

# Evaluating a major innovation in hospital design: workforce implications and impact on patient and staff experiences of all single room hospital accommodation

Jill Maben,<sup>1\*</sup> Peter Griffiths,<sup>2</sup> Clarissa Penfold,<sup>1</sup>  
Michael Simon,<sup>2</sup> Elena Pizzo,<sup>3</sup> Janet Anderson,<sup>1</sup>  
Glenn Robert,<sup>1</sup> Jane Hughes,<sup>1</sup> Trevor Murrells,<sup>1</sup>  
Sally Brearley<sup>1</sup> and James Barlow<sup>3</sup>

<sup>1</sup>National Nursing Research Unit, Florence Nightingale Faculty of Nursing and Midwifery (formerly Florence Nightingale School of Nursing and Midwifery), King's College London, London, UK

<sup>2</sup>Centre for Innovation and Leadership in Health Sciences, University of Southampton, Southampton, UK

<sup>3</sup>Imperial College Business School, London, UK

\*Corresponding author

**Declared competing interests of authors:** Sally Brearley acted as the Chair of the Prime Minister's Nursing and Care Quality Forum from January 2011 to December 2013.

Published February 2015

DOI: 10.3310/hsdr03030

## Scientific summary

### Evaluating a major innovation in hospital design

Health Services and Delivery Research 2015; Vol. 3: No. 3

DOI: 10.3310/hsdr03030

NIHR Journals Library [www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)

# Scientific summary

## Background

Increasingly, new hospital design includes greater proportions of single room accommodation and in some cases all single inpatient rooms. A recent review of hospital design options found scant and ambiguous evidence relating to the impact of single rooms on patient safety. There is also little evidence from the UK about likely impacts on staff and patients of single room accommodation. Results from an evaluation of a pilot ward in England with 100% single rooms suggest that, although patients were more satisfied than those in multibedded rooms, infection rates did not decrease, whereas cleaning costs increased. Length of stay was unaltered. The wider evidence of the impact of single rooms on infection rates is conflicting. This research seeks to add to the evidence base through the most detailed study conducted to date on the ways in which single room wards impact on staff working practices, safety and quality of care, costs and nurse staffing and patient satisfaction.

## Objectives

The overall aim of the project was to identify the impact of the move from 'traditional' facilities – comprising primarily open-plan Nightingale-style wards – to 100% single room accommodation in a newly built facility on:

1. care delivery and working practices
2. staff experience
3. patient experience
4. safety outcomes (including fall and infection rates)
5. capital and operational costs.

Nine specific research questions align with these aims and objectives (see *Results*, below).

## Methods

The study comprises three distinct but related workstreams conducted before and after the move to all single room accommodation in the NHS:

1. a mixed-methods study to inform a pre-/post-'move' evaluation within a single hospital
2. a quasi-experimental before-and-after study using two control hospitals (steady state and move to new build with less than 100% single rooms)
3. an analysis of comparative costs associated with single rooms.

### *Pre-/post-'move' evaluation within a single hospital*

In 2011 Tunbridge Wells Hospital opened, replacing facilities at Pembury Hospital and Kent and Sussex Hospital. This was the first NHS hospital in England to have 100% single in-patient rooms in all wards and high-acuity areas. Staff and patients moved from accommodation comprising predominantly large bays and open Nightingale wards. We undertook a pre/post evaluation within four 'nested' cases [a postnatal ward, an acute admissions unit (AAU), a surgical ward and an older people's ward] to assess impacts of the move to all single rooms. The research team had already collected 'before' data in 2010–11 from these four nested case study areas in the old accommodation.

Our post-move fieldwork comprised:

- 21 interviews and one focus group with stakeholders
- 250 hours of observation using a time and motion data collection tool
- 24 semistructured staff interviews
- 32 semistructured patient interviews
- a staff survey ( $n = 55$ )
- pedometer data ( $n = 55$  staff).

In addition, we analysed routinely collected trust data relating to costs, workforce and patient safety outcomes, and reviewed ward floor plans and staffing to understand the work implications of the built environment. Interviews were digitally recorded, transcribed verbatim and analysed alongside the pre-move data using a framework approach. Interpretation was discussed and refined in iterative drafts of findings.

