

Occupancy data: unravelling the mystery

AUTHORS

Johanna Stevenson

BN, RN, RM

Midwifery and Nurse Manager, Women's and Newborn Services. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia.

Susan Anderson

BN, RN

Nurse Manager, Cancer Care Services. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia.

Kate Veach

BN, Grad Cert Health Management, RN,

Nurse Manager, Internal Medicine Services. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia.

Bette-Anne Hine

Grad Cert Neuroscience Nursing, RN

Nurse Unit Manager, Surgical and Perioperative Services. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia.

Joan Webster

BA, RN

Nursing Director Research. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia. Adjunct Professor, School of Nursing and Midwifery, Griffith University. Associate Professor, School of Nursing and Midwifery, University of Queensland. Adjunct Associate Professor, School of Nursing and Midwifery, Queensland University of Technology.
joan_webster@health.qld.gov.au

Lesley Fleming

M. Health Serv. Mgt, RN

Executive Director Nursing and Midwifery Services. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia.

Sonya Osborne

PhD, RN.

Nurse Manager, Research Translation and Practice Innovation. Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia. Senior Lecturer, School of Nursing and Midwifery, Queensland University of Technology.

KEY WORDS

Bed occupancy; nursing workload; nursing resources

ABSTRACT

Objective

The main purpose of this study was to clarify the method used to calculate bed occupancy rates.

Design

Qualitative, using semi-structured face-to-face interviews, telephone interviews and email correspondence with internal and external stakeholders, as well as analysis of key documents.

Setting

A tertiary hospital in Queensland, Australia.

Participants

Nursing and administrative staff from 34 clinical areas, nurse managers and finance officers.

Main outcome measure

Identification of the method used to calculate bed occupancy.

Results

A number of issues potentially impact on the accuracy of occupancy data including timeliness of data entry, knowledge about what should be entered and skill deficits. There was also considerable confusion and misinformation about how occupancy data is calculated, used and reported.

Conclusion

Occupancy data integrity may be compromised by timeliness and accuracy of data entry and by methods used for calculation. Until these problems are resolved, occupancy remains a woolly measure on which to estimate nursing resources.

INTRODUCTION

Nursing resources generally account for the majority of the operational budget in most acute care facilities. This is because appropriate nursing staff levels are integral to providing not only safe patient care but also suitable and sustainable workloads for nurses. Since ground breaking research, published nearly a decade ago (Aiken et al 2002), researchers have continued to demonstrate strong links between nursing staffing levels and skills mix and patient morbidity and mortality (Kane et al 2007; Lankshear et al 2005; Lang et al 2004; Hickam et al 2003). In addition, nurse staffing levels have been directly related to higher retention, less turnover and greater job satisfaction (Rathert and May 2007; Kim et al 2005).

A variety of methodologies worldwide have been described in the literature to justify and rationalise nursing resources. For example, in an attempt to develop a staffing methodology to specifically meet the needs of facilities in Western Australia, Twigg and Duffield (2009) reviewed several nursing workload measurement systems from the past three decades, including professional judgment, commercially available acuity packages, staff-patient ratios, patient dependency systems and nursing hours per patient day. In earlier work, Hurst et al (2003) described other methodologies, ranging from simple to complex, which are used to calculate appropriate staffing levels including nurses per occupied bed, acuity-quality method, time-tasked activity method and regression analysis method.

What is obvious in the descriptions of these models is that the type of data required and the variables taken into account when calculating staffing levels varies between methodologies and any one system may not be totally suitable for any one organisation or clinical unit. This supports recommendations for the use of a combination of two or more methods to ensure appropriate nursing resources (Hurst 2003) and assertions that senior nurse managers do not have adequate workload measurement tools to justify what they believe is a suitable workload (Twigg and Duffield 2009). Despite the availability of several methodologies to estimate appropriate staffing levels, a dilemma for nursing management remains. The limited availability of validated, responsive measurement tools that adequately address nursing workloads and also provide the transparency required to justify the nursing budget remains (Callaway and Major 1988; Twigg and Duffield 2009).

