is positive. • To explore the possibility of a nonlinear staffing-assault rate association. • To investigate the relation between nursing skill mix and assault rates. **Study dates** 9.7 months of data from 2010 available for the average unit in the study. **Source of funding** Not reported. **Full citation** Staggs, Vincent S., Nurse staffing, RN mix, and assault rates on psychiatric units, Research in nursing & health. Res Nurs Health, 36, 26-37, 2013.	Association's National Database of Nursing Quality Indicators (NDNQI). **Sampling procedure** The sample was limited to adult psychiatric units for which 2010 data on both staffing and assaults were available. **Number and characteristics of participants** 351 adult psychiatric units from 255 hospitals. All but 18 (5%) of the sample units were classified as locked. There were 11 psychiatric hospitals and 244 general hospitals.154 (60%) had 300 or fewer beds, 167 (65%) were teaching facilities, and 232 (91%) were located in a metropolitan area. 12 (5%) of the hospitals were classified as for-profit, 45 (18%) were government facilities, and 198 (78%) were run by private non-profit organizations. **Sample size**	N/A **Interventions** Total nursing care hours per patient day (TNHPPD). Nursing skill mix. **Comparator** 1-5 Quintiles of TNHPPD and RN skill mix. **How was staffing measured/defined?** **Total nursing care hours per patient day (TNHPPD**). Care provided by RNs, LPNs, and assistive personnel, including mental health technicians. NDNQI defines nursing care hours as productive hours worked by personnel who spend the majority of their time in direct patient care. TNHPPD was calculated for each unit-month by dividing the total number of nursing care hours by the number of patient days. In terms of patient/staff ratios, 6 TNHPPD is equivalent to 4 patients per nursing staff member, and 8 TNHPPD is equivalent to 3 patients per staff member. **Nursing skill mix:** RN mix was computed as the percent of total nursing care	assault (defined as the first assault by the patient in the calendar month) or a repeat assault. 2 assault rates were modelled: total assaults per patient day and injury assaults per patient day. **Control variables** • unit locked status (locked or unlocked), • hospital type (psychiatric or general), and • hospital teaching status (teaching or non-teaching). **Statistical analysis** Total and injury assault rates were modelled as dependent variables using hierarchical Poisson regression, with total staffing and registered nurse (RN) mix as predictors. Linear and spline models were applied.	constant, is associated with an average increase of 12% (95% CI 7 to 16%) in the total assault rate Higher levels of RN mix were associated with lower assault rates (exponential beta 0.939, 95% CI 0.904 to 0.975, *p*=0.001). **Linear model: Injury assaults** Total nursing hours per patient day was associated with increased injury assaults (exponential beta 1.118, 95% CI 1.064 to 1.175, *p*<0.001). RN mix was associated with lower injury assault (exponential beta 0.939, 95% CI 0.899 to 0.980, *p*=0.004). For a typical unit, with values of TNHPPD and RN mix at the medians of 7.1% and 55%, increasing RN mix by 5 percentage points would mean replacing roughly 21 minutes of non-RN care per patient day with RN care. Based on the	126 hours per week, equivalent to more than 3 full-time nursing staff positions. **Author's conclusions** "If staffing has a causal effect on assault rates, hospitals may need to examine the assumptions underlying their psychiatric unit staffing practices. In addition, researchers need to identify the causal mechanism(s) of this effect. . . . . On the other hand, if staffing levels are largely driven by assault rates, it is worth asking why. Are units with higher assault rates staffed more heavily to increase their capacity to handle assaults or in an effort to prevent assaults? If assault prevention is the goal, the underlying assumption is that assault rates can be lowered or stabilized by increasing nurse staffing. Given the findings of this study, this assumption seems dubious except at staffing levels above a high threshold and raises the question of why higher

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	351 adult psychiatric units provided data for 3397 unit-months. **Exclusion criteria** Behavioural health units and units serving special populations (e.g. geriatric psychiatry, dual diagnosis) were excluded. **Inclusion criteria** Adult psychiatric units for which 2010 data on both staffing and assaults were available.	hours during the unit-month provided by RNs.		study average of about 18 patients per unit per day, this translates to 6.3 hours of care per day, or about 44 hours per week—slightly more than one full-time position—converted from non-RN to RN care. The model controlled for the following variables: staffing level (expressed as total nursing hours per patient day), TNHPPD, the interaction between TNHPPD and nursing skill mix, the unit locked status, hospital type and hospital teaching status. Estimates from linear model are presented here. **Spline Model Results** In cubic spline models fit to explore nonlinear staffing–violence associations, assault rates increased with staffing through most of its range but began to decline at very high levels.	staffing levels are not more effective in curtailing violent behavior. Identifying the casual relationship(s) underlying the staffing–violence association will require further research and patient-level data. True experiments involving nurse staffing levels are problematic, but there are quasi-experimental designs that would allow researchers to get a better sense of causation than observational studies like this one.”

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D.8 Evidence table 8 (Melvin et al 2005)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Melvin et al (2005) **Study type** Before and after study **Aim of the study** To audit key performance measures before and after the reconfiguration of acute mental health admission wards within the Royal Cornhill Hospital, Aberdeen. **Study dates** There were 2 6-month data collection periods: baseline data were collected between 1st November 2001 and 30th April 2002 while post-intervention data were collected between 1st May 2002 and 31st October 2002. **Source of funding** The audit was commissioned by the RCH's adult mental health directorate management team.	**Country/ies where the study was carried out** UK **Setting** The acute mental health admission wards within the Royal Cornhill Hospital (RCH) in Aberdeen, Scotland. **Sampling frame** N/A **Sampling procedure** N/A **Number and characteristics of participants** <u>At baseline</u> Prior to June 2002, acute mental health inpatient beds for the Grampian region (population 438 500) were provided in **5** x **25-bed** general psychiatry admissions wards at the Royal Cornhill Hospital (RCH), Aberdeen. In one of the wards, **6 beds** were allocated for patients over the age of 65 years. The total number of adult general psychiatry beds	**Data collection method** Data were collected on 3 specifically designed questionnaires completed daily by nursing staff. These questionnaires gathered staff activity data including: • long- and short-term sickness levels • overtime hours • staff borrowed and loaned to other wards • use of bank staff • staff leave • staff training • number of days ward doors were locked • number of patients placed on raised observations Statistical data on admission and discharge rates were obtained from the RCH records department. The numbers of incidents including missing patients was acquired from the Incident Records already completed by ward staff.	**Outcomes** • Number of admissions • Bed occupancy • Number of incidents • Number of days that ward doors were locked • Observation levels • Sickness levels • Number of bank hours used **Control variables** N/A **Statistical analysis** The data is only described with summary statistics (e.g. frequencies, means) and no further statistical analyses linking variables to outcomes appears to have been undertaken.	**Results** **Staffing hours outcomes** Short-term sickness had reduction of 200 staff hours compared with the previous 6 months when a different staffing establishment had been used, Long term sickness an increase of 610 staff hours, maternity leave a reduction of 1029 staff hours, annual leave an increase of 689 staff hours, Other leave an increase of 140 hours, training of an increase in 504 staff hours, banks staff a reduction of 590 hours and staff overtime an increase of 175 hours compared with the previous 6 month period **Incidents** Incidents were considered to be those which posed a risk to patients or staff, but were not further described by the authors. 42 (reduction 22.1%) less incidents in the after the change in staffing establishment (during the second time period).	**Overall quality score** - **Other information** No statistical testing was conducted. Changes to outcomes cannot be reliably attributed to staffing changes alone as other confounding factors have not been accounted for. **Author's conclusions** The results show it was possible to reduce the inpatient beds without an increase in numbers of incidents and patients placed on observation.

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Full citation Melvin, M., Hall, P., Bienek, E., Redesigning acute mental health services: an audit into the quality of inpatient care before and after service redesign in Grampian, Journal of psychiatric and mental health nursing. J Psychiatr Ment Health Nurs, 12, 733-738, 2005.	pre-June 2002 was therefore **119.** Each ward had the same funded staff establishment of **25.9** whole time equivalents (WTE). This consisted of **17.9 WTE trained nurses** and **8 WTE 'Nursing Assistants**'. At follow-up Following the redesign, the **6 beds** for old age were no longer required. A decision was taken to raise the number of beds in 4 wards from 25 to 28 and to close 1 of the wards. This left the bed compliment at **112**, a net reduction of **7 beds.** The establishment for each of the remaining wards was increased to **27.9 WTE.** **Sample size** See above. **Exclusion criteria** N/A **Inclusion criteria** N/A	2 community psychiatric nurses were each given a 0.5 day session per week to collect and collate the data. **Length of follow up** N/A **Details** N/A **Interventions** A service redesign in which one of the 5 acute mental health admission wards within RCH was closed and bed numbers in other wards were increased, resulting in a net loss of 7 inpatient beds. This resulted in a change in the staffing establishment from 25.9 WTE to 27.9 WTE **Comparator** Baseline data collected before the ward reconfiguration (staffing establishment 25.9 WTE). **How was staffing measured/defined?** See number of patients and characteristics for more details.		**Locked doors** During the second time period doors were locked 13 times more often (5.8% increase). **Patients absconding** There were 2 more patients reported missing than in the first time period (increase 66.7%). **Raised observations** The number of patients under 15 min observations was reduced from 3471 to 3158 (6.1% reduction) in the second time period. The number of patient under closed observations was reduced from 1021 to 856 (6.4% reduction) The number of patients under special observation was reduced from 111 to 42 (62.2%) in the second time period (however it was noted that most observations were made on one patient).	

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D.9 Evidence table 9 (Hanrahan et al 2010b)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Hanrahan et al (2010b) **Study type** Secondary cross-sectional analysis linking survey data and routine hospital data. **Aim of the study** To examine the extent to which organisational factors of the psychiatric nurse work environment (including staffing) affect psychiatric nurse reports of burnout. **Study dates** Psychiatric nurse data were extracted from the dataset of a 1999 nurses survey. **Source of funding** Not stated. **Full citation** Hanrahan, Nancy P., Aiken, Linda H., McClaine, Lakeetra, Hanlon, Alexandra L., Relationship between psychiatric nurse	**Country/ies where the study was carried out** USA **Setting** General hospitals in the state of Pennsylvania with a minimum of six licensed psychiatric beds and at least three psychiatric nurses reported to work there. **Sampling frame** The state licensure list of registered nurses in Pennsylvania, USA **Sampling procedure** <u>For the nurse sample:</u> All nurses included on Pennsylvania's state licensure list (approximately 80,000) were posted a survey; 43,000 nurses responded, a response rate of 52%. All psychiatric registered nurses (PRNs) who declared on the nurse survey that they provided direct patient care as a staff nurse working on a	**Data collection method** Using a cross-sectional observational design, a secondary analysis linked nurse survey data and hospital data to examine associations among organisational factors of the nurse practice environment (NPE) and psychiatric nurse burnout. Psychiatric nurse data were extracted from a large 1999 registered nurses survey dataset from the Commonwealth of Pennsylvania and included questions about: • demographic details • quality of patient care • organisational factors that facilitated or undermined nursing practice* • the presence of nurse burnout** *Organisational factors of the nurse practice environment (NPE) were measured using the Practice Environment Scale	**Outcomes** 3 elements of 'burnout' as detected by the Maslach Burnout Inventory: **Emotional exhaustion**: high levels of emotional exhaustion reflect feelings of being emotionally overextended and exhausted by one's work; **Depersonalisation**: reflects an unfeeling and impersonal response to clients; **Personal accomplishment**: reflects an experience of detachment from any potential job rewards. **Control variables** Adjusted models controlled for the following variables: <u>Nurse-level characteristics</u> • Baccalaureate degree in nursing (yes vs no)	**Results** The average patient-to-nurse ratio in the hospitals in the sample was calculated as **7.10** (SD 2.30). Staffing was not significantly correlated with any of the elements of burnout in the unadjusted models while 'patient-to-nurse staffing ratio was marginally associated with emotional exhaustion in the unadjusted model, it became statistically significant (p=0.047) when nurse and hospital characteristics were added in the adjusted models'.	**Overall quality score** - **Other information** <u>Limitations acknowledged by author:</u> Cross-sectional data; only provides snapshot. Longitudinal data would be more helpful to capture greater depth of the conditions experienced by nurses, staff, and patients that are inherent in the inpatient psychiatric unit in general hospitals. Cannot guarantee that all possible confounders/configuration of variables were controlled for in the regression analysis. <u>Reviewer comments:</u> Cross-sectional data; cannot establish direction of causation (e.g. burnout may cause higher attrition resulting in higher staffing ratios?).

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
work environments and nurse burnout in acute care general hospitals, Issues in mental health nursing. Issues Ment Health Nurs, 31, 198-207, 2010	psychiatric inpatient unit in a general hospital were included in the sample. For the hospital sample: Surveyed nurses were asked to record the name of their employing hospital on their completed survey. The hospital name was then linked with data from the American Hospital Association (AHA) survey data to obtain hospital characteristics. **Number and characteristics of participants** For the nurse sample: *n* = 353 For the hospital sample: *n* = 67 **Sample size** See above. **Exclusion criteria** N/A **Inclusion criteria** For the nurse sample: All psychiatric registered nurses (PRN) who declared on the Pennsylvania nurses survey that they provided direct patient care as a staff nurse working on a psychiatric inpatient unit in	- Nurse Work Index (PES-NWI). **The presence of nurse burnout (specifically: emotional exhaustion, depersonalisation and personal accomplishment) was measured using the Maslach Burnout Inventory. Information about the characteristics of the included hospitals were extracted from American Hospital Association (AHA) survey data from 1999 and included: • number of beds • teaching status ○ a non-teaching hospital was defined as a hospital without any postgraduate medical residents/fellows ○ a teaching hospital was a hospital with postgraduate medical residents/fellows • technology status ○ high technology hospitals were defined as those facilities that provided services for open-heart surgery, organ transplantation, or both, indicating more	• Years of experience Hospital-level characteristics • Bed size (<100 vs. 100 to 350 vs. >350) • Teaching status (teaching vs. non-teaching) • High technology (yes vs. no) Clustering of psychiatric nurses within hospitals was accounted for using Huber-White procedures. **Statistical analysis** • Data were summarised using descriptive statistics (frequencies, mean, median etc.). • Pearson's correlation coefficient was used to describe the strength and direction of linear association among variables. • Homoscedasticity was evaluated using Levine's tests. • Normality was assessed using Shapiro-Wilk tests. • Unadjusted and adjusted general linear regression models were used to		The data that were extracted were 10 years old by the time the analysis was conducted. A lot of the data were self-reported; no indication of implications for accuracy. The staffing ratio variable was a figure derived from respondents reporting the total number of patients they had cared for in their most recent shift and this was then aggregated up to give a ratio at the hospital level - not based on actual patient-to-staff ratio data collected from the hospitals included in the sample. No way of knowing whether the patient numbers given by nurses were a) accurate and b) representative of their average workload (could have been an exceptionally busy/quiet shift). No response rate reported specifically for RPNs but the RR for the wider nurses survey from which the data were drawn only had a RR of 52% - risk of

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	a general hospital. <u>For the hospital sample:</u> Defined by AHA as a general hospital with a minimum of 6 licensed psychiatric beds At least 3 psychiatric nurses were reported to work in the identified hospital	sophisticated resources **Length of follow up** N/A **Details** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** A question on the nurse survey asked each nurse to report the total number of patients they cared for on the last shift worked. The average number of patients that nurses reported caring for on their last shift was aggregated to the hospital level to define a patient-to-nurse staffing ratio. "The predictive validity of this method of measuring hospitals nurses' workload has been established".	examine the extent to which organisational factors, including the nurse-to-patient staffing variable, were associated with RPN emotional exhaustion, depersonalisation and personal achievement.		non-response bias. The nurse sample seems fairly representative of the wider nursing population in the USA (in terms of demographic characteristics) but not clear how representative the hospital sample is in terms of the institutional characteristics. Not clear how generalisable the findings would be to a UK setting. The original survey from which the data were extracted used instruments that appear to have been well-validated elsewhere in the literature (e.g. the PES-NWI and the MBI). **Author's conclusions** "Findings from our study show that lower psychiatric nurse staffing levels were associated with a higher risk for nurse burnout. Larger psychiatric nurse workloads (i.e. more patients per nurse) were significantly related to higher psychiatric nurse burnout. This is the first

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
					study showing an effect of psychiatric nurse staffing levels on psychiatric nurse burnout in the US [...] Burnout of psychiatric nurses may represent precursors for nurse turnover which must raise attention to safety practice and research."