### ***Quasi-experimental study in control hospitals***

To isolate any effect of single room accommodation on safety outcomes, a quasi-experimental before-and-after study with non-equivalent controls was undertaken. We recruited two hospitals: one in which no move occurred (steady state control) and one which moved to a new build with an increase in single rooms during the study period (new build control). Control hospitals provided outcome data (safety events and hospital-acquired infections) for a 3-year period from January 2010 to December 2012 for wards of the same type as the study site. An interrupted time-series analysis was conducted augmented by statistical process control charts and used u-charts to look for evidence of special-cause variation associated with the move to single rooms. Where special-cause variation was found, we further explored data to assess if this could be attributed to the move to 100% single rooms.

### ***Cost analysis***

A full economic analysis of the impact of single rooms across the local health system was not feasible because of time, resource and data availability constraints. We therefore conducted a comparative analysis of costs associated with single rooms, excluding impacts across the wider care system. Our focus was on the additional costs of changes in the workforce, additional costs of provision of accommodation and average additional treatment costs of adverse outcomes. We collated all available data relevant to these categories of costs and activity. We also consulted a range of experts from the construction and facilities management industries, and from hospital operation and management, to seek views on the relative impacts of different hospital designs on costs and resource use. We modelled the impact of these costs over the lifetime of the hospital in discounted cash flow/net present value terms. The experts also provided opinion on the emerging research findings.

## **Results**

### ***How are staff perceptions and experiences of the move to single rooms shaped by formal organisational and change management processes?***

Staff accounts detail a sense of anxiety, hard work and the need to work differently in the new hospital primarily because of single rooms. The priority given to the move and migration strategy left staff ill prepared for the challenges of working in single rooms, for example in terms of fall prevention, new ways of working as a team, locating and communicating with colleagues and ensuring good patient experience. Operational procedures were incompletely specified or were developed after the move. Some staff felt that there was more that could have been done to prepare for working on single room wards; others felt that the only way was to learn on the job. There was no explicit criticism of management, but some disappointment that lessons from the initial women's and children's move had not been learnt for the second phase of the move 9 months later.

***What are the advantages and disadvantages of a move to all single rooms for staff? Does the move to all single rooms affect staff experience and well-being and their ability to deliver effective and high-quality care?***

Staff reported that single rooms improved privacy, dignity and confidentiality for patients and were better for visitors. Single rooms were perceived to facilitate communication with patients, with reduced interruptions. Staff reported spending more time with some patients; in some cases, care was more personalised and individualised, although this was not always possible, and more time did not always result in more personalised care. Nurses found time management and prioritisation of workloads challenging in the new environment and struggled to divide their attention between all the patients they were caring for (which nurses had found easier in open wards in the old setting). The design met many staff expectations for an improved working environment, supporting them to deliver efficient and effective care. Staff also believed that single rooms reduced the risk of infection.

Staff also identified various obstacles to safe and efficient working, unique to this particular build, which increased the distances they had to walk, diverted them from patient care and impacted on their well-being. There were no significant differences in staff well-being and stress before and after the move. However, ward design limited visibility of patients more than staff had expected and they saw their greatest challenge as monitoring and safeguarding patients, especially those at risk of falls. Social isolation was perceived by staff to be a real disadvantage for both patients and staff. The quality of ward teamwork enjoyed in the old hospital had been difficult to recreate on the new wards. Staff adapted to decentralised nursing teams, but information exchange within wider nursing teams was perceived to be worse. The move to the new build did not result in a significant change to the proportion of nursing staff time spent on different activities, but findings of the time and motion study suggest there were fewer interruptions during these tasks and work was less fragmented. Staff felt reluctant to interrupt a colleague providing direct care in a single room. Overall, when asked their preference, most staff said that they would prefer wards with a mix of single rooms and multibedded accommodation.

***How are work patterns disrupted and reconstituted, including through trial-and-error use of new approaches (and to what extent are these successful/unsuccessful)?***

The challenges identified by staff required adaptation of working patterns. Trial and error was a feature of many innovations, with nursing teams trying, for example, different ways of preventing falls and various configurations of decentralised teams. Locating colleagues to obtain assistance was one of the main difficulties described by staff, and was largely unresolved by new ways of working. Nurses had to work differently to ensure all patients were seen regularly, requiring teamwork with colleagues and the initiation of regular hourly intentional rounds. Staff recognised that they required different strategies for time management and prioritisation on single room wards, to enable them to divide their time between patients and feel satisfied that they were giving all patients sufficient personalised care (easier on multibedded wards), but this challenge had largely been left to individuals to resolve, with reportedly limited success and associated dissatisfaction.