BACKGROUND

In Queensland, Australia, the Business Planning Framework (BPF), endorsed by Queensland Health in 2001, is the tool utilised by Nurse Managers to calculate nursing resources. The BPF calculates nursing hours per patient day for each inpatient ward or unit and utilises occupied bed days as a demand indicator. In other words, occupancy is a rate, based on occupied bed days (Queensland Health 2008). Consequently, calculating appropriate nursing resources depends on the accuracy of the occupancy data, which is entered into the BPF system.

The current study started in 2009 in response to what was perceived by senior nurses as inaccuracies in occupied bed days and occupancy data. There were discrepancies between what was being reported in the hospital's Patient Information System; in the data published at national health meetings, where health executive representatives compare data for national benchmarking purposes; and what was observed or perceived 'at the coalface' on a day to day basis. With continuing pressure to justify the nursing budget, the aim of the study was to identify which data is used to calculate occupancy and factors that may impede accuracy.

METHODS

Design

A pragmatic study design, using qualitative data collection methods was used. Data was collected through semi-structured, face-to-face interviews, telephone interviews and email correspondence with internal and external stakeholders, as well as analysis of key documents.

Procedure

The study was undertaken between March 2009 and May 2010. The project team consisted of four senior nurse leaders, each from one of four major clinical areas of the organisation; surgery, cancer care, maternity and newborn services and medicine. An interview schedule (Figure 1) was used to guide data collection. A snowball sampling strategy was used to identify and interview appropriate staff throughout the study period. Key internal and external stakeholders were contacted initially by telephone or email and further information obtained, if required, through follow-up contact. Interviews were not tape recorded, careful field notes were taken during contact with all participants.

Figure1: Interview schedule used to guide data collection

Who enters the patient's admission, discharge and internal transfer data into the hospital's Patient Information System?

What is your understanding of the area or person responsible for ensuring this data is entered?

Are there any official guidelines or rules regarding the area or person responsible for this data entry?

In regard to internal transfers, which procedures or investigations is the patient's data entered into the hospital's Patient Information System?

In regard to internal transfer to operating theatre, is the patient's data entered into the hospital's Patient Information System?

Please describe what actually happens in regard to data entry into the hospital's Patient Information System during business hours.

Please describe what actually happens in regard to data entry into the hospital's Patient Information System after hours.

Please describe what actually happens in regard to data entry into the hospital's Patient Information System on weekends.

Is there a process in place to capture data to be entered retrospectively into the hospital's Patient Information System – for example: a book with the details of the patient's admission, discharge or transfer?

In your opinion is the hospital's Patient Information System data entered in a timely manner?

Occupancy data accuracy

Informal interviews were conducted with ward receptionists and all levels of nursing staff from 34 clinical areas. Each staff member was contacted by telephone, advised of the study and provided with an overview of the information to be discussed at interview. A request for a one hour interview, at a date and time suitable to each individual, was scheduled in the clinical area where the staff member worked. Staff were asked about data entry into the hospital's Patient Information System related to patient admissions, discharges and transfers. This was to clarify which data was entered, accuracy and timeliness of data entry, how data entry was managed out of hours and whether those entering data understood the implications of correct data entry. Data was also obtained from senior ward reception staff regarding the training provided to ward receptionists about how patient data should be entered. In addition, staff from the computer training unit were asked about the education provided to nurses in relation to the Patient Information System.

Occupancy data calculation

Because occupancy is related to bed numbers, interviews were scheduled with those who are responsible for calculating bed numbers. Queensland's Health Information Services reports organisational health information data, physical bed numbers are also reported monthly to the State Government. So, from a state wide perspective, two senior State Government data collections staff and a senior head of department from the State Government statistical unit were asked how bed numbers were estimated. In addition, to clarify how the related issue of occupancy is calculated, initial discussions were held with divisional Business Managers and subsequently with a senior Financial Manager to determine where they sourced their information about occupied bed days and occupancy data for their monthly financial reports.

ANALYSIS

Analysis and data collection were intertwined. In the team meetings, field notes were compared and findings discussed. This enabled specific issues to be revisited in one or more services, to ensure a degree of consistency in data was achieved. Content validity was supported through the emergence of substantively similar findings between the project officers. Using their observations, the authors were able to describe the general understandings of key informants and identify key areas of concern related to accuracy of data entry, which emerged time after time, in each service.

