Hospital staffing and healthcare associated Infections: A systematic review of the literature

Research Proposal

V2.5

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Contents
Title......................................................................................................................... 3
Funding, sponsors and partners ............................................................................... 3
Roles and responsibilities ...................................................................................... 3
Background ........................................................................................................... 4
Methods ................................................................................................................. 4
  Review question .................................................................................................. 4
  Definitions ......................................................................................................... 4
  Search strategy .................................................................................................. 5
  Inclusion and exclusion criteria ......................................................................... 5
  Study selection ................................................................................................... 6
  Data collection process ...................................................................................... 6
  Risk of bias in individual studies ...................................................................... 6
  Data analysis ...................................................................................................... 7
Ethical considerations ............................................................................................ Error! Bookmark not defined.
Timeframe ............................................................................................................. 7
Significance and impact .......................................................................................... 8
Translation of findings into practice ....................................................................... 8
Multidisciplinary Research Team ........................................................................... 9
Project Governance ............................................................................................... 10
Intellectual Property ............................................................................................. 10
Ethical considerations ............................................................................................ 10
Reporting ............................................................................................................... 10
Publications .......................................................................................................... 11
Confidentiality ....................................................................................................... 11
References ............................................................................................................ 11
Title

The Hospital staffing and healthcare associated Infections: A systematic review of the literature

Funding, sponsors and partners

This project is led by Associate Professor Brett Mitchell, Avondale College of Higher Education. Avondale College will be responsible for managing the study design, data collection, data analysis and interpretation, publication and dissemination of results. Academic project partners at Queensland University of Technology, Australian Catholic University, Columbia University and Jefferson University will provide in-kind contributions to the study design, conduct, data analysis and interpretation, and the publication and dissemination of results.

Roles and responsibilities

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Responsibility and contributions</th>
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<tbody>
<tr>
<td>A/Professor Brett Mitchell</td>
<td>Avondale College</td>
<td>Study design, Protocol development, Ethics, Oversight of data collection and extraction, Data analysis, Publication oversight</td>
</tr>
<tr>
<td>Professor Patricia Stone</td>
<td>Columbia University</td>
<td>Study design, Protocol development, Data interpretation, Content expert</td>
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<tr>
<td>Professor Anne Gardner</td>
<td>Australian Catholic University</td>
<td>Study design, Protocol development, Data interpretation, Governance</td>
</tr>
<tr>
<td>Dr Lisa Hall</td>
<td>Queensland University of Technology</td>
<td>Study design, Protocol review, Protocol development, Data extraction</td>
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<tr>
<td>Dr Monika Pogorzelska-Maziarz</td>
<td>Jefferson University</td>
<td>Study design, Protocol review, Protocol development, Data analysis</td>
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Background

Health care-associated infections (HAIs) are a serious patient safety issue that result in increased morbidity and mortality as well as excessive health resource utilisation.\(^1\) Therefore, there is much interest in understanding the transmission, prevention and control of HAIs. One particular issue is the relationship between levels and types of staffing of health facilities and HAIs. In 2008, a systematic review was undertaken to examine the relationship between hospital staffing and HAIs.\(^2\) Since this time, there has been a growing interest in HAI prevention and subsequent research.\(^3\) However, a subsequent review has not been undertaken. Understanding and synthesizing the most recent research will inform health administrators, policy makers and researchers. The purpose of the proposed study is to conduct a systematic review of the research examining relationships between staffing resources and the risk of a HAI in hospital settings.

Methods

**Review question**
In a hospital setting, what is the relationship between hospital staffing and healthcare associated infections?

**Definitions**
Hospital staffing refers to nurse staffing, medical staffing or infection prevention and control staffing levels.

Nurse staffing means one of more of the following: nurse-to-patient ratio; nursing hours per patient day or admission; skill mix; use of float or non-permanent staff; absenteeism and/or overtime.

Healthcare associated infections mean: bloodstream infection, pneumonia, urinary tract infection, wound or surgical site infection, organism specific infections (e.g. *Clostridium difficile* infection) that are defined by the authors as being hospital or healthcare associated. The definition of hospital or healthcare associated infections used by authors must reference a recognised standard i.e. a definition agreed or published by professional association or government agency; or a definition widely used in the published literature; or an ICD10 code that constitutes a HAI (not any infection). Any disputes regarding whether a study has used an appropriate definition will be determined by the research team.
Search strategy
A systematic search will be conducted. Electronic databases Medline (PubMed) and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) will be searched using the key words stated below. For eligible articles, the reference lists will be reviewed to identify any additional articles. The electronic search of bibliographic databases will limited to article published between 1st January 2000 and 30th November 2015.