***What are the advantages and disadvantages for patients of a move to all single rooms? How does the move to all single rooms affect patient experience and well-being? Does it affect diverse patient groups differently?***

Patients experienced high levels of comfort in the single rooms, particularly in relation to the en suite toilet facilities, lighting, ventilation, having a view from a window and noise levels. Patients also experienced a high degree of control in the single room; consequently, many reported feeling relaxed. Patients also enjoyed the confidentiality afforded by the single room, and the privacy and flexibility it gave for visitors. Patients reported regular visits to their single room by various staff, and all patients described nursing staff conducting frequent intentional ward rounds. Some patients experienced a good quality of interaction and felt connected with staff, while others experienced care as largely task-driven and functional. Interaction with other patients was largely absent in the new hospital, leading to a sense of isolation for some

patients. Overall, however, the majority of patients (two-thirds of those interviewed) expressed a clear preference for single rooms. All the postnatal women liked single rooms. One-fifth of patients, including almost half of the men interviewed, said that they preferred multibedded accommodation. Staff associated loneliness with older patients, but it was experienced by all age groups in this study.

### ***What impact do different percentages of inpatient single rooms have on patient safety outcomes (including falls and infection rates) compared with standard accommodation?***

There were few changes in safety outcomes that might be associated with the move to single room accommodation. Infection rates remained low throughout the study period. Some differences were associated with substantial changes in case mix following the move and so could not be attributed to the single room environment. Immediately following the move there was an increase in falls and medication errors in the AAU, but the rates decreased to previous levels 6–9 months after the move. The temporary nature of this increase and no similar change at the new build/mixed accommodation control site suggest that the adverse outcomes are not directly associated with single rooms. Rather they are associated with disruption from the move to a new environment and the need to adjust work patterns. However, while some of the need for adaptation may be associated with the 100% single rooms, the temporary nature of increases and lack of a similar pattern in the control wards, which also experienced an increase in single rooms, suggests that it is not an inevitable result of single rooms. Although this conclusion must be interpreted in the light of an overall increase in falls at the hospital level and nurses' perception of any increase in fall rate as a 'single room issue' because of diminished visibility, the strong correlation between changes in the fall rate and in patient-level risk factors associated with service reconfigurations makes it difficult to conclude that single room accommodation is the cause.

### ***How does the move to all single rooms affect costs, including nurse staffing, patient services and costs associated with adverse patient events?***

An all single room hospital requires more floor space for wards, but space requirements for other areas are the same. The cost of building an all single room hospital is probably under 5% more than that of a 50% single room hospital. There was no evidence of difference in maintenance costs per square metre, or of an increase in the cost of preparing and serving meals related to single rooms. We modelled the cleaning costs for 500-bed 100% and 50% single room designs. Total annual costs for cleaning ward areas were 53% higher in the 100% design, but in relation to annual and lifetime running costs this would be marginal.

There was an overall increase in the number of whole-time equivalent (WTE) nurses after the move to single room design, and a change in the skill mix. However, when measured by proportions of WTE per bed before and after the move, the AAU saw a slight decrease, as did the surgical and older people's wards.

There is no clear evidence of any cost impact of single rooms associated with changes in falls, length of stay, medication errors or hospital-acquired infections. An analysis of the wider economic impact of single rooms was beyond the scope of this research.

## Conclusions

Although the nature of tasks undertaken by nursing staff did not change, nurses needed to adapt their working practices significantly and felt ill-prepared for the new ways of working, resulting in trial-and-error use of new approaches to care. Staff preference remained for a mix of single rooms and bays, and our findings suggest that a move to all single rooms may have significant implications for the nature of teamwork in the longer term. Patients preferred single rooms. There was no evidence that single rooms had any impact on patient safety outcomes, although staff in some areas felt that surveillance was more difficult and fall risk increased. Cleaning costs are higher.

The evidence suggests that training and rehearsal of new ways of working in advance of the move may facilitate and possibly accelerate adaptation to single room working, potentially improving patient and staff experience and enhancing patient monitoring and surveillance. The evidence also has implications for future ward design. Recommendations for future research concern the need to use a larger patient sample to explore patient experience and preferences in hospital builds with different proportions of single rooms and different designs, and the need to examine the long-term impact of single room working on the nature of teamwork and informal learning. We also need more evidence of the impact of single rooms on clinical/care outcomes and costs.