D.10 Evidence table 10 (Williams et al 2001)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Williams et al (2001) **Study type** Correlational study (prospective observational). **Aim of the study** The study aimed to examine the relationship of 'lesser restrictive interventions' (LRI) with the use of seclusion/restraint by addressing the following research questions: • Is there a significant relationship between the	**Country/ies where the study was carried out** USA **Setting** A 148-bed state mental health facility. **Sampling frame** Not clear how the participating facility was selected. **Sampling procedure** All voluntary and involuntary patients in hospital over a 5-week period who had Axis 1	**Data collection method** Crisis events involving LRI were identified from the crisis cycle intervention tool used at the participating facility. For each event, staff initiated and completed a crisis cycle intervention tool. A staff questionnaire was used to collect demographic information about nursing staff working in the facility: • This questionnaire was designed by the researchers and was assessed for content validity by the facility's HR director and unit managers.	**Outcomes** The use of LRI, expressed as the mean number of LRI recorded during the data collection period. **Control variables** The linear regression analyses simply analysed the association between staff mix/experience variables and the use of LRI - no other variables were controlled for. **Statistical analysis** For the research questions relating to staff mix/experience, the total sample of **82** crisis events	**Results** The mean number of LRI used was **11.28** (SD 5.47) The mean percentage of licensed staff on a nursing team was **58.79%** and the mean years of psychiatric nursing experience was **4.89** (SD 1.68) There was a positive significant relationship between the proportion of licensed staff on the nursing team and the mean number of LRI used: r=**0.379**, p<**0.001**. Regression analysis	**Overall quality score** - **Other information** Author-acknowledged limitations: 'There are multiple variables associated with the use of seclusion/restraint and LRI and it is difficult to single out the effect each one has on the outcome. Many factors, such as staff attitudes and demographics, patient behaviours and diagnoses, patient population, hospital setting (private vs public),

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
number of lesser restrictive interventions (LRI) implemented during the third phase of the crisis cycle and the use of seclusion/restraint? • Will the number of LRI implemented during the first three phases of the crisis cycle increase as the **average number of psychiatric years' experience among nurse staff increases**? • Will the number of LRI implemented during the first three phases of the crisis cycle increase as the **percentage of licensed nurses increases**? **Study dates** Not stated. **Source of funding** None stated. **Full citation** Williams, J. Earle, Myers, Rachel E., Brown, Canatsey, Craig, Crenshaw, Fisher, Kirkpatrick, Mandt, Mason, Morales, Myers, Outlaw, Schwab, Thompson, Relationship of less restrictive interventions	and/or Axis 2 diagnoses. **Number and characteristics of participants** The population consisted of all voluntary and involuntary patients in hospital over a 5-week period who had Axis 1 and/or Axis 2 diagnoses. Patients ranged from 18 to 64 years. 'The sample consisted of all events in which a patient required crisis intervention which led to the initiation and completion of the crisis cycle intervention tool per the researchers' protocol': • **82** crisis events identified • **66** involved the 3rd phase of the crisis cycle (see 'Methods' section for further details). **Sample size** See above. **Exclusion criteria** N/A **Inclusion criteria** N/A	• The questionnaire was piloted with 8 staff none of whom made any comments regarding concerns or issues they had with the survey. Researchers obtained staffing lists from each unit in which a crisis event was reported. **Length of follow up** N/A **Details** **Seclusion** was defined as 'the placement of a patient in a room with the door secured in such a way that will not permit the patient to open it'. **Restraint** was defined as 'the use of any mechanical device that restricts the physical movement of a patient'. **Lesser restrictive interventions (LRI)** are 'alternative treatments to seclusion and restraint during a crisis event that are used to assist the patient with managing self using the least restrictive	was used in the analysis. Pearson's correlation and simple regression analyses were used to test the relationship between staff mix/experience and the use of LRI. For the research question analysing the correlation between LRI and seclusion/restraint, the subsample of **66** incidents (which involved the 3rd phase of the crisis cycle) were included in the analysis.	demonstrated that **14.3%** of the variability in the number of LRI used could be explained by the proportion of licensed staff (R^2=**0.143**). There was no significant relationship between average years of psychiatric experience and the use of LRI: r=**0.146**, p=**0.096**.	hospital mission and policies, and administrative philosophies and beliefs, need to be considered, as well as the effect of extraneous variables.' 'The impact of staff education is another vital variable to consider. Of importance, the researchers did find that the state mental health facility advocates and supports staff education for crisis management. In fact, it is mandatory training for all clinical staff during their orientation and must be renewed every year. This emphasis on staff education, along with the facility's strong philosophy of using the least restrictive means in managing patients in crisis, most likely are significant contributing factors to the low use of seclusion/restraint.' 'The lack of validity/reliability testing of the crisis cycle intervention tool was a limitation of the study. The completion of this tool was dependent on

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
with seclusion/restraints usage, average years of psychiatric experience, and staff mix, Journal of the American Psychiatric Nurses Association. J Am Psychiatr Nurses Assoc, 7, 139-144, 2001.		means'. An **event** refers to an 'occurrence in which a patient experiences/expresses verbal or physical symptomatology in relation to external or internal stimuli. In addition, this occurrence must require crisis intervention and the initiation of the crisis cycle intervention tool'. **Crisis cycle** refers to 'a progression of internal and external behaviour exhibited by the patient while experiencing a stressful situation'. This cycle has been described in terms of six stages: • Stimulation • Escalation • Crisis • De-escalation • Stabilisation • Post crisis drain The **crisis cycle intervention tool** was developed at Northern Virginia Mental Health Institute and is used by staff to indicate which phase of the crisis cycle a patient is experiencing and the associated nursing			individual nursing staff members, so accuracy could have been an issue. The number of LRI indicated on the tool may have differed from the actual LRI used by the staff. Also, all staff demographics were obtained by voluntary participation; thus, some staff may have misreported information.' '...the study was conducted at only 1 psychiatric facility; therefore, the findings cannot be generalized to all settings.' **Author's conclusions** 'The number of LRI implemented significantly increased as the percentage of licensed nurses increased [...] with current emphasis on decreasing costs, many health care facilities are replacing licensed staff with unlicensed assistive personnel. However, little research has been conducted on analyzing the effect of staff mix changes on clinical outcomes. If nursing departments decide

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
		interventions used to assist the patient. For the purposes of this study, the term **'nursing staff'** refers to registered nurses, psychiatric practical nurses, and unlicensed psychiatric technicians. **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Staff mix was expressed as the proportion of licensed staff on a nursing team.			to change their staff mix, it is crucial that they establish a mechanism to evaluate the impact of this change on quality of care and desired outcomes.'

D.11 Evidence table 11 (Lewin et al 2012)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Lewin et al (2012) **Study type** Secondary analysis of psychiatric unit datasets.	**Country/ies where the study was carried out** Australia **Setting** **11** psychiatric units from **3** catchment-based area mental health services in the state of New South Wales, Australia. This	**Data collection method** **3** data sources were used: a primary dataset comprising **shift-level** ward event logs (WELs) completed by the nurse in charge of the shift which	**Outcomes** Shift climate rating (SCR) Note: The SCR was calculated using an instrument developed especially for this study - the SCR scale - which was designed to provide a 'snapshot' of the overall social-emotional climate	**Results** Higher SCR shifts (i.e. those with **poorer** shift climate) were positively and significantly correlated with higher proportions of experienced staff (**0.19**) and the reporting of additional	**Overall quality score** - **Other information** Reviewer comments: The study failed to show that staff-to-patient ratios were significantly correlated with variations in the

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Aims of the study • To describe the methods used to assess shift climate and to report associated profiles. • To examine the contributions that unit, staff and patient characteristics make to shift climate. **Study dates** Data from a 12 month period were used in the analyses although the exact study dates are not stated. **Source of funding** The project was sponsored by the Centre for Mental health (New South Wales Department of Health and Aged Care, Sydney) and received ongoing support from the 3 participating health services (Hunter, Illawarra and South Western Sydney). **Full citation** Lewin, Terry J., Carr, Vaughan J., Conrad, Agatha M., Sly, Ketrina A., Tirupati, Srinivasan, Cohen, Martin, Ward, Philip B., Coombs, Tim, Shift climate	included **4** units in a stand-alone psychiatric hospital (including a high dependency unit and a specialised unit for comorbid substance abuse) and **7** units in general hospitals (including 1 high dependency unit). **Sampling frame** Not stated. **Sampling procedure** It is not clear how the 3 area mental health services were selected for inclusion in the study. The 11 psychiatric units included in the study represent **all** of the acute inpatient units within these 3 services. **Number and characteristics of participants** The primary level of analysis for this paper was the 8 hour nursing shift: during the 12 month evaluation period, shift-level data were potentially available for **11, 866** shifts. Of these, climate ratings were available for **8176** shifts. Only the **5945** shifts with complete data for	included: • bed usage • ward movements (i.e. patient transfers, admissions, discharges) • number of involuntary patients • nursing experience (the number of nurses with <2 or ≥2 years of psychiatric nursing experience) • staffing demands (i.e. 'as usual' vs. additional, moderate or high, including unexpected staff absences, or excessive numbers of patients requiring particular interventions and support) • number of formal incident forms completed (e.g. for serious or reportable aggressive episodes or other incidents) • shift climate ratings (SCR) a secondary dataset of patient-level events, comprising patient daily logs (PDL) completed at the end of the shift by the nurse assigned to each patient: • nursing observation/care	within each unit during each shift. The scale consists of four Likert-style ratings measuring overall perceptions of the unit at the time of completion, covering: • emotional state (0 [calm] to 4 [frightening]) • aggression (0 [cooperative] to 3 [violent]) • activity level (0 [goal directed] to 2 [disruptive]) • social cohesion (0 [cohesion] or 1 [fragmentation]). The SCR scale was completed by the nurse in charge of the unit at the end of each shift and scores were entered into the ward event log (WEL). **Control variables** There were 32 variables considered to be potential predictors of shift climate. These included staff-patient ratio as well as the perception of additional staffing demands. (Unit size, shift, occupancy rate, staffing experience, patient gender, patient age, proportion of involuntary	staffing demands (**0.61**). The contribution of additional staffing demands to variations in climate from shift-to-shift persisted in the second regression model (**0.46**) in which unit location and non-specific unit differences were controlled for. • After controlling for unit location and non-specific unit differences, the association between staff experience and shift climate became smaller and non-significant - this suggests that this characteristic varied systematically across the participating units (e.g. there may be more experienced staff in high dependency units containing predominantly involuntary patients). • A higher **nurse-to-patient ratio** was inversely correlated with higher SCR shifts (i.e. those with **poorer** shift climate) but the association was non-significant both before and after	social-emotional climate from shift to shift. That is not to say that staff-to-patient ratio doesn't affect shift climate - it's just that if staffing ratios remained fairly static between shifts within each unit then an effect on the shift-level micro-climate would be unlikely to be detected. <u>Strengths:</u> Robust statistical modelling techniques used to assess the relative predictive value of many factors on overall shift climate while controlling for differences between the 11 units included in the study. Very low threshold for statistical significance in order to overcome potential issues arising from large sample size and large number of statistical tests undertaken - relatively low risk of type II errors. Large multi-centre sample. <u>Limitations:</u> The main outcome measure in this study, shift climate,

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
profiles and correlates in acute psychiatric inpatient units, Social psychiatry and psychiatric epidemiology. Soc Psychiatry Psychiatr Epidemiol, 47, 1429-1440, 2012.	all potential predictors of shift climate were included in the main regression analysis. The typical unit averaged **20.21** beds, with **88.4%** occupancy and a patient mix comprising **56.0%** males, averaging **38.32** years of age, **64.7%** of whom were involuntary admission. The majority of nursing staff (**85.1%**) had more than 2 years' relevant mental health experience. On the typical shift, each nurse managed **5.23** patients with **27.8%** of shifts involving 'moderate' additional staffing demands (e.g. large number of patients attending ECT). **Sample size** See above. **Exclusion criteria** Shifts for which climate ratings and/or information on predictors of climate were unavailable were excluded from the main regression analysis. **Inclusion criteria** N/A	levels (e.g. from constant observation to 2-hourly intervals) • contacts with mental health staff and visitors • periods of authorised or unauthorised leave • participation in structured therapy programmes • usage of pro re nata (PRN) medications • legal status changes • usage of non-prescribed substances • ratings of aggressive incidents which were subsequently coded as reportable (i.e. involving physical contact or a definite intention to inflict harm) or less serious (i.e. verbal threats or demands without a plan to inflict harm) • observed mental state readings the health information exchange, a secondary dataset comprising admission-level information for each patient: • age • gender	patients, ward movements, structured therapy, visitors, reportable aggressive incidents, non-reportable aggressive incidents, unauthorised leave, PRM medication, emotional distress, withdrawal, disinhibition, psychosis, cognitive impairment, additional staffing demands) **Statistical analysis** Hierarchical regression analysis was used to examine the predictors of overall shift climate. A variety of regression models were also used to assess the relative contributions of shift- and unit-level factors. The threshold for significance was set at $p<0.001$.	controlling for unit-level characteristics (**-0.01, R^2 0.031**). The authors speculate that this may be because staff-patient ratios are a unit-level characteristic and thus are relatively 'enduring' between shifts.	was derived from self-completed rating scales filled in by a senior nurse at the end of each shift. This introduces a degree of subjectivity to the process and thus the results of the SCR scale may be influenced by the characteristics of the completer. SCR scores also seem to be highly influenced by unit-level characteristics. Inter-rater reliability of SCR not formally assessed. There is a potential conflict in asking staff to report shift climate at the same time as reporting staffing demands - if the nurse perceives that the shift climate has been severe then this may well lead them to report additional staffing demands. 'Moderate' completion rates for shift-based logs Patient perceptions of social-emotional climate not assessed - this may have different determinants than

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
		• legal status on admission • ICD-10 discharge diagnosis • length of stay • re-admission status **Length of follow up** N/A **Details** The study sought to assess the extent to which shift-to-shift variations in social-emotional climate are independent of overall unit-to-unit differences. That is, are there genuine changes in the micro-climate from shift-to-shift or do the observed differences largely reflect more enduring unit characteristics such as location and setting effects, organisational and role differences, and overall patient and staffing characteristics? **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?**			staff-reported climate. Much of the analysis was based on staff-reported data - elements of reporting bias may therefore affect the robustness of the findings. **Author's conclusions** "Some studies have shown that staffing experience is associated with reduced violence. However, in the current study, increased experience was associated with a poorer climate, suggesting that more experience staff may tend to be placed in units with more challenging patients." "Other studies have found that mental health service-specific demands tend to increase staff stress. Another possible explanation is that the units with the most severely ill patients tend to precipitate a higher level of additional demands. Alternatively, units in which the shift climate was more severe may have also been perceived as having a higher level of additional demands."