RESULTS

A total of 79 interviews were conducted including 10 senior administrators, 33 administrative officers and 36 nursing staff. Data were categorised and is reported using two key areas, occupancy data accuracy and occupancy data calculation.

Occupancy data accuracy

Occupancy-related data entry is guided by a local Patient Information System Handbook, which is provided to new employees during their orientation program. The handbook offers instructions about how to enter data into the system but does not provide business rules about when data should be entered or by whom. It suggests that internal transfers on the system be limited to those patients going to the operating theatre, to the cardiac investigation unit, the gastroenterology unit, and to those being transferred to other wards. This is to ensure that entries into the hospital's Patient Information System are consistent and of high quality, to support the Casemix funding model. Registered nurses are provided with limited training related to data entry for admissions, discharges and internal transfers.

Despite the presence of a 'handbook', respondents described a number of issues that potentially impact on the accuracy of occupancy data. These were consistent in all clinical areas surveyed. Administrative officers enter most patient data related to admissions, discharges and transfers; however, they are faced with multiple factors that impact on data accuracy. After hours, registered nurses are responsible for either entering patient movement data or recording movements accurately on paper, so that administrative staff may adjust the data base retrospectively. Several issues were identified that have implications for both administrative staff and registered nurses in maintaining data integrity; these are shown in figure 2.

Figure 2: Receptionist and nursing factors affecting accuracy of data entry**Issues for ward receptionists**

- Less than 24 hour coverage by ward receptionists, most commonly 0700–2000 weekdays, 0800–1200 Saturdays, no cover Sundays.
- Information about patient movements is not always communicated to the ward receptionists and therefore not able to be recorded.
- Generally information to enable retrospective adjustments to data entry is not available.
- Timeliness and completeness of data entry is influenced by the number and urgency of other requests to the ward receptionists.
- Data entry is given a lower priority than performing activities that more directly relate to the provision of patient care.
- Lack of clear, documented instructions regarding the business rules for patient movements.
- Data entry is sometimes made more complex by incomplete or inaccurate patient data.

Issues for nursing staff

- Skills and knowledge for accurate data entry are limited as the system is used infrequently.
- Expired or forgotten passwords are a frequent occurrence and difficult to reset.
- Skills and knowledge in relation to retrospective data entry or correction are mostly non-existent.
- Patient care activities take precedence over maintenance of the patient data entry.
- Workload often prevents data entry.

Occupancy data calculation

Discussions with those responsible for providing a monthly report to the State Government about the number of inpatient hospital beds and bed alternatives advised this information is collated from the Patient Flow Unit's Bed Manager Information System. Hospital bed numbers data from the hospital's primary Patient Information System is not utilised for this report.

On the other hand, business managers advised the data source for occupied bed days, and therefore the occupancy rate, is generated from the hospital's Patient Information System. This was confirmed by the Senior Finance Manager who stated three data sets (patient admissions, discharges and transfers) are used to calculate fractional bed days, or the actual hours a bed is occupied. Data is downloaded three times each week so any retrospective data is captured and forms part of occupied bed day calculations. A formula is used by financial services, which is entered manually into the financial information system that generates the occupancy data. A key component of the formula is the total number of beds for each clinical area. To change the formula every month is not practical so the bed number is not changed routinely. This means, even though it is every day practice within the organisation for each clinical area to 'close' beds in the hospital's Patient Information System when they are not required, this bed closure information is not included in the data that calculates the fractional bed days.

DISCUSSION

There is widespread use of occupancy data and occupancy rates in calculations for estimating appropriate nursing workloads and justifying nursing resources. The ideal occupancy rate generally accepted by health administrators is 85%. This figure is based on a queuing model, developed by Erlang in 1909, which suggests systems are most efficient at 85% capacity (Bain et al 2010). It is argued, when the occupancy rate exceeds 85%, the risk of patients being turned away from emergency departments is likely to increase (Keagan 2010; DeLia 2006; Bagust et al 1999). This leads to a phenomenon known as hospital access block described as a situation brought about when beds are unavailable (Bain et al 2010; Green 2002). Although the 85% occupancy rate is accepted as ideal and perceived to reduce the risk of hospital access block, the argument