## Funding

Funding for this study was provided by the Health Services and Delivery Research programme of the National Institute for Health Research.

# Health Services and Delivery Research

ISSN 2050-4349 (Print)

ISSN 2050-4357 (Online)

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) ([www.publicationethics.org/](http://www.publicationethics.org/)).

Editorial contact: [nihredit@southampton.ac.uk](mailto:nihredit@southampton.ac.uk)

The full HSDR archive is freely available to view online at [www.journalslibrary.nihr.ac.uk/hsdr](http://www.journalslibrary.nihr.ac.uk/hsdr). Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: [www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)

## Criteria for inclusion in the *Health Services and Delivery Research* journal

Reports are published in *Health Services and Delivery Research* (HS&DR) if (1) they have resulted from work for the HS&DR programme or programmes which preceded the HS&DR programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

## HS&DR programme

The Health Services and Delivery Research (HS&DR) programme, part of the National Institute for Health Research (NIHR), was established to fund a broad range of research. It combines the strengths and contributions of two previous NIHR research programmes: the Health Services Research (HSR) programme and the Service Delivery and Organisation (SDO) programme, which were merged in January 2012.

The HS&DR programme aims to produce rigorous and relevant evidence on the quality, access and organisation of health services including costs and outcomes, as well as research on implementation. The programme will enhance the strategic focus on research that matters to the NHS and is keen to support ambitious evaluative research to improve health services.

For more information about the HS&DR programme please visit the website: <http://www.nets.nihr.ac.uk/programmes/hsdr>

## This report

The research reported in this issue of the journal was funded by the HS&DR programme or one of its preceding programmes as project number 10/1013/42. The contractual start date was in January 2012. The final report began editorial review in March 2014 and was accepted for publication in September 2014. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health.

**© Queen's Printer and Controller of HMSO 2015. This work was produced by Maben *et al.* under the terms of a commissioning contract issued by the Secretary of State for Health. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.**

Published by the NIHR Journals Library ([www.journalslibrary.nihr.ac.uk](http://www.journalslibrary.nihr.ac.uk)), produced by Prepress Projects Ltd, Perth, Scotland ([www.prepress-projects.co.uk](http://www.prepress-projects.co.uk)).

## **Health Services and Delivery Research Editor-in-Chief**

**Professor Ray Fitzpatrick** Professor of Public Health and Primary Care, University of Oxford, UK

## **NIHR Journals Library Editor-in-Chief**

**Professor Tom Walley** Director, NIHR Evaluation, Trials and Studies and Director of the HTA Programme, UK

## **NIHR Journals Library Editors**

**Professor Ken Stein** Chair of HTA Editorial Board and Professor of Public Health, University of Exeter Medical School, UK

**Professor Andree Le May** Chair of NIHR Journals Library Editorial Group (EME, HS&DR, PGfAR, PHR journals)

**Dr Martin Ashton-Key** Consultant in Public Health Medicine/Consultant Advisor, NETSCC, UK

**Professor Matthias Beck** Chair in Public Sector Management and Subject Leader (Management Group), Queen's University Management School, Queen's University Belfast, UK

**Professor Aileen Clarke** Professor of Public Health and Health Services Research, Warwick Medical School, University of Warwick, UK

**Dr Tessa Crilly** Director, Crystal Blue Consulting Ltd, UK

**Dr Peter Davidson** Director of NETSCC, HTA, UK

**Ms Tara Lamont** Scientific Advisor, NETSCC, UK

**Professor Elaine McColl** Director, Newcastle Clinical Trials Unit, Institute of Health and Society, Newcastle University, UK

**Professor William McGuire** Professor of Child Health, Hull York Medical School, University of York, UK

**Professor Geoffrey Meads** Professor of Health Sciences Research, Faculty of Education, University of Winchester, UK

**Professor John Powell** Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK

**Professor James Raftery** Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK

**Dr Rob Riemsma** Reviews Manager, Kleijnen Systematic Reviews Ltd, UK

**Professor Helen Roberts** Professor of Child Health Research, UCL Institute of Child Health, UK

**Professor Helen Snooks** Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK

Please visit the website for a list of members of the NIHR Journals Library Board:  
[www.journalslibrary.nihr.ac.uk/about/editors](http://www.journalslibrary.nihr.ac.uk/about/editors)

**Editorial contact:** [nihredit@southampton.ac.uk](mailto:nihredit@southampton.ac.uk)