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
		The staff ratio was expressed as the number of patients per member of nursing staff.			"It needs to be clearly acknowledged that there was a substantial variation across the units. A large proportion of the variance in overall climate scores was associated with unit-to-unit differences."

D.12 Evidence table 12 (Daffern et al 2006)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Daffern et al (2006) **Study type** Secondary analysis of a dataset collected during a wider prospective observational study. **Aim of the study** To examine the relationship between staff gender ratio and incidents of aggression on 3 acute wards within a secure forensic psychiatric hospital.	**Country/ies where the study was carried out** Australia **Setting** The Thomas Embling Hospital (TEH), a secure hospital of the Victorian Institute of Forensic Mental Health, situated in Melbourne, Australia. **Sampling frame** N/A **Sampling procedure** Unclear how participating units were selected. **Number and**	**Data collection method** The data used in this analysis were collected as part of a wider programme of research into aggression at TEH. The proportion of male/female staff on each shift was calculated using information extracted from nursing rosters. The gender of the Registered Psychiatric Nurse level 3 (RPN3) whose role was to manage the shift and whose influence affected the 'culture' of a shift was also determined for each shift. Incidents of aggression were logged on paper forms	**Outcomes** • The likelihood of aggressive incidents occurring during a shift. • The likelihood of an incident form being completed following an aggressive incident. • The likelihood of seclusion occurring as a result of aggression. **Control variables** Aside from staff gender ratio/the gender of the nurse in charge, the analysis did not control for any other variables which may affect the incidence of	**Results** <u>Summary</u> **316** incidents of aggression recorded during 6 month study period. Males were responsible for **228** aggressive behaviours; females were responsible for **88**. The gender ratio varied considerably on a shift-by-shift basis on both the male and female acute units. <u>Aggression on the female acute ward</u>	**Overall quality score** - **Author-acknowledged limitations** The 6 month period of investigation was short. A number of other staffing factors which potentially confound the association between gender ratio and aggressive incidents were not accounted for e.g. staff experience, staff skill mix, use of temporary staff. Only univariate analysis undertaken.

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study dates 1st October 2001 to 31st March 2002 **Source of funding** Not stated **Full citation** Daffern, Michael, Mayer, Maggie, Martin, Trish, Staff gender ratio and aggression in a forensic psychiatric hospital, International journal of mental health nursing. Int J Ment Health Nurs, 15, 93-99, 2006.	**characteristics of participants** TEH provides psychiatric assessment and treatment for mentally disordered offenders and serves the following: • Patients who are either remanded or sentenced prisoners with a serious mental illness requiring inpatient treatment • Patients detained as being unfit to plead or not guilty because of mental impairment • Patients referred by courts for psychiatric assessment and/or treatment • Patients referred from general mental health services, often because they were considered to be at high risk of aggression. At the time of the study: • the TEH's acute care programme comprised **40 beds** in **3 units**: **2 15-bed units** for acutely ill men and **1 10-bed unit** for acutely ill women. • the TEH's continuing care programme comprised	by staff members using an adapted version of the Overt Aggression Scale (OAS): an aggressive episode was defined as the occurrence of any behaviour listed on the adapted OAS (which excludes aggression against self). Incidents of seclusion were also logged. **Length of follow up** N/A **Details** The study sought to assess the following: • The relationship between a shift's staff gender ratio and the likelihood of aggressive incidents occurring. • The relationship between a shift's staff gender ratio and the severity of aggressive incidents which occurred. • The relationship between the gender of the RPN3 on shift and the likelihood of aggressive incidents/seclusion occurring. • The relationship between the gender of the RPN3 on shift and the likelihood	aggressive acts. **Statistical analysis** Descriptive statistics were used to describe the type/nature of aggressive incidents. Several analyses were conducted to investigate the association between staff gender ratio, and the gender of the RPN3, with the likelihood of aggression: • *T*-tests were used to assess the relationship between the proportion of male/female staff working on shifts where aggressive incidents occurred compared to those when there was no incident. • Chi-square analyses were used to determine the relationship between the RPN3 and the likelihood of aggression. Chi-square tests were also used to determine whether a patient was more likely to be secluded following an aggressive incident, and incident form completed, depending on the gender of the RPN3. • Non-parametric correlation analysis	A total of **502** shifts were assessed: **341** in which the RPN3 was female and **139** in which the RPN3 was male. There were **22** shifts where the nurse in charge could not be identified. There was no significant difference in the likelihood of aggression occurring when the RPN3 was female compared with when the RPN3 was male: χ^2=**1.363**, *p* **not significant** *[actual p value not reported nor is the threshold used for statistical significance].* There was no significant difference in the mean percentage of female staff working on the female acute ward on the shifts where there was an aggressive incident (**68.71%**) compared with when there was no aggressive incident (**68.02%**): *t*= -**0.220**, *p* **not significant.** The correlation between the severity of the aggressive incident and the percentage of male staff was not significant: Pearson	Only considers single-sex units - findings potentially not generalisable to mixed wards. Secure forensic setting may mean that findings can't be generalised to other mental health settings. For example, in some settings, security staff are responsible for some/all aspects of restraint whereas in others, restraint is the sole responsibility of clinical staff (as was the case in this particular setting). **Reviewer conclusions** Large number of non-significant associations may indicate that the study was insufficiently powered to detect significant effects. Difficult to assess whether certain shortcomings of the paper are related to poor study conduct or merely poor reporting - no data presented in tables/figures, no absolute staff numbers reported (only gender ratios), p values/significance threshold not reported, no

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	40 beds: **1 20-bed** extended care unit and **1 20-bed** intensive psychosocial rehabilitation unit. **Only the acute care units were included in the study.** **Sample size** See above. **Exclusion criteria** Not stated. **Inclusion criteria** Not stated.	of an incident form being completed after an aggressive incident. **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Staff gender ratio was expressed as the percentage of male/female members of nursing staff on duty during a shift.	(Spearman's rho) was used to assess the correlation between the percentage of male/female staff on shift and the severity of aggressive incidents.	correlation **0.115,** *p* not significant**,** *n*=**66**. <u>Aggression on the male acute wards</u> A total of 1092 shifts were assessed: **453** in which the RPN3 was female and **639** in which the RPN3 was male. There was no significant difference in the likelihood of aggression occurring when the RPN3 was female compared with when the RPN3 was male: χ^2=**1.204**, *p* not significant *[actual p value not reported nor is the threshold used for statistical significance].* There was no significant difference in the mean percentage of male staff working on the male acute ward on the shifts where there was an aggressive incident (**56.51%**) compared with when there was no aggressive incident (**58.41%**): *t*=-**0.220**, *p* not significant. The correlation between the severity of the aggressive	results reported from the continuing care programme etc. Study does not include a description of the nursing staff included in the gender ratio - not clear if staffing figures consist solely of registered nurses or if it also includes HCA-type staff. Sampling procedure unclear: the paper initially describes both the acute and long-stay units within TEH and then goes on to state that only incidents that occurred on the acute wards were included in the study - not clear why/how this decision was taking. May have led to an element of selection bias. No commentary re: possible reporting biases - no indication as to how accurate one could expect the reporting of aggressive incidents to be. **Author's conclusions** "This study, although limited, has identified that

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				incident and the percentage of male staff was not significant: Pearson correlation **0.99,** *p*=**0.2,** *n*=**170.** <u>Other</u> There was no significant difference in the likelihood of an incident form being completed when the RPN3 was male compared with when the RPN3 was female: χ^2=**3.366**, *p* **not significant.** There were **50** occasions during the study when patients were secluded as a consequence of aggressive behaviour; there was no significant difference in the likelihood of a patient being secluded after an aggressive incident when the RPN3 was male compared with when the RPN3 was female: χ^2=**0.335**, *p* **not significant.**	there were no statistically significant relationships between gender ratio of staff and aggression, or staff responses to aggression in one psychiatric inpatient setting. The findings, although far from conclusive, may serve to challenge, or support, beliefs about the staff gender ratio in an inpatient unit and to stimulate further research in this area."

D.13 Evidence table 13 (Janssen et al 2007)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Janssen et al (2007) **Study type** Retrospective analysis of hospital administrative data. **Aim of the study** To explore the impact of staff characteristics such as number of nurses on the ward, level of education, male-female ratio and (variability in) the staff's work experience on the likelihood of seclusion. **Study dates** Data were collected for all the days in 1997 to 1999. **Source of funding** Not stated. **Full citation** Janssen, Wim, Noorthoorn, Eric, Linge, Roland van, Lendemeijer, Bert, The influence of staffing levels on the use of seclusion, International journal of law and psychiatry. Int J Law Psychiatry, 30, 118-126, 2007.	**Country/ies where the study was carried out** Netherlands **Setting** 4 mid-sized Dutch psychiatric hospitals with a capacity of 350 to 560 beds participated in the study. The study was carried out on 10 wards: 4 adult long-stay wards (length of stay more than 1 year) and 6 adult admission wards (length of stay shorter than 1 year). **Sampling frame** The administrative databases of 3 departments in the participating hospitals: • Patient administration departments • Staff planning departments • Personnel and finance departments. **Sampling procedure** Data were collected for all the days in 1997 to 1999. For the analysis, a sample of 2 months per year was taken for each participating ward on rota including	**Data collection method** Data were collected from 3 sources within the participating institutions: • **Patient administration departments** provided information re: dates, number of seclusions and number of patients admitted per day • **Staff planning departments** identified staff members working each given day. • **Personnel and finance departments** provided information on gender, level of education, work experience and employment status. **Length of follow up** N/A **Details** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Staffing levels described as	**Outcomes** • Number of seclusion events. • Entire days (24 hours) with or without seclusions. **Control variables** **Level of education**: • Higher professional (bachelor level, BSc) • Mid-level vocational (4 year course at secondary school) • Nurse's aid (3 years lower level course at secondary school) • Geriatric aid (2 years lower level course at secondary school) • Student nurses (yet to finish courses or unqualified). The staff's level of education-patient ratio was expressed in a variable which calculated the **number of nurses per level of education per patient** by dividing the number of nurses in each educational category by the actual number of patients	**Results** **Univariate analysis** <u>Staff complement</u> • A significant relationship was only found between patient-staff ratio and the number of seclusions on long-stay wards. • An increase in the patient-staff ratio corresponded with an increase in the number of seclusions on long-stay wards (r_{xy}=***0.253***; p<0.001). • In the long-term wards, an increase in number of seclusions was also associated with an increase in the ratio of patients per permanent staff members (r_{xy} = 0.313, p<0.001). <u>Staff composition by gender</u> • The means of male-female staff ratios differed significantly on days with seclusions and days without seclusions in both the admissions ward (T-test = -4.387, p<0.001, 95% CI -0.0375 to -0.143), and long-stay wards (T-test	**Overall quality score** - The study design limited the ability of the authors to collect data on variables may well also have an association with seclusion rates e.g. patient characteristics (such as age, gender, diagnosis etc.) and organisational factors (e.g. hospital seclusion policy). This may mean that important confounders were not accounted for in the multivariate analysis and thus the effects observed cannot be interpreted with a high degree of confidence. The retrospective data analysis also impairs the ability of the authors to assess the reliability of information gathered by ward staff (e.g. the number of seclusions) as they were unable to observe outcomes for themselves. **Other information** **Author's conclusions** The authors state that staff complement (i.e. patient-nurse ratios), staff

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	1 spring month and 1 autumn month (e.g. data for ward 1 were taken during February and August in 1997; during April and October in 1998; and during June and December in 1999). **Number and characteristics of participants** <u>Overview</u> • Data from **1373** days were used in the analysis. • A mean of **35** patients and **14** nurses per **24 hour** period was observed across the 10 study wards. As administrative data were used no information concerning patient characteristics is available. <u>Hospital/ward characteristics</u> Hospital 1: 440 beds Hospital 2: 350 beds Hospital 3: 570 beds Hospital 4: 410 beds <u>Staff complement</u> Mean on admissions wards: **2.2** patients per nurse per 24 hours	the number of nurses in a team per day (24h). Patient-staff ratio was calculated by dividing the number of patients admitted on the ward by the number of staff. A male-female staff ratio was calculated by dividing the number of male staff by the number of female staff.	on the ward each day. **Work experience (in years)** The **team**'s work experience was presented as the **mean of years worked** calculated by summarising the work experience of each attending staff member and dividing this by the number of staff. The standard deviation of the team's mean work experience was used to illustrate homogeneity/variability i.e. whether or not all nurses on the ward on a certain day were very experienced. **Employment status -** permanent staff member or temporarily hired nurse. **Statistical analysis** Pearson's correlation coefficients were calculated to study the association between seclusion events and staffing variables (patient-staff ratio, mean of work experience and variability in work experience). Unpaired Student *T*-test (2-tailed) was used to test the difference of means of	= -7.821, p<0.001, 95% CI -0.0373 to -0.223). <u>Staff composition by level of education</u> • The composition of teams in terms of level of education was never constant in time and was subject to daily fluctuations. • On admission wards, more staff with higher professional level and mid-level vocational education were employed; **this was not associated with likelihood of seclusion**. • On long-stay wards there were more nurse's aides and student nurses and fewer mid-level vocational educated nurses on seclusion days. <u>Staff composition by work experience</u> • On both types of ward, longer work experience was inversely related to seclusions: ○ admissions wards: r_{xy}=**-0.134**; p<0.001 ○ long-stay wards: r_{xy}=-**0.187**; p<0.001 • The	composition according to gender and staff's variability in work experience are "preconditions for the use of seclusion". However, while seclusion use may be attributed to inadequate staff complement/composition, the authors conceded that the study "did not explore the causal direction of this attribution". "The correlation found on the long-stay wards between the number of permanent staff, the number of temporarily hired nurses and the number of seclusions observed in this study was reasonably small but this trend was similar to findings of [other studies where it was proposed] that patients admitted to long-stay wards were less likely to exhibit potentially dangerous behaviour in the presence of permanent staff members. Also, based on their knowledge of and experience with the patients, permanent staff members may be expected to recognise certain behavioural characteristics in their patients at an early

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	• **5** to **6** patients per nurse during day/evening shifts • Up to **10** to **20** patients per nurse on night shifts Mean on long-stay wards: **2.8** patients per nurse per 24 hours • **7** patients per nurse during day/evening shifts • Up to **10** to **20** patients per nurse during night shifts. Nursing teams on both admissions wards and long-stay wards consisted of **93%** permanent staff members and **7%** temporary staff members. <u>Staff composition by gender</u> Mean male-female ratio on admissions wards: **1.1** Mean of males employed ratio on long-stay wards: 39%. <u>Staff composition by level of education*</u>		all staffing variables between days on which seclusions took place and days no seclusions occurred. A binary logistic regression analysis was used to develop a model to investigate the effects of a combination of independent staffing variables on a dichotomous outcome variable: days with or without seclusions.	homogeneity/variability in a team's work experience was **6 years** across all the wards. • An increase in the variability of experience (i.e. the presence of fewer and more experienced staff in the team on a given day) was associated with a decrease in seclusions on both types of ward: ○ admissions wards: r_{xy}=**-0.112**; p=0.002 ○ long-stay wards: r_{xy}=**-0.204**; p<0.001. **Multivariate analysis** • On the admissions wards only the variables 'variability of work experience' and 'male-female staff ratio' persisted as significantly associated with seclusion in the logistic regression analysis. • Variability of work experience was the most powerful predictor (OR 0.871; 95% CI 0.808 to 0.938; p<0.001) followed by male-female ratio (OR 0.75; 95% CI 0.674 to 0.898;	stage, and take necessary measures." "In long-term wards, the presence of nurse's aides and student nurses in the teams increased the probability of seclusion." "More seclusions might occur within a homogenous team with a small variability in work experience."