is contentious in professional literature (Bain et al 2010; Garling 2008; Green 2002; Pettinger 1997). Nonetheless, 85% occupancy rate is referred to in position statements documents and reports related to healthcare funding models (CHA 2009; AMA 2006) and patient safety and quality care (Kane et al 2007) at state and national levels. The occupancy rate is also the basis of staffing workload measurement tools, such as the BPF. Although use of occupancy data in calculations of nursing staff levels is widespread, the consideration and communication of clear and replicable processes for identifying the required data to make the calculations is crucial.

Another factor relating to occupancy rates that requires consideration when estimating staffing levels is the size of the hospital. Smaller hospitals have less economies of scale and may require a lower occupancy rate than the accepted 85% (Green 2002; Jones 2001; Green and Nguyen 2001). When considering occupancy rates, the final report for the Special Commission of Inquiry for Acute Care Services in NSW public hospitals concluded that further research into levels of risk and safety associated with varying levels of bed occupancy was required before ideal occupancy levels could be determined (Garling 2008). The Garling report also suggested an occupancy rate of 92% to 95% for individual hospitals should not be exceeded until further research provides scientific proof of the appropriate bed occupancy level (Garling 2008). It is further suggested that other demand indicators instead of occupancy be used for capacity planning by health administrators (Green 2002; Green and Nguyen 2001). Despite the literature attempting to describe the most appropriate occupancy rate for hospitals, any occupancy rate depends on the method used to calculate it. However, as this investigation has shown, there is considerable confusion and misinformation regarding occupancy data including how it is calculated, who undertakes the calculations and how the occupancy data is used and reported.

When accurate data is used to calculate occupancy rates, it is invaluable for decision making regarding bed availability and hence nursing resources (Green 2002; Cohen and Martorella 2000). One vital component in the calculation of occupancy rates is the number of available beds that are included (DeLia 2006; Green 2002; Jones 2001). This study has identified, despite senior management ensuring beds are 'closed' in the Patient Information System for individual wards on a shift by shift basis, that this data is not utilised in occupancy calculations. Occupancy data is calculated using only the total number of beds in a clinical area regardless of the beds being funded or staffed. Bed numbers are rarely changed in the Patient Information System, with the exception of a permanent increase or decrease in beds. Despite this, the importance of accurately recording bed closures in the Patient Information System is emphasised to all staff because of a belief that this data impacts on occupancy rates and funding but this is not the case.

Although complex modelling techniques are utilised for long term planning of hospital beds, to manage hospital resources on a day to day basis it is necessary to have accurate data which is collected on a frequent basis (DeLia 2006; Mackay 2001). In the study hospital, this has resulted in some areas developing their own system. Local occupancy data is recorded three times each day to calculate accurate nursing resource requirements. If this was a hospital wide practice, it could provide the raw data for more accurate occupancy data for use in BPF calculations and nursing services workforce reports.

The study has also highlighted a number of issues affecting accuracy of the occupied bed days data. Although there are some business rules around data entry into the Patient Information System by ward receptionists and nursing staff, the actual information entered was dependent on individuals entering the data. For ward receptionists, the primary issues related to timeliness and accuracy of information about patient admissions, discharges and transfers. This was affected by the fact that there is no 24 hour cover for data entry and communication about patient movements after hours was poorly documented. Even though data

can be retrospectively entered into the Patient Information System this did not always occur. Although other studies reporting similar findings were not found, retrospective data entry may also be a factor for accurate occupancy calculations elsewhere. Administrative staff expressed relief that there was a review of the data entry requirements and processes for the Patient Information System. They commented that the overall, 'rules' surrounding the transfer of patients temporarily leaving the unit remained unclear, despite efforts to ensure high quality data input. Decisions around entering information in the Patient Information System for transfers to procedures and investigations are often made by the administrative staff, based on historical or personal practices, time demands, and whether or not patient movement are communicated to them. Some clinical areas utilise a transfer and discharge book after hours, and the Patient Information System is updated by administrative staff retrospectively. This may be up to 48 hours after the patient was discharged or transferred and leads to a significant increase in workload for these clerical staff.