To retrieve sources from MEDLINE a combination of Medical Subject Heading (MeSH) and free-text terms will be used. The dates of the last search for each database, the period searched, and the number of records retrieved for each database searched will be recorded and all searches saved. Search filters used will also be recorded. Only papers in English will be reviewed.

Keywords to be used for searching databases are:

- “nurse staffing” OR “nurse resources” OR “nursing resources” OR “nurse workload” OR “nursing workload” OR “staffing” OR “physician staffing ” OR “medical staffing” AND
- “infection” OR “infection control” OR “nosocomial infection” OR “hospital acquired infection” OR “healthcare associated infection”.

MeSH terms (where appropriate) to be used in database searches will be:

- Personnel Staffing and Scheduling” OR “A change or shift in personnel due to reorganization, resignation, or discharge” OR “Workload” AND
- “Infection Control” OR “Cross Infection” OR “Infectious Disease Transmission, Patient-to-Professional” OR “Infectious Disease Transmission OR Professional-to-Patient”

Inclusion and exclusion criteria
Articles will be considered eligible if they are cohort, case control, cross sectional, randomised controlled or case reports; were published in peer-reviewed English-language journals; published since between 1st January 2000 and 30th November 2015; examine the relationship between hospital staffing and healthcare associated infections in hospital settings.
Staffing levels described in the study must be at the unit level OR local (organisation). The description of staffing levels may include Nursing Hours Per Patient Day (NHPPD) or staff to patient ratio.

Exclusion criteria are:

- all grey literature
- non-peer reviewed literature (e.g. conference abstracts, letters to editors, etc.)
- reviews and papers written in languages other than English
- reviews, editorials, commentaries or policy statements

**Study selection**
The titles and abstracts of all the publications identified in the electronic databases will be examined and assessed for relevance and appropriateness to the review question. Those not relevant were excluded. Of the remaining articles, a full text was reviewed to further assess eligibility. Articles deemed to have data relevant to the systematic review and meta-analysis will be included. The study selection process and other stages of the review will be performed by trained research assistants. Ten percent of the original articles will be a cross-checked against study eligibility by two of the research assistants. In addition, ten percent of the original articles retrieved in the initial search will be selected at random and reviewed by an experienced research member as a cross-check against study eligibility. Any discrepancies in either the application of the inclusion or exclusion criteria will be resolved by two members of the research team.

**Data collection process**
A data extraction form in Excel will be designed for the purpose of extracting data for the systematic review. All data extracted will be cross-checked. No attempt will be made to contact the authors of papers that contained missing data or unclear information. For each eligible study, the following data will be extracted: author; year of publication, country of study, study design, study population, unit of analysis (patient, unit or hospital), sample, setting, adjustments for confounding, the staffing category studied, staffing data source, staffing variables and parameters, the type of HAI, HAI definition, HAI incidence or prevalence data.

**Risk of bias in individual studies**
An assessment of quality and risk of bias in the final papers included in the review will be conducted using the Newcastle–Ottawa Scale (NOS) as recommended by the Cochrane Collaboration.\textsuperscript{4,5} The content validity and inter-rater reliability of this tool has been established.\textsuperscript{5} The tool enables a maximum of nine stars to be awarded to an individual study. A research assistant and a member of the study team will undertake the quality and risk of bias assessment in the final papers.

\textbf{Data analysis}
All data extracted data will be presented in a comprehensive evidence-base table, where the evidence will be synthesized and summarized. Summary tables will include studies that examined nurse staffing and single site–specific infection, nurse staffing and multiple types of infections, nurse staffing and organism-specific HAI, nurse staffing and unspecified HAI, and non-nurse staffing and HAI. Potential confounders and limitations will be presented. If the pooling of data is possible, such analysis will be undertaken in Review Manager software (Revman 5.3; Cochrane Collaboration, Oxford, UK).