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	Higher professional: **15%** (median 9.1%; SD 18.4%) Mid-level vocational: **74.1%** (median 77.3%; SD 18.5%) Nurse's aid: **2.1%** (median 0%; SD 4%) Geriatric aid: **0.7%** (median 0%; SD 4.4%) Student nurses: **7.3%** (median 0%; SD 2.2%) **See section on control variables for descriptions of each education level.* <u>Staff composition by work experience</u> Mean level of work experience on both admissions wards and long-stay wards was approximately **7.5** years. Mean homogeneity/variability of work experience across all wards was approximately			*p*=0.001). • On the long-stay wards the variables 'male-female staff ratio', 'variability in work experience' and the employment of mid-level vocational educated nurses' were significantly associated with seclusion in the regression model. • Male-female staff ratio was the most powerful predictor (OR 0.353; 95% CI 0.220 to 0.567; *p*<0.001) followed by variability of work experience (OR 0.778; 95% CI 0.674 to 0.898; *p*<0.001) and employment of mid-level vocational educated nurses (OR 0.02; 95% CI 0.002 to 0.257; *p*<0.003). • On both types of wards more males and more variability of working experience were related to a decrease in seclusion. Taking odds ratios into account, these variables were more strongly associated with seclusions on long-stay wards.	

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	6 years. **Sample size** Data from 1373 days were used in the analysis. **Exclusion criteria** Months with incomplete data were excluded from the study. **Inclusion criteria** N/A				

D.14 Evidence table 14 (Lay et al 2011)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Lay et al (2011) **Study type** Retrospective dataset analysis. **Aim of the study** • To determine how frequently, and to whom, coercive measures (compulsory admission, restraint/seclusion and	**Country/ies where the study was carried out** Switzerland **Setting** All psychiatric facilities mandated to provide basic psychiatric care to adults in the Canton of Zurich, Switzerland. **Sampling frame** The central psychiatric register covering all psychiatric hospitals in the Canton of Zurich,	**Data collection method** Information was extracted from the central psychiatric register for the Canton of Zurich, Switzerland and included: • compulsory detention data • patient-level information including socio-demographic data (e.g. age, gender, educational level etc.) and clinical measures (e.g. psychiatric	**Outcomes** The use of 3 coercive measures: • compulsory/involuntary admission • restraint/seclusion • coercive psychopharmacological medication. **Control variables** Measures at the patient level (assessed at admission): • **psychopathological**	**Results** <u>Summary:</u> • 21.7% of all inpatients were compulsorily admitted to psychiatric care. • Restraint or seclusion were applied to 5.6% of patients during the course of their treatment. • Coerced/forced administration of medication occurred during the treatment of 3.7% of patients.	**Overall quality score** - **Other information** • Large sample size - reported results appear precise (very narrow confidence intervals) and robust (significance reported at threshold of 0.01). • Data collected on wide range of variables, no obvious confounders missing from the

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
forced medication) are applied in hospitals mandated to provide basic adult psychiatric care. • To assess the patient characteristics and hospital characteristics associated with the use of coercion. **Study dates** 1st January to 31st December 2007. **Source of funding** Not stated. **Full citation** Lay, B., Nordt, C., Rossler, W., Variation in use of coercive measures in psychiatric hospitals, European psychiatry : the journal of the Association of European Psychiatrists. Eur Psychiatry, 26, 244-251, 2011.	Switzerland. This register covers data of all psychiatric hospitals in the region which serve a population of 1.3 million people. **Sampling procedure** The authors traced all inpatient records for patients aged 18 to 70 discharged between 1st January 2007 and 31st December 2007. **Number and characteristics of participants** A total of **9698** inpatient records were identified. Patient files with missing data were excluded from the analysis so the final sample for analysis comprised **9580** records corresponding to **9608** patients from **6** psychiatric hospitals. The total number of nursing staff in whole-time equivalents (WTE) was **1071** across the 6 hospitals with an average of **378.9** patient-days per nurse. Further patient data are available in Table 1 in the	diagnosis, use of coercive measures during inpatient stay). Information about structural characteristics of each of the psychiatric hospitals in the sample were compiled from Health Department documents referring to the study year 2007: • number of hospital beds, mean length of stay, mean bed occupancy rate • number of WTE staff nurses. **Length of follow up** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** A measure of 'patient-days per nursing staff' was calculated from the number of WTE staff nurses and the sum of 'patient-days passed to account'.	**variables** ○ psychiatric diagnosis (ICD-10 main categories) ○ severity of disorder (CGI scale) • **socio-demographic variables** ○ age ○ gender ○ educational level ○ employment status ○ citizenship (Swiss national vs foreign national) ○ residential situation pre-admission Measures at the centre level: • **structural characteristics** ○ number of hospital beds ○ mean length of stay ○ mean bed occupancy rate ○ nursing staff workload (expressed as 'patient-days per nursing staff') **Statistical analysis** • In the first instance logistic regression	<u>Results from the 'pre-analysis':</u> The logistic regression showed that there were significant differences between the hospitals in their use of coercive measures after adjusting for all socio-demographic and clinical variables observed in the study. The authors state that this clearly demonstrates that hospital characteristics obviously contribute to the variation in use of coercive measures. <u>Results from the GEE model analysis:</u> 1. **Compulsory admissions** 5 significant predictors for compulsory admission were found at the **patient level**: • education, living situation, citizenship • higher severity of disorder (OR 2.6) • a diagnosis of organic mental disorder or mental retardation (OR 2.7) or psychosis (OR 2.6). Some **centre-level** variables were significantly	regression analyses. • Robust statistical techniques undertaken to account for hospital-level clustering of patient characteristics. **Limitations** The patient cohort includes patients with organic mental disorders, mental retardation and substance misuse diagnoses - this may affect the generalisability to the UK settings our review is examining as these patients are often cared for in specialist units that are not within the scope of this guideline. Nurse staffing is expressed as a measure of workload and is not a straightforward nurse-to-patient ratio - this may limit comparisons with the outcomes of other studies in the review. No detail is provided about the roles included in the 'nursing staff in WTE' variable - not clear what type of nurses this definition covers. Again, may limit

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
	paper. **Sample size** As above. **Exclusion criteria** N/A **Inclusion criteria** All patients aged between 18 and 70 years who were discharged from a facility included in the sample between 1st January 2007 and 31st December 2007.		analysis was used to check whether the hospitals in the sample differed in their use of coercive measures after adjusting for patient characteristics i.e. after accounting for a specific patient mix in a given institution. • Marginal generalised estimating equations (GEE) models were then used to examine associations between patient/institutional factors and the use of coercive measures.	associated with compulsory admission although the effects were only weak: • lower number of hospital beds (i.e. a small facility) • shorter mean duration of inpatient stay. **2. Restraint/seclusion** Several **patient-level** variables were significantly associated with the restraint/seclusion events occurring during hospitalisation, particularly those related to diagnosis type/severity: • patients with a diagnosis of an organic mental disorder or mental retardation (OR 2.9) • patients with a psychotic disorder (OR 2.5) • patients with personality disorder (OR 2.0) • higher severity of psychiatric disorder (OR 2.7) • male gender (OR 1.6), younger age (OR 0.9), not living at home (OR 1.4)	generalisability to UK setting. Swiss setting may limit generalisability to UK setting - different approaches/policies with regards to coercive measures e.g. Switzerland has one of the highest rates of compulsory admissions among Western countries. Despite the comparatively large sample size, authors state that as the analysis only included 6 hospitals, they cannot preclude that the study was underpowered to detect a significant effect among the centre-level variables such as nursing workload. The low number of centres may have meant type 1 error rates were inflated - could be argued that statistical models do not perform well under these conditions. Analysis based on routinely collected data - cannot exclude possibility that coercive events were under-reported (although very unlikely that

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				Of the centre-level variables collected, the size of a hospital and **the workload of the nursing staff (patient-days per nursing staff)** were predictors of restraint/seclusion: • a lower number of hospital beds • **lighter workload of the nursing staff** (OR 0.978) **3. Forced administration of medication** Several **patient-level** variables were significantly associated with an **increased risk** of coerced medication administration: • male gender • younger age • unemployment • not living at home • diagnosis Patients with a very severe disorder (OR 2.7) Patients with organic mental disorder or mental	compulsory admissions were not reported correctly given the statutory requirement to record such events). Restraint and seclusion combined as 1 variable - investigated/reported separately in other studies within the review. Analysis was based on number of discharges in 2007, not the number of patients discharged - therefore possible that the same individual was readmitted during the year which could have resulted in an overrepresentation of patients readmitted. **Author's conclusions** "Of the variables in the regression models, psychopathological factors, in terms of their effect size, are the most important risk factors for compulsory admission as well as for coercive measures during inpatient care." "The impact of socio-demographic variables was not

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				retardation (OR 2.7) or those with psychotic disorder (OR 2.3) Conversely, several **patient-level** variables were significantly associated with a **decreased risk** of coerced medication administration: • patients with a diagnosis of substance misuse disorder (OR 0.4) • patients with neurotic disorder (OR 0.5) Only 1 **centre-level** variable was associated with forced medication events although the effect size was only small: • being treated in a hospital with a greater number of beds <u>Staffing-related results:</u> **1. Compulsory admissions** • OR 1.003 • 95% CI 1.000 to 1.005 • p value not reported as significant at the level	consistently established across all measures of coercion." "High variance in the use of coercive psychiatric measures cannot be explained by characteristics on the patient level alone [...] This implies that psychiatric hospitals themselves are still an important source of variability in the use of coercive treatments." "Our hypothesis that a higher bed occupancy rate or a **heavier workload of the nursing staff** might play a decisive role [in use of coercive measures] is not supported".

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
				0.01 **2. Restraint/seclusion** • OR 0.978 • 95% CI 0.965 to 0.990 • p<0.01 **3. Forced administration of medication** • OR 1.005 • 95% CI 1.000 to 1.010 • P value not reported as significant at the level 0.01.	

D.15 Evidence table 15 (Ng et al 2001)

Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
Study name N/A **Author (year)** Ng et al (2001) **Study type** Retrospective observational: secondary analysis of hospital records. **Aim of the study** To examine the relationship between ward occupancy levels and staff-to-patient ratios and violent incidents	**Country/ies where the study was carried out** New Zealand **Setting** Acute adult psychiatric unit (14 beds). No child or forensic admissions. **Sampling frame** Data collected on 268 patients admitted during the 12 month study period.	**Data collection method** Data extracted retrospectively from the unit's census records. Hospital records of all admissions to the inpatient unit were obtained. The log of ward incidents which contains descriptive accounts of all violent incidents that occur on the unit was reviewed. **Length of follow up** N/A	**Outcomes** Number of incidents of physical aggression. Number of incidents of verbal aggression. **Control variables** Explanatory variables • Ward occupancy • Staff-to-patient ratio • Shift time • Day of week **Statistical analysis** Logistic regression to explore relationship	**Results** No significant associations were found between staff-to-patient ratios and incidents of either verbal or physical aggression. No data are presented to support this statement.	**Overall quality score** - **Other information** No data reported to support results. Authors report likelihood of underreporting of incidents. **Author's conclusions** **"**Crowding was found to be significantly associated with aggressive incidents, and in particular with verbal aggression."

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Study details	Population and settings	Methods	Outcome and control variables	Results	Comments
(physical and verbal) on an acute psychiatric ward. hypothesised that the number of violent incidents would be positively associated with a low staff-to-patient ration and with high ward occupancy. **Study dates** December 1997 to November 1998 **Source of funding** Not reported. **Full citation** Ng, B., Kumar, S., Ranclaud, M., Robinson, E., Ward crowding and incidents of violence on an acute psychiatric inpatient unit, Psychiatric Services. Psychiatr.Serv., 52, 521-525, 2001.	**Sampling procedure** All logged incidents that fit definitions of physical or verbal aggression were included. **Number and characteristics of participants** 58 incidents. Perpetrator characteristics: • Verbal incidents n=25 (male n=11, female n=14, mean age 30.7 [SD 7.35]) • Physical incidents N=33 (male n=17, female n=16, mean age 32.5 [SD 10.20]) **Sample size** N/A **Exclusion criteria** N/A **Inclusion criteria** N/A	**Details** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Staff-to-patient ratio. Data on the actual number of patients present on the ward used for the occupancy and staff-to-patient ratio. The corresponding number of nursing staff directly involved in patient care was noted for each of the 8 hour shifts.	between explanatory variables and binary outcomes. With nursing shift as unit of analysis.		

D.16 Evidence table 16 (Sabes-Figuera et al 2012)

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Study name	**Country/ies where the**	**Data collection method**	**Outcomes**	**Results**	**Overall quality score**

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
PERCEIVE **Author (year)** Sabes-Figuera et al (2012) **Study type** Time and motion study/prospective cross-sectional study. **Aim of the study** To describe the development and assess the reliability of a tool (CITRINE) to achieve the objectives of collecting data on the care contacts and therapeutic activities of patients whilst on a psychiatric ward. **Study dates** Specific dates for the relevant data collection periods are not stated. **Source of funding** The PERCEIVE study was commissioned by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research scheme (RP-PG-0606-1050). **Full citation** Sabes-Figuera, R.,	**study was carried out** UK **Setting** Inpatient psychiatric wards. **Sampling frame** South London and Maudsley (SLAM) NHS Foundation Trust. **Sampling procedure** Not stated. **Number and characteristics of participants** Tool appears to have been tested within wards in **1** hospital. Information on the number and duration of staff contacts for **41 service users** over the preceding 7 days was collected initially. Mean age was 37 years and 19 participants were women. 68% had a primary diagnosis of psychosis or bipolar disorder and the average length of stay at assessment was 43 days. However, there was great variation in this represented	<u>Initial draft</u>: Interviews were conducted with inpatient staff to discuss the content and structure of the CITRINE tool; the main objective was to identify the group activities that take place on the wards and which professionals were most likely to have contacts with inpatients. <u>Feasibility testing</u>: 25 service users were interviewed using the questionnaire to determine its acceptability, identify difficulties in answering questions and evaluate the practicality of collecting data in this way. 2 focus groups were also conducted with nurses and OTs to garner opinions about the tool and suggestions for improvement. <u>Reliability testing</u>: This assessed the level of congruence between the information provided by service users using the tool and information that could	Mean numbers and costs of activities. Mean numbers and costs of nursing contacts. **Control variables** No control variables accounted for in a multivariate analysis. **Statistical analysis** The difference in activities/contacts reported by service users via CITRINE and those reported by OTs from case notes were compared using a paired *t*-test and further assessed using the concordance correlation coefficient.	From the sample of 41 service users: Service users report attending more activities than is reported in their case notes. This difference is statistically significant. Attaching an average unit cost of activities indicates a cost difference of £10 per person. Average number of one-to-one contacts with nursing staff: Reported by patients= 2.8 (SD 2.7). Reported by occupational therapists/case notes= 3.2 (SD 3.9) T -0.501, p=0.619 Average duration of one-to-one contacts with nursing staff: Reported by patients= 7.1 minutes (SD 13.8) Reported by independent observer= 29.8 minutes (SD 23.0). P value not reported Case notes report more 1-to-1 nursing contacts that service users reported via	- **Other information** Limitations: • Inter-rater reliability of CITRINE tool not calculated • Activities related to wards in one particular hospital - it may be that another setting would present a more complex array of activities and thus recording these may be more difficult. • Significant difference in duration of nursing contacts recorded by patients compared with those observed independently – low concordance indicates question may not have been clear. **Author's conclusions** Primary conclusion: "The CITRINE is a tool that, despite some limitations, provides adequate information on the activities that take place within psychiatric wards.

Not published draft

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
McCrone, P., Sharac, J., Csipke, E., Craig, T., Rose, D., Pearman, D., and Wykes, T. Developing a tool for collecting and costing activity data on psychiatric inpatient wards. Epidemiol Psychiatr Sci. 21(4), 393-399. 2012.	by a standard deviation of 66 days. Information on the number and duration of staff contacts for **22 service users** was then collected through a 12 hour direct observation period. No baseline characteristics are reported for this sample. These 2 samples were separate i.e. included different service users. (NOTE: other service users were involved in other elements of the study but as this review is concerned with nursing activities, only data pertaining to these samples of 41/ 22 participants is extracted here.) **Sample size** See above. **Exclusion criteria** None stated. **Inclusion criteria**	be obtained from other sources. This took place in 2 stages: Stage 1: Information on the activities attended by **41** service users over the preceding 7 days was obtained from the OT of each ward and the number of contacts with nursing staff members was collected from the patient's records for the same period. This information was also collected from the same patients and period using the CITRINE tool. Stage 2: Information on the number and duration of staff contacts and activities attended by **22** other service users was a collected over a 14 hour direct observation period (08:00-20:00). An adapted 1-day version of the CITRINE questionnaire was used to collect the relevant information from the same service users over this period. Activity data/staff contacts were combined with unit		CITRINE – a cost difference of £4 per person. From the sample of 22 service users: The comparison of data obtained from the 1-day observational study and the one-day version of the CITRINE tool show good congruence in terms of activities attended and psychiatrist contacts. However, the congruence in terms of contact with nurses and other staff is less good. The differences in the latter services were significant or borderline significant. The concordance correlation coefficient for total costs from this part of the reliability study was 0.79. The cost implications for the difference in nursing contact is important given that the observational data suggest this accounts for one-third of the total cost.	Therefore its use is recommended, alone or in combination with other sources, in economic analyses of inpatient care." "In relation to nursing staff contacts, there are some aspects that should be considered. First, this type of contact is the one that is common and consequently creates difficulties for accurate recall. Second, service users might report only contacts that they think are significant or meaningful for them. This classification is subjective and can result in some contacts being labelled as 'non contacts' by service users. For example, a member of staff may have spent some time asking how a patient was, and would regard this as a contact, but it may not have been recognised as such by a patient if it was very brief or unwanted. This may have been the key reason for the discrepancy between the observed nurse-patient contacts and the patient-reported contacts. The mental health status of some of the service users

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
	None stated.	costs measured in GBP for the 2007/08 financial year (derived from an 'established source' – PSSRU data). **Length of follow up** N/A **Details** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** 1-to-1 contacts between service users and nursing staff were provided – both by number and by duration in minutes.			may affect their ability to provide accurate information, although data on this is lacking. Whilst time with nursing staff needs to be measured correctly, the difficulty seems only to apply to 1-to-1 contacts. Contacts as part of organised activities are more readily measured and therefore the disagreement over total cost is limited." "The alternative sources of information on inpatient psychiatric activities and staff contacts are not free of problems. Registers and electronic databases are designed to support clinical care and not record activities within wards. Furthermore, there might be intra- and inter-ward variability on the level of completion of these and on the accuracy of the information recorded. Observational data is an alternative but require too many resources to be realistic when studies involve large numbers of individuals/wards with data collected at several time

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
					points.”

D.17 Evidence table 17 (Jorgensen et al 2009)

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Study name N/A **Author (year)** Jorgensen et al. (2009) **Study type** Prospective before and after study/prospective cross-sectional study. **Aim of the study** To examine the relationship between ward atmosphere and outcome of treatment. **Study dates** Sep 2006 to Mar 2007 **Source of funding** None stated. **Full citation** Jorgensen, K., Romma, V., Rundmo, T., Associations between ward atmosphere, patient satisfaction and outcome, Journal of	**Country/ies where the study was carried out** Not stated, but authors are based in Norway. **Setting** Intermediary general psychiatric inpatient wards. **Sampling frame** Number of eligible ward units not reported. 326 patients available in included wards. 128 patients excluded (see below). 201 eligible for the study. **Sampling procedure** For wards: Convenience sample of local general psychiatric ward units ‘randomly’ asked to participate (no further details of randomisation given).	**Data collection method** Self-report questionnaire for patients. Data for age, gender and length of stay obtained from staff. ICD-10 diagnosis and Global Assessment of Functioning (GAF) scores obtained from patients’ journals. **Length of follow up** Questionnaire given 3 days after admission and again before discharge. **Details** Self-report questionnaire consisted of Ward Atmosphere Scale (WAS; social climate of a ward), Good Milieu Index (GMI; satisfaction with ward environment), Generalised Self-Efficacy Scale (GSE;	**Outcomes** Mean for each WAS subscale for each ward unit. **Control variables** N/A (regression analyses were not performed) **Statistical analysis** Ward means compared using 2 step strategy: Step 1) Multivariate ANOVA for differences between ward units, which lead to hypothesis that patients on 1 of the wards had unfavourable outcomes compared to the other 2. Step 2) MANOVA for repeated measures used to test hypothesis from step 1. A post-hoc Bonferroni analysis was applied to obtain *p* values for comparisons of each ward.	**Results** ‘Before’ Ward Atmosphere Scale results (from table 4 in journal article): Involvement Ward 1= 6.3624 Ward 2= 6.6023 Ward 3= 4.2458 1 vs. 2= not significant 1 vs. 3= $p<0.001$ 2 vs. 3= $p<0.001$ Support Ward 1= 6.5928 Ward 2= 6.7778 Ward 3= 4.9750 1 vs. 2= not significant 1 vs. 3= $p<0.001$ 2 vs. 3= $p<0.001$ Spontaneity Ward 1= 5.0179 Ward 2= 5.0362 Ward 3= 3.3210 1 vs. 2= not significant 1 vs. 3= $p<0.01$ 2 vs. 3= $p<0.01$	**Overall quality score** - **Other information** The main part of the study compared patient outcomes before and after treatment (prospective before and after study), however, the part of the study relevant to the review question was a comparison of the mean results for each ward unit (prospective cross-sectional study). Only methods, outcomes and results relevant to the review question are presented here. **Author's conclusions** Not possible to draw any conclusions about possible relationships between ward atmosphere and outcomes from the data in this study.

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
psychiatric and mental health nursing. J Psychiatr Ment Health Nurs, 16, 113-120, 2009.	For patients: All patients admitted to the included local general psychiatric ward units between Sep 2006 and Mar 2007 were considered for inclusion. **Number and characteristics of participants** 4 local general psychiatric ward units Wards 1 and 2 were in the same hospital with similar staff, ward rules and treatment policies. These are treated as 1 unit in the analyses (ward 1). Wards 1 and 2 (referred to as 'ward 1' in the results) 11 beds, 13 patients, 6/1/1 staff (day/evening/night) 9 beds, 12 patients, 6/2/1 staff (day/evening/night) Ward 3 (referred to as 'ward 2' in the results) 10 beds, 27 patients, 3-4/2/1 staff (day/evening/night)	self-beliefs about coping ability), Symptom Checklist-90 Revised (SCL-90R; symptoms of psychopathology and global distress), and a measure of life satisfaction. **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Staff numbers were provided for staff working in the day, evening and at night on each ward unit.	Reliability testing: Cronbach's alpha and average corrected item-total correlation for the WAS, SCL-90R, global factors of the GSE and life satisfaction measure.	Autonomy Ward 1= 6.1329 Ward 2= 6.2029 Ward 3= 4.8333 1 vs. 2= not significant 1 vs. 3= $p<0.05$ 2 vs. 3= $p<0.05$ Practical orientation Ward 1= 6.1412 Ward 2= 6.7909 Ward 3= 4.1652 1 vs. 2= not significant 1 vs. 3= $p<0.001$ 2 vs. 3= $p<0.001$ Personal problem orientation Ward 1= 5.9444 Ward 2= 5.8792 Ward 3= 3.6008 1 vs. 2= not significant 1 vs. 3= $p<0.001$ 2 vs. 3= $p<0.001$ Anger and aggression Ward 1= 2.6894 Ward 2= 2.9066 Ward 3= 2.3944 1 vs. 2= not significant 1 vs. 3= not significant 2 vs. 3= not significant Order and organisation Ward 1= 7.1164 Ward 2= 8.0467	

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
	Ward 4 (referred to as 'ward 3' in the results) 16 beds, 28 patients, 7-6/3/1 staff (day/evening/night) 80 patients out of 201 eligible patients (39.8%) participated. Participants did not differ significantly from the total population admitted in terms of gender, age or length of stay. **Sample size** 4 ward units and 80 patients. **Exclusion criteria** For ward units: Not reported. For patients: Admitted for less than 1 week (n=84) Unable to consent (n=7) Admitted to the same ward unit less than 6 months prior to study period (n=37) **Inclusion criteria** For ward units: Not reported. For patients: Patients who did not meet			Ward 3= 6.9753 1 vs. 2= not significant 1 vs. 3= not significant 2 vs. 3= $p<0.05$ Programme clarity Ward 1= 6.4914 Ward 2= 6.2802 Ward 3= 4.8508 1 vs. 2= not significant 1 vs. 3= $p<0.01$ 2 vs. 3= $p<0.05$ Staff control Ward 1= 4.1960 Ward 2= 4.2210 Ward 3= 4.4819 No significant difference between any wards. Staff attitude to expressed feelings Ward 1= 6.9841 Ward 2= 6.7633 Ward 3= 4.7325 1 vs. 2= not significant 1 vs. 3= $p<0.001$ 2 vs. 3= $p<0.01$ Discussion section of the journal article (page 119, column 1) states: "The results showed that the treatment environment at ward 3 differed from the other 2 wards' environments. There are	

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
	the exclusion criteria (see above).			many possible reasons for this. One reason may be lower staffing; ward units 1 and 2 had more staff in the environment. Another reason may be patients' symptom level at the time of admission. Patients in ward unit 3 reported somewhat more symptoms than patients in the other two ward units. It is of course possible that other factors that lay outside the scope of this study may be responsible for differences in the ward profiles." No numerical data were provided for the link between staffing levels and outcomes. Reliability was judged to be acceptable (no numerical results provided).	

D.18 Evidence table 18 (Tompkins Acute Ward: Bowers et al 2007b)

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Study name Tompkins Acute Ward Study	**Country/ies where the study was carried out** UK	**Data collection method** Data were drawn from 2 sources of official reporting systems.	**Outcomes** Dependent variables: Physical aggression, verbal aggression, deliberate	**Results** Total staff absence and vacancy was significantly associated with rates of	**Overall Risk of Bias** -

Unpublished draft

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Author (year) Bowers et al (2007) **Study type** Study had multiple different elements and overall can be described as a retrospective and prospective longitudinal study, using continuous and repeated measures (qualitative and quantitative). For the purposes of this evidence review the only relevant data are taken from a multivariate cross-sectional analysis. **Aim of the study** To assess the relationship between (i) nurses' positive appreciation of patients, nurses' emotional self-regulation, the effective structuring of the ward's rules and routine, and (ii) rates of conflict (patients' violence, verbal abuse, absconding, etc.) and containment (nurses use of seclusion, restraint, special observation, etc.). Subsidiary goals were: to provide data on the natural variation in incident rates on	**Setting** Acute psychiatric inpatient wards. **Sampling frame** 1 inner London Mental Health Trust. **Sampling procedure** Data were drawn from official reporting systems of 1 NHS Mental Health Trust in London. **Number and characteristics of participants** 14 acute psychiatric wards on 3 hospital sites. 1 ward was female only, 1 ward was an assessment ward and the remainder were mixed gender wards serving a specific locality. All were sampled from a Mental Health Trust serving 3 inner London boroughs, each of which had high proportions of ethnic minority residents (approximately 60% compared to England and Wales average of 12%), and high levels of social deprivation (all fell within the category of the 10%	Data on adverse incidents were routinely collected by nursing reports entered on a proprietary computer system. The following data were provided: dates and wards of all incidents falling into the following categories (verbal abuse, property damage, physical assault, self-harm, and absconding). Some of these incidents were severe, requiring special investigation and report, and these were referred to as 'serious untoward incidents' (SUIs). An SUI was any incident where medical treatment was required or death occurred, or where moderate to high financial loss, or loss of reputation might occur. Data on the workforce were collected from a workforce information system. Weekly returns from ward managers were collated centrally and covered staffing changes, vacancy rates, bank and agency nursing utilisation, annual leave, study leave, sick leave, and number of hours spent providing constant special observation.	self-harm, property damage, absconds, and all incidents. **Control variables** Independent variables: Total staff absence (through vacancies, sick, study, annual and maternity leave). **Statistical analysis** Data were screened for outliers and obvious errors, which were checked against other sources of information and/or removed. Poisson regression modelling was used to identify individual variables that might have a significant effect on various incident types. The modelling used the occupied bed days as the exposure variable in all analyses as this allowed for the differing ward size. Lagged variables, of 1 and 2 weeks, were created for admission variables to examine any time dependent effects of admissions on the wards. Any variables found to be significant in univariate models were then entered	**physical aggression** (IRR 1.10, 95% CI 1.02 to 1.19), **deliberate self-harm** (IRR 1.22, 95% CI 1.11 to 1.34), and **all incidents** (IRR 1.11, 95% CI 1.06 to 1.16). See Table 3, p151 of paper.	**Other information** **Author's conclusions** **"**The importance of nursing staff availability is the third consistent finding that emerges from the modelling exercise…Our data suggest that it is not the use of temporary staff per se, but the total absence of regular staff through a diverse range of factors: vacancies, sick, study, annual and maternity leave. There has always been much discussion about appropriate nurse staffing levels in acute psychiatry, and although there have been findings linking adequate nurse staffing to positive care outcomes in general hospitals, we do not know of any previous evidence demonstrating the importance of regular staff presence for the safety of patients and other staff." p209

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
psychiatric wards over time; and, to specifically explore the impact of interdisciplinary relationships on conflict and containment rates. **Study dates** 2002 to 2004 approximately two and a half years. **Source of funding** Tompkins Foundation and the Department of Health. **Full citation** Bowers L, Hackney D, Nijman H, Grange A, Allan T, Simpson A, Hall C, Eyres S, A Longitudinal Study of Conflict and Containment on Acute Psychiatirc Wards: Report to the DH Policy Research Programme, 2007.	most deprived areas in the country). **Sample size** Data on adverse incidents routinely collected by nursing reports were available for 1404 ward weeks of observations. Data on the workforce availability and deployment were available for 570 ward weeks. **Exclusion criteria** Not reported. **Inclusion criteria** All nursing medical and occupational therapy staff on the ward participated in the study, as did all residents on the wards.	**Length of follow up** N/A **Interventions** N/A **Comparator** N/A **How was staffing measured/defined?** Mean bank and agency hours per week, and total staff absence hours. - raw frequencies per week, then adjusted to either occupied bed days or number of beds.	into a multivariable Poisson regression to examine the relative importance of the variables in the final model selected for each incident type. Variables were eliminated in a backward selection process deselecting the least significant at each stage. This analytic strategy was applied to all incidents, and in a separate exercise to serious untoward incidents. Incident rate ratios are reported for each model's significant independent variables. These are a measure of relative incidence of the dependent variable due to an independent variable. For example, if the dependent variable is incidents and the independent variable is admissions and the IRR for the independent variable is 1.5, then for a 1 unit increase in admissions there is an increase in incidents of 1.5.		