\textbf{Timeframe}

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<thead>
<tr>
<th>Timeframe</th>
<th>Activity</th>
<th>Role/Person(s)</th>
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<tr>
<td>October 2015</td>
<td>Agreement of study protocol</td>
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<tr>
<td>November 2016</td>
<td>Agreement of study protocol</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Appointment of research assistant</td>
<td>BM</td>
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<tr>
<td>April 2016</td>
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Significance and impact

This research will describe relationships between hospital staffing and HAIs. The findings will inform healthcare managers and professional organisations on recommendations for hospital staffing as they relate to infection prevention. The findings will support better decision-making and advocate for effective use of resources.

Translation of findings into practice

The following diagram summarises the mechanism to be used for dissemination of the results to assist with translation into practice.
Multidisciplinary Research Team

The team members have a strong background and experience in infection prevention and control practice and research. The following people will constitute the Chief Investigators for this study.

Associate Professor Brett Mitchell – A/Prof Mitchell will lead the project. He is an active researcher and speaker within the infection control community in Australia and internationally and will use his profile to promote the research outcomes directly to infection control practitioners and managers. He has extensive experience in contributing to health policy documents and with Dr Hall will utilize this experience in dissemination of results to healthcare policymakers. He has a rapidly increasing research profile with a number of peer reviewed publications and research reports. A/Prof Mitchell is also involved in a number of infection control research projects and collaborations across Australia and serves on national committees related to healthcare associated infections.

Professor Patricia Stone. Professor Stone is a Professor of Nursing at Columbia University. She is a health services researcher with interests in cost and quality outcomes as it pertains to the nurse work environment and the impact of organizational components on patient, employee and systems outcomes. Much of Professor Stone’s work has been focused on HAIs. She is the Director of the Center for Health Policy and Centennial Professor in Health Policy. Professor Stone is the principal investigator of the “Prevention of Nosocomial Infections & Cost Effectiveness Refined” study (The P-NICER Study). Professor Stone provides an international perspective to the study and has undertaken similar work in this field in 2008.

Professor Anne Gardner. Professor Gardner is a very experienced researcher and clinician. She is a Professor of Nursing in the School of Nursing, Midwifery and Paramedicine at ACU. Professor Gardner has an established, internationally recognised track record in the field of health services research and infection control. Over the last 10 years she has been successful in grant applications totalling over $4 million, had over 50 peer reviewed journal publications and presented or supported novices to present over 100 conference papers or posters. She provides the content and methodological expertise for the study.
Dr Lisa Hall. CI Hall will lead the epidemiological analysis on this project. She will use her epidemiological skills and experience to contribute to the study design and analysis of outcome data. She will also use her previous experience in implementation of multicentre, hospital-based, infection control programs to provide practical insight into potential implementation strategies from this study. CI Hall will be instrumental in the dissemination of project results to healthcare policy makers. She sits on the Healthcare Associated Infection working group of the ACSQHC.

Dr Monika Pogorzelska-Maziarz is an Adjunct Associate Research Scientist at Columbia University School of Nursing. She is an Infectious Disease Epidemiologist and has served as a Senior Project Director on several, federally-funded studies related to prevention of healthcare-associated infections. In addition, she has collaborated on several systematic reviews, one of which was the 2008 systematic review on staffing and infection rates which she co-authored with Dr. Stone. She has been recognized for her research in infection prevention with the 2009 New Investigator Award from the Association of Professionals in Infection Control and Epidemiology, Inc (APIC). Recently, she has served as a section editor on the update to the APIC Text, 5th edition.

**Project Governance**

Chief Investigators Mitchell will take overall responsibility for delivering this project. All Chief Investigators will constitute the project management team.

**Intellectual Property**

All Intellectual Property generated through the project will be managed in accordance with Avondale College’s Intellectual Property Policy.

**Ethical considerations**

Ethics approval for this project will be sought from Avondale College of Higher Education.

**Reporting**
Progress reports will be prepared by CI Mitchell and agreed upon by CIs. This will describe the research objectives, methods and findings. Reports will be made available to stakeholders in this project.

**Publications**
Associate Professor Brett Mitchell, Avondale College of Higher Education, may publish the research results, subject to providing the full details of the research results proposed for publication and the nature of the publication to all other Chief Investigators. All Chief Investigators will have the opportunity to co-author a publication, subject to compliance with the International Committee of Medical Journal Editors (ICJME) recommendations on authorship (2014).

**Confidentiality**
Each CI will treat all information and data obtained from this study as confidential and will not, without the consent of the lead Chief Investigators (CI Mitchell) disclose or permit the disclosure of information or data to any third parties.

**References**