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D.19 Evidence table 19: Toolkits (Anderson et al 2012, Mincsovics 2009, Carter & Cox 2000)

Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Study name N/A **Author (year)** Anderson et al (2012) **Study type** Before and after study **Aim of the study** To develop and implement a valid and reliable psychiatric patient classification system (PCS) that would accurately measure the intensity of nursing care required by the inpatient paediatric population of a hospital's psychiatric service. To determine the impact of the new PCS on current staffing practices and related nursing labour costs. **Study dates** Project initiated in February 2009	**Country/ies where the study was carried out** USA. **Setting** 6 inpatient units within the psychiatric department of a 577-bed paediatric academic hospital in the US. **Sampling frame** Members of the direct care nursing staff on the 6 inpatient units included in the study. **Sampling procedure** Not stated. **Sample size** See below. **Number and characteristics of participants** Nurse participants: 46 members of the 'direct care RN staff' participated either as expert panel members or data collectors for development of the new system. Direct care nursing staff across the 6 included units consisted of: • registered nurses • mental health specialists	**Data collection method** Patient acuity data were collected by nurses (method of data collection not reported). Nursing hours per patient day were determined according to the patient's documented needs for nursing care. Unit census and staffing data were also collected (source and method of data collection not reported). **Length of follow up** The 'trial period' for the system lasted for 56 days. Paper reports key outcomes 21 months after the PCS became fully operational in November 2010. **Details** *'Trial period'* Acuity data collected on 2818 patients. Unit census and staffing data collected on 1008 shifts (168 shifts per unit). *New system* New system consisted of 81 indicators across 11 categories: nutrition; elimination; personal hygiene; mobility; monitoring; medication administration; treatments and procedures;	**Outcomes** *'Trial period' outcomes* • Number of actual nursing labour hours allocated during trial as compared with projected nursing labour hours determined by current practice. • Number of actual nursing labour hours allocated for patients placed on imminent danger precautions and constant observation status (i.e. staff member required to be at arm's length at all times). • Inter-rater reliability of the new system. *21 month outcomes* • Management decision making for appropriate	**Results** *Results during 'trial period'* • Number of actual nursing labour hours allocated significantly greater than projected nursing labour hours required (no numerical data presented, *p* value not reported). • Number of actual nursing labour hours allocated for patients placed on imminent danger precautions and constant observation status significantly greater than the projected number of nursing labour hours (no numerical data presented, *p* value not reported). *Inter-rater reliability during 'trial period'* Agreement between pairs of raters using the new system on day 54, based on convenience	**Overall Risk of Bias** - **Other information** The 'trial period' was not a trial period of the new PCS. Instead it was used to look at inter-rater reliability and to compare actual and projected nursing hours from the existing data. It does not appear to be the case that the PCS was used to determine staffing levels during the trial period. It is not clear how data collected by the new PCS is used to inform staffing requirements. It is not clear what the fixed ratios used in the previous system were. **Author's conclusions** "The results obtained from the trial period provided additional evidence of the ability of the new system to yield valid and reliable data for determining appropriate unit staffing levels. The results further

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Source of funding The authors have "no financial relationships related to this article". **Full citation** Anderson, Darlene A., Davis, Linda Sue, Keehn, Krista, Palazzolo, Lynne, Classifying psychiatric inpatient pediatric populations, Nursing Management (USA), 43, 42-48, 2012.	• patient-care assistants • patient-care facilitators (PCFs) Each unit also had 1 RN case manager. Patient participants: Acuity data collected on 2818 patients. **Inclusion criteria** Not stated. **Exclusion criteria** Not stated.	cognitive, behavioural and psychotherapeutic interventions; structured teaching and group activities; patient assessments; and collaborative care planning, consultation and coordination. Details of the indicators are not reported. **Interventions** A new patient classification system (PCS) for assessing patient acuity and thus determining nurse staffing requirements. **Comparator** Current practice of scheduling staff for each shift using fixed ratios based solely on the unit census data. **How was staffing measured/defined?** Direct care nursing staff on all inpatient units consisted of RNs, mental health specialists, patient-care assistants, and patient-care facilitators who function in the charge nurse role. Each unit had an assigned RN case manager. No further details relating to staffing levels are reported.	allocation of nursing labour resources. • Nursing productivity and costs. • Nursing documentation. **Statistical analysis** Statistical methods not stated.	sample of 20 patients: Range 87% to 95% Overall agreement 91.4% *21 month results* Management decision making for appropriate allocation of nursing labour resources: • "Improved management decision making related to the appropriate allocation of nursing labour resources." • "These decision support tools have enabled managers to continually monitor and improve the effectiveness of unit staffing levels to achieve optimal patient outcomes." Nursing productivity and costs: • "Improved nursing productivity and control of costs." • "Biweekly productivity reports have enabled clinical directors to monitor and manage variances in a	demonstrated that the use of a patient acuity-based staffing method would provide a more flexible, cost-effective alternative to the current method of using fixed staffing ratios."

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
				proactive manner." • Productivity trends have "fallen within the acceptable range of 85% to 115%" (no further data or statistical analysis presented). • Hours of nursing staff time required for patients placed on ID precautions and CO status decreased from 167 hours per day to 127 hours per day across the 6 units (decrease of 24%, *p* value not reported). Nursing documentation: • "Improved" nursing documentation. • "Meaningful, real-time information" available to all disciplines. *Inter-rater reliability at 21 months* Inter-rater agreement levels 85% or higher (no further data or statistical analysis presented).	
Study name N/A	**Country/ies where the study was carried out**	**Data collection method** Data collection as described in	**Outcomes** Improvement in	**Results** The sequence of	**Overall Risk of Bias** -

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Author (year) Mincsovics (2009) **Study type** Simulation study based on previously collected data. The previously collected data is presented in Ridley, C. (2007) Relating nursing workload to quality of care in child and adolescent mental health inpatient services. International journal of health care quality assurance. 20(5) pp.429-440. **Aim of the study** To present a methodology to support staffing decisions in service environments that have quality considerations. **Study dates** The author does not provide a date for the development of their methodology. The paper was published in 2009. The data used to provide an example of the author's methodology	UK and the Netherlands **Setting** The methodology was developed by an academic based in the Netherlands but it was tested on data collected in the UK (from Ridley 2007). The setting in Ridley 2007 was a 14-bed inpatient psychiatric unit for older adolescents (14 to 16 years) based within the Birmingham Children's Hospital Trust. **Sampling frame** Not stated in Ridley 2007. Not stated in the current paper. **Sampling procedure** The author could not find a data source that exactly met their data collection requirements. They therefore 'carefully selected' an accessible, similar data set that collected data on workload, staffing and quality. The author states that Ridley 2007 was the only published article to discuss the collection of workload, staffing and quality data. Ridley 2007 does not state sampling methods. **Sample size** Data from Ridley 2007 was for 3000 nursing shifts over 1000 days.	Ridley (2007). Collected by nursing staff at the lunchtime shift handover: • Dependency of patient, therapeutic milieu and quality of care each assessed on a 6 point scale. • Number and work experience of nurses, number of staff away on study leave or sick • Nurses' perceived adequacy of nursing numbers. None of the collection tools were validated. Estimated a 95% return rate. These data were used by the author in their own methodology. **Length of follow up** Data was collected for Ridley 2007 for 36 months. **Details** The methodology described by the author consists of 3 consecutive phases: 1. Data collection 2. Development of a 'quality loss function' (QLF) 3. Making staffing decisions *Data collection* Data on nursing service quality (on a qualitative scale from 'poor' to	service quality. **Statistical analysis** The author used 3 different types of regression analysis. They stated the following for each type of regression method used: • Quadratic regression method: very easy to use, poor accuracy, bad reliability for extremes, • Patient-to-nurse regression method: very easy to use, average accuracy, good reliability for extremes, • Ridge regression method: not very easy to use, good accuracy, average reliability for extremes. The author presented results using the patient-to-nurse ratio loss function outcome.	decisions from the author's methodology outperformed the manager's decisions from Ridley 2007 and improved the service quality by 0.27%. The numerical data on service quality provided by the author's methodology and by the manager's decisions from Ridley 2007 were not reported.	**Other information** The author states that the results from using their methodology with data from Ridley 2007 do not necessarily apply to any other nursing unit service. No further details were provided on the actual functions or calculations used to determine the quality loss function. **Author's conclusions** "With the help of the quality loss function, the amount of capacity necessary to provide a given quality level for a given workload can be answered, where this supports rational decision making." "..the test showed that the quadratic form hypothesis is to be rejected and the patient-to-nurse is to be accepted. Our results indicate that our methodology has a potential for use in real-life situations." "The calculation methods presented here may be used under different measurement techniques. Our methodology enables

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
were collected in Ridley 2007. These data were collected between February 2002 and January 2005. **Source of funding** The study was supported by the Department of Technology Management at the Technical University of Eindhoven. **Full citation** Mincsovics, G., A staffing decision support methodology using a quality loss function: a cross-disciplinary quantitative study, International journal of nursing studies. Int J Nurs Stud, 46, 903-911, 2009.	**Number and characteristics of participants** Participants (staff, patients) and ward characteristics in Ridley 2007 are not clearly reported. Data were collected from Irwin Ward in the first instance, a 14-bed inpatient psychiatric unit for older adolescents (14 to 16 years). However, the characteristics of this ward were changed part way through the study and in the latter parts of the study included patients with more 'subtle' illnesses and patients undergoing rehabilitation for psychosis. **Inclusion criteria** Not stated in Ridley 2007. **Exclusion criteria** Not stated in Ridley 2007.	'excellent'), workload (the minimal amount of nursing capacity required to reach zero quality loss) and nursing capacity (in hours) needs to be collected. *Development of a 'quality loss function' (QLF)* The author states that a quality loss function can be calculated by: 1) Converting qualitative quality into quantitative values, using a survey to establish what quantitative values correspond with each qualitative quality value. 2) Fitting a function to the collected data for workload and nursing capacity (no further details of the function or how to fit it are provided) *Making staffing decisions* The author states that staffing decisions can be made by doing the following: 1) Predicting the average workload for the relevant period of time 2) Calculating the average spending on service capacity per period of time 3) Substituting average workload and average spending into the loss function - this gives the target quality loss. Data collection, development of the loss function, and decision making are repeated in cycles.	No statistical analyses were reported for the comparison of results from the author's methodology with those from the managerial decisions made in Ridley 2007.		the economic comparison of these measurement techniques by accounting for administration time. Such comparisons could help make the correct choice for measurement techniques."

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
		The author demonstrated this methodology with data from Ridley 2007. The methodology used an autoregressive moving-average model to calculate workload for the next time period and the average workload of the remaining periods. Therefore this approach relied solely on past data and did not use any additional information on future irregularities. **Interventions** Author's methodology using Ridley 2007 data. **Comparator** Managerial decisions made in Ridley 2007.			
Study name N/A **Author (year)** Carter & Cox (2000) **Study type** Non-randomised control trial. **Aim of the study** To determine whether there was a meaningful difference in nursing labour cost per patient day (PPD) when a nurse	**Country/ies where the study was carried out** USA **Setting** 2 units in a psychiatric hospital and 2 units in a general medical hospital. **Sampling frame** Not stated. **Sampling procedure** Convenience sampling was used to recruit 4 nurse managers from 2 hospitals (1 general hospital,	**Data collection method** A comparison of nursing labour cost and hours data was made based on use/non-use of the CDSS in each hospital. Both hospitals reported their total nursing labour costs and hours in their accounting reports. These accounting reports were used to determine the mean nursing costs/hours PPD during both the baseline period and the study period. The nursing labour cost and hour data were collected on all 4 nursing	**Outcomes** • Nursing labour cost per patient day (PPD). • Nursing hours per patient day (HPPD). • The number of patient complaints about staffing issues was also monitored 'to ensure patient care was not jeopardized with	**Results** The results presented here are for the psychiatric units only. *CDSS unit* Total nursing labour cost per patient day (PPD): Baseline $44.77 End of study $43.60 Difference between baseline and end of study $1.17 (3%) Monthly reduction $1030 Total nursing hours per	**Overall Risk of Bias** - **Other information** Limitations acknowledged by the authors: Convenience sampling of available and willing nurse managers may mean findings are not representative of the wider population of nursing managers. Small sample size - difficult to attribute changes in units' performance to use

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
manager used a labour computer decision support system (CDSS) and when another did not use the system. **Study dates** Baseline data collected for psychiatric units: September, October & November 1997. Study period for psychiatric units: March, April & May 1998 *(Baseline data collected for medical units: August & October 1997, February 1998* *Study period for medical units: April, May & June 1998)* **Source of funding** Research was funded by a Sigma Theta Tau International Research Grant, Epsilon Omega Chapter. **Full citation** Carter, M., Cox, R., Nurse managers' use of a computer decision support system: differences in nursing labor costs per patient day, Nursing Leadership	1 psychiatric hospital) for participation in the study. The nurse managers were matched as closely as possible on the following criteria: • years of nursing experience • years of nursing management experience • years of management experience on their current unit • knowledge of computer spreadsheets. The 4 nurse managers were allocated into either the study group or comparison group according to their arrival time at the first study meeting - the first to arrive was placed in the comparison group, the second in the study group and so on. Each hospital had a study group and a comparison group with a nurse manager in each group. **Sample size** 4 nurse managers (NM) (2 in psychiatric hospitals) **Number and characteristics of participants** 4 nurse managers: 2 from psychiatric units and 2 from units in a general medical hospital. The 2 psychiatric units included in the study were located within a 466-bed state-owned psychiatric	units for the 3 month study period immediately following the introduction of the CDSS on the study units. To account for the impact of patient volume on staffing costs, data from the 4 nurse managers were collected from historical accounting reports for a 3-month baseline period that closely mirrored the patient census of the 3-month study period. Baseline mean cost PPD data for the psychiatric units were determined by adding the staffing costs PPD from September, October and November 1997 and dividing by three. These historical months were used because the patient census for these months most closely mirrored those of the study period months of March, April and May 1998. During the 3-month study period, information about nursing hours worked and the patient census were entered daily. **Length of follow up** N/A **Details** **Interventions** Computer decision support system (CDSS) The nurse managers in the study	staffing changes.' **Statistical analysis** Mean cost and hours per patient day were used to compare the baseline staffing costs/nursing hours with the study period labour costs/nursing hours.	patient day (HPPD): Baseline 5.1 hours End of study 4.9 hours Difference between baseline and end of study 0.2 hours (1%) Total nursing labour cost in relation to budget: Baseline $1929 below budget End of study $2959 below budget Cost improvement 53% *Non-CDSS/manual unit* Total nursing labour cost per patient day (PPD): Baseline $51.49 End of study $53.97 Difference between baseline and end of study $2.48 (1%) Increase above budgeted level per month $1594 Total nursing hours per patient day (HPPD): Baseline 5.8 hours End of study 6.1 hours Difference 0.3 hours (1%) Total nursing labour cost in relation to budget: Baseline $2608 over	of the CDSS alone. Author speculates that the study unit's decreased costs/nursing hours may also have been influenced by factors such as having more male staff assigned to the unit and the nurse manager's 'interest in costs'. **Author's conclusions** 'The cost and hour decrease finding on the [psychiatric] CDSS unit suggests the CDSS nurse manager was able to control the total nursing labour cost and hours PPD even with the increase in census and acuity.'

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
Forum, 5, 57-64, 2000.	hospital in the southeast United States. **Inclusion criteria** Participants met the following criteria: • the nurse managers managed a nursing unit with a similar census that varied in number of patients and acuity • the nurse managers were responsible for preparing and monitoring their unit's nursing labour budget. **Exclusion criteria** None stated.	groups had the use of a CDSS that provided daily labour cost information on which to base staffing decisions. The CDSS used in the study was previously developed by the study author to assist nurse managers with controlling their staffing costs. It included 4 components: 1. an assumption sheet: included the number of days in the pay period and the number of weekend and weekdays, as well as the budgeted number of patients. 2. a labour table: included average hourly rates in the different caregiver categories (e.g. registered nurse), adjusted for shift differentials. 3. a daily hours-worked sheet: included total hours worked per day in each caregiver category plus the average daily census for each day of the calendar month 4. a summary sheet: data on all the above sheets were used to calculate the labour cost data presented on the summary sheet For this study, nurse managers used information from time cards to enter worked and paid hours for each nursing category. The midnight census was also entered. Both hours and census data were entered daily for a 3 month time		budget End of study $4202 over budget Cost increase 61% Note: 2 intermediate units closed in February 1998 causing patient numbers and acuity in both the study and comparator units to increase equally during March, April and May 1998.	

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Study details	Population and setting	Methods	Outcomes and control variables	Results	Comments
		period. Approximately 5 minutes were required to enter the data each day. The total labour cost determined by the CDSS was compared with the costs reported by the hospitals' accounting systems - they matched within a 0.002% to 0.1% error. **Comparator** Non-computer/manual systems The nurse managers in the comparator groups did not have use of the CDSS and instead used their own current manual systems to make staffing decisions. **How was staffing measured/defined?** Definitions of staffing measures was unclear. The total hours per patient day were 7.907 (for all staff) and 2.594 for registered nurses. However, outcomes are reported for all nursing staff not just for RNs.			

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Appendix E: Quality assessment tools

E.1 QA Checklist for cross-sectional studies

Study name or author and year [Type study name, or author and year (include letter if more than 1 paper with the same author and year, e.g. 'Smith 2010a')]	**STAR ID** [Type STAR ID]
Citation [Include citation details – usually authors, title of study, journal details, year]	
Linked studies (study name or author, year, STAR ID) [Include study name or author, year and STAR ID of any related studies, or state 'None']	
Final study quality score [Click to choose the final quality score. See 'Calculation of final study quality score' below for details on how to complete this.]	
Date of QA [Click to choose the date the QA was completed]	**Reviewer(s) names** [Type name of the reviewer/reviewers completing the quality assessment]

Calculation of final study quality score (from box 6.1 on page 95 of the NICE Guidelines Manual)

++ All or most of the checklist criteria have been fulfilled, and where they have not been fulfilled the conclusions are very unlikely to alter.

+ Some of the checklist criteria have been fulfilled, and where they have not been fulfilled, or are not adequately described, the conclusions are unlikely to alter.

- Few or no checklist criteria have been fulfilled and the conclusions are likely or very likely to alter.

Note: The items in the quality assessment below are weighted equally to determine the final study score, with the exception of items 3.1, 5.2 and 5.4 which have a larger weight on the final study score than the other items.

3.1 & 5.2: The overall quality score for a study cannot exceed the individual scores assigned to these criteria. That is, if either the study design or statistical methods are scored [+] then the study cannot be scored higher than [+] overall, and if either the study design or statistical methods are scored [-] then the study cannot be scored higher than [-] overall, regardless of how well it scores against other criteria.
5.4: If this item is scored [-] then the overall study quality must be downgraded to [-].

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For all questions:

++	'Yes'	The study full meets the criterion.
+	'Partly'	The study largely meets the criterion but differs in some important respect.
-	'No'	The study deviates substantially from the criterion.
	'Unclear'	Report provides insufficient information to judge whether the study complies with the criterion.
	'NA (not applicable'	The criterion is not relevant in this particular instance.

Item	Decision	Comments
1. Setting		
1.1 Is the setting applicable to the UK?	[Click to choose a decision: [++] for UK; [+] for northern European country, Australia, Canada or New Zealand; [-] for all other countries including USA]	[State which country the study was conducted in. Add any other comments if appropriate]
2. Aims		
2.1 Are the aims/objectives of the study clearly stated?	[Click to choose a decision]	[Add comments if appropriate and if the decision is [+] or [-], or state 'None']
3. Design		
3.1 Is the research design clearly specified and appropriate for the research aims?	[Click to choose a decision: [++] for randomised/controlled intervention designs, [+] for prospective observational designs, [-] if design is retrospective cross-sectional]	[State the study design. State whether the study design is clearly specified in the paper. State whether the study design is appropriate for the research aims. Add any other comments if appropriate]
3.2 Were the participants recruited in an acceptable way?	[Click to choose a decision]	[State how participants were recruited. Add comments if appropriate and if the decision is [+] or [-], or state 'None']
3.3 Was the sample representative of the population of interest? *Consider the proportion of the eligible sample who agreed to participate, whether there are differences between participants and non-*	[Click to choose a decision]	[State what proportion of the eligible sample agreed to participate. State whether there are differences between participants and non-participants. State whether sampling was randomised. State whether sampling was stratified. Add further comments if appropriate.]

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participants, and whether sampling was randomised and stratified.		
4. Measurement and observation		
4.1 Were the exposures (independent variables) clearly defined and accurately measured?	[Click to choose a decision]	[State whether the exposures were clearly defined. State whether the exposures were accurately measured. Add comments if appropriate.]
4.2 Were the outcome measures (dependent variables) clearly defined and accurately measured? *Consider whether the authors used subjective or objective measurements, whether the measures truly reflect what they are supposed to measure, and whether the measures have been validated.*	[Click to choose a decision]	[State whether the outcomes measures were clearly defined. State whether the outcome measures were accurately measured. State whether objective or subjective measurements. If the measures do not reflect what they are supposed to measure, state that here. State whether the measures have been validated. Add any other comments if appropriate.]
5 Analysis		
5.1 Was the study sufficiently powered to detect correlations or associations? *Consider whether a power calculation was conducted, whether there enough wards/units/hospitals to detect effects, and whether it was a large multi-hospital study with administrative data.*	[Click to choose a decision]	[State whether a power calculation has been conducted and what the results of this were. State whether there are enough wards/units/hospitals to detect effects. Add other comments if appropriate.]
5.2 Are the authors' choice and use of statistical methods appropriate? *Consider whether there is adjustment for clustering of data within wards/hospitals/trusts. Consider whether the authors identified all confounding factors and whether the results were adjusted for any of the confounding factors.* *Consider whether the analysis minimised the risk of endogeneity: consider whether issues of simultaneity, omission variables and/or*	[Click to choose a decision: [++] if effects of all likely confounders/clustering/endogeneity are accounted for, [+] if multivariate analysis is used but there remains a risk of endogeneity, [-] if univariate analyses or no statistical analyses were reported.]	[State whether the choice/use of statistical methods was appropriate.. State whether there was adjustment for clustering of data within wards/hospitals/trusts. State whether any confounding factors were identified by the authors. State whether there were any additional confounding factors not identified by the authors. State whether the results were adjusted for any of the confounding factors, and if so, which results and which factors. Add comments if appropriate.]

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measurement error were accounted for.		
5.3 Was the precision of association given or calculable? *Consider whether the confidence intervals or p values for effect estimates are given or calculable, whether the confidence intervals are wide, and whether the confidence intervals cross the line of no effect.*	[Click to choose a decision: [++] if both confidence intervals and p values are reported, [+] if *either* confidence intervals *or* p values are reported, [-] if neither are reported]	[State whether the confidence intervals and/or p values are provided or are calculable. State whether the confidence intervals are wide. State whether the confidence intervals cross the line of no effect. Add other comments if appropriate.]
5.4 Are sufficient data presented to support the conclusions of the paper?	[Click to choose a decision]	[Add comments if appropriate and if the decision is [+] or [-], or state 'None']
6. Any other issues		
6.1 Please describe any other issues that affect the quality of the study and whether this affects the final study quality score.	[Add additional comments or state 'None']	

Notes:

Section 1.1: All northern European countries plus the Commonwealth states of Australia, Canada and New Zealand are classed as 'similar' systems to the UK. All other countries (i.e. those from southern/eastern Europe, Asia and South America), and USA are classed as 'significantly different' systems to the UK. These criteria were agreed by a topic specialist.

Section 3.4: Population wide samples are likely to be large BUT some populations may be well represented by hundreds rather than thousands of subjects.

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E.2 QA EPOC Checklist for RCTs, non-randomised controlled trials and controlled before-after studies

Administrative details

Study name or author and year [Type study name, or author and year (include letter if more than 1 paper with the same author and year, e.g. 'Smith 2010a')]	**STAR ID** [Type STAR ID]
Citation [Include citation details – usually authors, title of study, journal details, year]	
Linked studies (study name or author, year, STAR ID) [Include study name or author, year and STAR ID of any related studies, or state 'None']	
Final study quality score [Click to choose the final quality score. See 'Calculation of final study quality score' below for details on how to complete this.]	
Date of QA [Click to choose the date the QA was completed]	**Reviewer(s) names** [Type name of the reviewer/reviewers completing the quality assessment]

Calculation of final study quality score (from box 6.1 on page 95 of the NICE Guidelines Manual)

++ All or most of the checklist criteria have been fulfilled, and where they have not been fulfilled the conclusions are very unlikely to alter.

+ Some of the checklist criteria have been fulfilled, and where they have not been fulfilled, or are not adequately described, the conclusions are unlikely to alter.

- Few or no checklist criteria have been fulfilled and the conclusions are likely or very likely to alter.

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Quality Assessment

For all questions:

++	'Yes'	The study full meets the criterion.
+	'Partly'	The study largely meets the criterion but differs in some important respect.
-	'No'	The study deviates substantially from the criterion.
	'Unclear'	Report provides insufficient information to judge whether the study complies with the criterion.
	'NA (not applicable'	The criterion is not relevant in this particular instance.

Item	Decision	Comments
1. Is the setting applicable to the UK?	[Click to choose a decision: [++] for UK; [+] for northern European country, Australia, Canada or New Zealand; [-] for all other countries including USA]	[State which country the study was conducted in. Add any other comments if appropriate]
2. Was the allocation sequence adequately generated?	[Click here to choose a decision. ++ if a random component in the sequence generation process is described (e.g. a random number table), - if a non-random method is used (e.g. date of admission) or if study is a non-randomised controlled trial or controlled before-after study]	[State how the allocation sequence was generated.]
3. Was the allocation adequately concealed?	[Click here to choose a decision. ++ if allocation by institution, team or professional and allocation performed on all units at start of the study, or if the unit of allocation was by patient or episode of care and there was a centralised randomisation scheme (on-site computer system or sealed opaque envelopes). – if controlled before-after study.]	[State how the allocation was concealed.]
4. Were baseline outcome measurements	[Click here to choose a decision.++	[State whether the baseline outcome measurements were similar.]

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similar?	if performance or patient outcomes were measured prior to intervention and no important differences present across study groups. In RCTs score ++ if imbalanced but appropriate adjusted analysis was performed (e.g. analysis of covariance). Score - if important differences were present and not adjusted for in analysis.]	
5. Were baseline characteristics similar?	[Click here to choose a decision. ++ if baseline characteristics of the study and control providers are reported and similar. Score - if there is no report of characteristics or if there are differences between control and intervention providers.]	[State whether the baseline characteristics were similar.]
6. Were incomplete outcome data adequately addressed?	[Click here to choose a decision. ++ if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion of missing data was less than the effect size i.e. unlikely to overturn the study result). Score - if missing outcome data was likely to bias the results.]	[State whether incomplete outcome data were adequately addressed.]
7. Was knowledge of the allocated interventions adequately prevented during the study?	[Click here to choose a decision. ++ if the authors state explicitly that primary outcome variables were assessed blindly, or outcomes are objective, e.g. length of hospital stay. Score - if primary outcomes were not assessed blindly.]	[State whether knowledge of the allocated interventions was adequately prevented during the study.]
8. Was the study adequately protected against	[Click here to choose a decision. ++	[State whether the study was adequately protected against

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contamination?	if allocation by community, institution or practice and it is unlikely that the control group received the intervention. Score - if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised). Score “unclear” if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians within practices were allocated to intervention or control).]	contamination.]
9. Was the study free from selective outcome reporting?	[Click here to choose a decision. ++ if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section). Score - if some important outcomes are subsequently omitted from the results.]	[State whether the study was free from selective outcome reporting.]
10. Was the study free from other risks of bias?	[Click here to choose a decision. Score ++ if there is no evidence of other risk of biases.]	[State whether the study was free from other risks of bias.]

Notes:

1: All northern European countries plus the Commonwealth states of Australia, Canada and New Zealand are classed as ‘similar’ systems to the UK. All other countries (i.e. those from southern/eastern Europe, Asia and South America), and USA are classed as ‘significantly different’ systems to the UK. These criteria were agreed by a topic specialist.

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Appendix F:Excluded studies

Anon (1998) Critical perspectives in forensic care: inside out. *Reason excluded: No outcomes.*

Anon (1998) In-patient child psychiatry: modern practice, research and the future. *Reason excluded: No outcomes.*

Anon (2004) Reducing restraint by 99% brings less staff turnover. Healthcare Risk Management 26: 31–33. *Reason excluded: Not primary research.*

Anon (2005) Acute care 2004: a national survey of adult psychiatric wards in England: in association with the National Institute for Mental Health in England acute inpatient care programme. *Reason excluded: No outcomes.*

Anon (2006) Staff shortages led to 'restrictive' practices, says boss. Learning Disability Practice 9: 7-7. *Reason excluded: Not primary research.*

Anon (2006) Forum debates workloads tool for mental health. Lamp 63: 18-18. *Reason excluded: Not staffing.*

Anon (2007) Engagement is key in mental health. Nursing times 103: 54-. *Reason excluded: Not primary research.*

Anon (2009) Flawed systems and long hours put patients at risk. Nursing Standard 23: 7-7. *Reason excluded: Not primary research.*

Anon (2009) *Safe and appropriate care for young people on adult mental health wards. Reason excluded: Not toolkits.*

Anon (2010) Advice on relational security targets staff in secure settings. Mental Health Practice 13: 6–6. *Reason excluded: Not primary research.*

Anon (2011) Closing beds wins more staff: Breakthrough for mental health nurses. Lamp 68: 12-21. *Reason excluded: Not primary research.*

Anon (2011) *Efficiency in mental health services: supporting improvements in the acute care pathway Forum debates workloads tool for mental health*. *Reason excluded: Not staffing.*

Anon (2012) Toolkit makes first impressions count. Forum debates workloads tool for mental health. Nursing times 108: 5-5. *Reason excluded: Not staffing.*

Anon (2013) New care model cuts conflict. Nursing Standard 28: 8-8. *Reason excluded: Not primary research.*

Anon (2014) Short staffing warning at mental health trust. Nursing times 110: 4-4. *Reason excluded: Not primary research.*

Anon (2014) Developing the tools for mental health nurses. Kai Tiaki Nursing New Zealand 20: 30-30. *Reason excluded: Not primary research.*

Adali EA, Priami M, Evagelou H et al. (2003) Burnout in Psychiatric Nursing Personnel in Greek Hospitals. European Journal of Psychiatry 17: 173-181. *Reason excluded: Not staffing.*

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Adeshokan E (2010) Meeting the needs of families and carers of acute psychiatric inpatients: a nurse-led family service. British Journal of Wellbeing, vol 1, no 4, Jul 2010, p 31-34 34. *Reason excluded: Not primary research.*

Akid M (2001) Staff retention. Staying power. Nursing times 97: 10-11. *Reason excluded: Not primary research.*

Alderman N (2007) Prevalence, characteristics and causes of aggressive behaviour observed within a neurobehavioural rehabilitation service: predictors and implications for management. Brain injury 21: 891-911. *Reason excluded: Wrong setting.*

Alexander JA, Lichtenstein R, Oh HJ et al. (1998) A causal model of voluntary turnover among nursing personnel in long-term psychiatric settings. Research in nursing & health 21: 415-427. *Reason excluded: Date.*

Alexander JA, Lichtenstein R, Jinnett K et al. (2005) Cross-functional team processes and patient functional improvement. Health services research 40: 1335-1355. *Reason excluded: Wrong staff group.*

Allen D (2007) The vanishing act. Mental Health Practice 10: 9-9. *Reason excluded: Not primary research.*

Allen D, Robinson D, Aucoin L et al. (2014) Demystifying accountability by decreasing employee absences. Nursing management 45: 20-22. *Reason excluded: Not primary research.*

Alsaraireh F, Quinn Griffin MT, Ziehm SR et al. (2014) Job satisfaction and turnover intention among Jordanian nurses in psychiatric units. International journal of mental health nursing 23: 460-467. *Reason excluded: Wrong country.*

Andes M, Shattell MM (2006) An exploration of the meanings of space and place in acute psychiatric care. Issues in mental health nursing 27: 699-707. *Reason excluded: Not staffing.*

Armitage C, Higham N, Bunker N (2012) Introducing the role of therapeutic liaison worker in acute care. Mental Health Practice 15: 14-18. *Reason excluded: No link made between staffing and outcomes.*

Baguley I, Alexander J, Middleton H (2007) New ways of working in acute inpatient care: a case for change. Journal of Mental Health, Training, Education and Practice 2: 43-52. *Reason excluded: Not primary research.*

Beadsmore A (1998) Acute problems: a survey of the quality of care in acute psychiatric wards. *Reason excluded: Date.*

Beck A, Morrison T (2002) Barriers to using early signs monitoring in a forensic population. Journal of Mental Health 11: 501-509. *Reason excluded: Not staffing.*

Beecham J, Chisholm D, O'Herlihy A et al. (2003) Variations in the costs of child and adolescent psychiatric in-patient units. The British journal of psychiatry : the journal of mental science 183: 220-227. *Reason excluded: No data on staffing.*

Bimenyimana E, Poggenpoel M, Myburgh C et al. (2009) The lived experience by psychiatric nurses of aggression and violence from patients in a Gauteng psychiatric institution. Curationis 32: 4-13. *Reason excluded: Wrong country.*

Boardman J, Parsonage M (2009) Government policy and the National Service Framework for Mental Health: Modelling and costing services in England. Advances in Psychiatric Treatment 15: 230-240. *Reason excluded: Wrong setting.*

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Bonnell W, Alatishe YA, Hofner A (2014) The effects of a changing culture on a child and adolescent psychiatric inpatient unit. Journal of the Canadian Academy of Child and Adolescent Psychiatry 23: 65-69. *Reason excluded: No data on staffing.*

Bonner G, Lowe T, Rawcliffe D et al. (2002) Trauma for all: a pilot study of the subjective experience of physical restraint for mental health inpatients and staff in the UK. Journal of psychiatric and mental health nursing 9: 465-473. *Reason excluded: No data on staffing.*

Boumans CE, Egger JIM, Souren PM et al. (2012) Nurses' decision on seclusion: patient characteristics, contextual factors and reflexivity in teams. Journal of psychiatric and mental health nursing 19: 264-270. *Reason excluded: Not staffing.*

Bourbonniere MG (2001) Organizational characteristics and restraint use for hospitalized nursing home residents. 77. *Reason excluded: Date.*

Bowers A, Aldouri E (2011) Creating efficiencies in the acute care pathway: The rapid assessment, treatment and discharge approach. Forum debates workloads tool for mental health. Mental Health Review Journal 16: 50-55. *Reason excluded: Not staffing.*

Bowers L, Flood C. Nurse staffing, bed numbers and the cost of acute psychiatric inpatient care in England. J Psychiatr Ment Health Nurs 2008; 15(8):630-637.*Reason excluded: No data on staffing.*

Bowers L, Crowhurst N, Alexander J et al. (2003) Psychiatric nurses' views on criteria for psychiatric intensive care: acute and intensive care staff compared. Forum debates workloads tool for mental health. International journal of nursing studies 40: 145-152. *Reason excluded: Not staffing.*

Bowers L (2006) Patient homicide causes nursing staff to leave. Journal of psychiatric and mental health nursing 13: 778-779. *Reason excluded: No outcomes.*

Bowers L, Nijman H, Allan T et al. (2006) Prevention and management of aggression training and violent incidents on U.K. Acute psychiatric wards. Psychiatric services (Washington, D.C.) 57: 1022-1026. *Reason excluded: Not staffing.*

Bowers L, Simpson A, Eyres S et al. (2006) Serious untoward incidents and their aftermath in acute inpatient psychiatry: the Tompkins Acute Ward study. International journal of mental health nursing 15: 226-234. *Reason excluded: Not staffing.*

Bowers L, Allan T, Simpson A et al. (2007) Adverse incidents, patient flow and nursing workforce variables on acute psychiatric wards: the Tompkins Acute Ward Study. The International journal of social psychiatry 53: 75-84. *Reason excluded: Data presented in another included study.*

Bowers L, Jeffery D, Simpson A et al. (2007) Junior staffing changes and the temporal ecology of adverse incidents in acute psychiatric wards. Journal of advanced nursing 57: 153-160. *Reason excluded: Wrong staff group.*

Bowers L (2008) Relationship between service ecology, special observation and self-harm during acute in-patient care : City-128 study. British Journal of Psychiatry 2008; 193 (5): 395-401 (November 2008) : 395-401. *Reason excluded: Data presented in another included study.*

Bowers L, Nijman H, Simpson A et al. (2011) The relationship between leadership, teamworking, structure, burnout and attitude to patients on acute psychiatric wards. Social psychiatry and psychiatric epidemiology 46: 143-148. *Reason excluded: Not staffing.*

Braithwaite T (2006) The search for acute solutions: improving the quality of care in acute psychiatric wards. *Reason excluded: Not staffing.*

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Browne G, Cashin A, Graham I et al. (2013) Addressing the mental health nurse shortage: undergraduate nursing students working as assistants in nursing in inpatient mental health settings. International journal of nursing practice 19: 539-545. *Reason excluded: Not primary research.*

Bybel BA (2011) Does education of alternative measures decrease the use of physical restraints and seclusion? 109. *Reason excluded: Thesis.*

Byford S F (2000) Cost effectiveness of intensive versus standard case management for severe psychotic illness UK700 case management trial. *British Journal of Psychiatry* 176:537-543. *Reason excluded: Not staffing.*

Carr P (2012) Using zonal nursing to engage women in a medium secure setting. Mental Health Practice 15: 14-20. *Reason excluded: No link made between staffing and outcomes.*

Carter MR (2004) Recruitment & retention report. The ABCs of staffing decisions. Nursing management 35: 16–16. *Reason excluded: Not primary research.*

Chaplin R, McGeorge M, Lelliott P (2006) The National Audit of Violence: In-patient care for adults of working age. Psychiatric Bulletin 30: 444-446. *Reason excluded: No data on staffing.*

Chaplin R, McGeorge M, Lelliott P (2006) Violence on inpatient units for people with learning disability and mental illness: The experiences of service users and staff. British Journal of Developmental Disabilities 52: 105-115. *Reason excluded: No data on staffing.*

Chen SP, Krupa T, Lysaght R et al. (2013) The development of recovery competencies for in-patient mental health providers working with people with serious mental illness. Forum debates workloads tool for mental health. Administration & Policy in Mental Health 40: 96-116. *Reason excluded: Not staffing.*

Chiesa Marco, Drahorad Carla, Pringle Pamela (2003) Users' views of therapeutic community treatment: a satisfaction survey at the Cassel hospital. Therapeutic Communities 24: Summer-141. *Reason excluded: No data on staffing.*

Child RJH, Mentes JC (2010) Violence against women: the phenomenon of workplace violence against nurses. Issues in mental health nursing 31: 89-95. *Reason excluded: Not primary research.*

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Coleman JC, Paul GL (2001) Relationship between staffing ratios and effectiveness of inpatient psychiatric units. Psychiatric services (Washington, D.C.) 52: 1374-1379. *Reason excluded: Wrong staff group.*

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Coombs T, Walter G, Brann P (2011) Overview of the national mental health benchmarking project. Forum debates workloads tool for mental health. Australasian psychiatry : bulletin of Royal Australian and New Zealand College of Psychiatrists 19: 37-44. *Reason excluded: Not staffing.*

Cromwell J, Maier J (2006) Variation in staffing and activities in psychiatric inpatient use. Psychiatric Services 57: 772-774. *Reason excluded: Wrong country.*

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Crowhurst N, Bowers L (2002) Philosophy, care and treatment on the psychiatric intensive care unit: themes, trends and future practice. Journal of psychiatric and mental health nursing 9: 689-695. *Reason excluded: Not primary research.*

Currier GW, Allen M (2003) Organization and function of academic psychiatric emergency services. General hospital psychiatry 25: 124-129. *Reason excluded: No link made between staffing and outcomes.*

Cyr JJ, Paradis J (2012) The forensic float nurse: a new concept in the effective management of service delivery in a forensic program. Journal of forensic nursing 8: 188-194. *Reason excluded: No data on staffing.*

Daley K, Richardson J, James I et al. (2013) Clinical dashboard: Use in older adult mental health wards. Forum debates workloads tool for mental health. Psychiatrist 37: 85-88. *Reason excluded: Not staffing.*

Davidhizar R, Mallow GE, Bechtel GA et al. (1998) Management note: a patient classification system for the chronic psychiatric patient. Demystifying accountability by decreasing employee absences. Australian & New Zealand Journal of Mental Health Nursing 7: 126-133. *Reason excluded: Not staffing.*

Davis GY (2006) Fundamental reforms: disempowerment and access to evidence-based treatment. Mental Health Review, vol 11, no 2, Jun 2006, p 3-6 6. *Reason excluded: Not primary research.*

De Lacy LC (2006) The influence of nursing staff numbers and skill mix on seclusion and restraint use in public psychiatric hospitals. Dissertation Abstracts International: Section B: The Sciences and Engineering 66: 5899-. *Reason excluded: Thesis.*

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Deacon M, Fairhurst E (2008) The real-life practice of acute inpatient mental health nurses: an analysis of 'eight interrelated bundles of activity'. Nursing inquiry 15: 330-340. *Reason excluded: Not primary research.*

Deacon M, Cleary M (2013) The reality of teamwork in an acute mental health ward. Perspectives in psychiatric care 49: 50-57. *Reason excluded: No data on staffing.*

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Delaney KR, Johnson ME (2006) Keeping the unit safe: mapping psychiatric nursing skills. Journal of the American Psychiatric Nurses Association 12: 198-207. *Reason excluded: Wrong country.*

Delaney KR, Johnson ME (2014) Metasynthesis of research on the role of psychiatric inpatient nurses: what is important to staff? Journal of the American Psychiatric Nurses Association 20: 125-137. *Reason excluded: Not primary research.*

Delaney KR, Hardy L (2008) Challenges faced by inpatient child/adolescent psychiatric nurses. Journal of psychosocial nursing and mental health services 46: 21-24. *Reason excluded: Not primary research.*

Dent E (2006) Out of harm's way. Health Service Journal 116: 22-24. *Reason excluded: Not primary research.*

Di Lorenzo R, Baraldi S, Ferrara M et al. (2012) Physical restraints in an Italian psychiatric ward: clinical reasons and staff organization problems. Perspectives in psychiatric care 48: 95-107. *Reason excluded: Not staffing.*

Dickens G, Stubbs J, Haw C (2008) Delegation of medication administration: an exploratory study. Nursing Standard 22: 35-40. *Reason excluded: Not primary research.*

Dinshaw C (2006) Surveying nursing practice on wards for older people with mental health needs. Nursing older people 18: 25-31. *Reason excluded: No link made between staffing and outcomes.*

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Doran D, Paterson J, Clark C et al. (2010) A pilot study of an electronic interprofessional evidence-based care planning tool for clients with mental health problems and addictions. Worldviews on evidence-based nursing / Sigma Theta Tau International, Honor Society of Nursing 7: 174-184. *Reason excluded: No link made between staffing and outcomes.*

Doyle M (1998) Clinical risk assessment for mental health nurses. Forum debates workloads tool for mental health. Nursing times 94: 47–49. *Reason excluded: Not primary research.*

Drew BL (2001) Self-harm behavior and no-suicide contracting in psychiatric inpatient settings. Archives of psychiatric nursing 15: 99-106. *Reason excluded: Date.*

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Dyer C (2014) The Productive Ward in an over productive environment. Australian Nursing and Midwifery Journal 21: 45-. *Reason excluded: Not primary research.*

Edvardsson D, Sandman PO, Rasmussen B (2012) Forecasting the ward climate: A study from a dementia care unit. Journal of clinical nursing 21: 1136-1144. *Reason excluded: Wrong setting.*

Edwards K (2008) Evaluating protected time in mental health acute care. Nursing times 104: 28-29. *Reason excluded: Not staffing.*

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Ellila H, Sourander A, Valimaki M et al. (2005) Characteristics and staff resources of child and adolescent psychiatric hospital wards in Finland. Journal of psychiatric and mental health nursing 12: 209-214. *Reason excluded: No outcomes.*

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