For nurses, the issues were different. They were infrequent users of the system so re-setting passwords was time consuming and remembering processes required for accurate data entry was difficult. Overriding these issues though, was their focus on care delivery, which always took precedence over data entry. Willmer (2007) found similar problems for nurses, which included not having the required information technology skills and others who did not have time for data entry (Willmer 2007).

CONCLUSION

Currently the calculation of nursing resources is directly related to the integrity of occupancy data, which in turn is directly related to the data entered into the hospital's Patient Information System. There is confusion about how occupancy is calculated, the definition of 'a transfer' and what the State and Federal reporting requirements are in relation to occupancy. Until these issues are addressed, calculating appropriate nursing resources will remain difficult, despite the availability of several methodologies to estimate appropriate staffing levels. Although, a myriad of contextual, patient and staff variables impact on any process used to determine appropriate nursing resources, correctly estimating appropriate nurse staffing levels depends on the accuracy and consistency of data used in workload measurement calculations.

REFERENCES

- Aiken, L.H., Clarke, S.P., Sloane, D.M., Sochalski, J. and Silber, J.H. 2002. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA*, 288(16):1987-93.
- Australian Medical Association (AMA). 2006. Position Statement on Quality and Safety in Public Hospitals. Kingston ACT: Australian Medical Association 2006:7. (Retrieved 25/5/2010) available from <http://www.ama.com.au/print/2540>
- Bagust, A., Place, M. and Ponsett, J.W. 1999. Dynamics of bed use in accommodating emergency admissions: stochastic simulation model. *BMJ*, 319(7203):155-8.
- Bain, C.A., Taylor, P.G., McDonnell, G. and Georgiou, A. 2010. Myths of ideal hospital occupancy. *Medical Journal of Australia*, 192(1):42-3.
- Callaway, L. and Major, E. 1988. The importance of data in verifying nurse staffing requirements. *Intensive Care Nurse*, 4(1):21-3.
- Catholic Health Australia (CHA). 2009. Federal Budget Submission 2010/11 Funding the first phase of health reform. (Retrieved 25/5/2010) available from <http://www.cha.org.au/site.php?id=843>
- Cohen, L. and Martorella, C. 2000. Bed availability report: facilitating patient placement. *Journal of Nursing Administration*, 30(12):599-603.
- DeLia, D. 2006. Annual bed statistics give a misleading picture of hospital surge capacity. *Annals of Emergency Medicine*, 48(4):384-8,388 e1-2.
- Garling, P. 2008. *Final Report of the Special Commission of Inquiry into Acute Care Services in NSW Public Hospitals*. Sydney, NSW Government 993-994.
- Green, L.V. 2002. How many hospital beds? *Inquiry*, 39(4):400-12.
- Green, L.V. and Nguyen, V. 2001. Strategies for cutting hospital beds: the impact on patient service. *Health Services Research*, 36(2):421-42.

- Hickam, D.H., Severance, S., Feldstein, A., Ray, L., Gorman, P., Schuldheis, S., Hersh, W.R., Krages, K.P. and Helfand, M. 2003. The Effect of Health Care Working Conditions on Patient Safety. *Evidence Report/Technology Assessment (Summary)*, March (74):-3.
- Hurst, K. 2003. *Selecting and Applying Methods for Estimating the Size and Mix of Nursing Teams*. Nuffield Institute for Health. Leeds.
- Jones, R. 2001. Bed occupancy. Don't take it lying down. *Health Services Journal*, 111(5752):28-31.
- Kane, R.L., Shamliyan, T.A., Mueller, C., Duval, S. and Wilt, T.J. 2007. The association of registered nurse staffing levels and patient outcomes: systematic review and meta-analysis. *Medical Care*, 45(12):1195-204.
- Keegan, D.A. 2010. Hospital bed occupancy: more than queuing for a bed. *Medical Journal of Australia*, 193(5):291-293.
- Kim, Y.M., June, K.J. and Cho, S.H. 2005. Factors related to nurse staffing levels in tertiary and general hospitals. *Journal of Korean Academy of Nursing*, 35(8):1493-9.
- Lang, T.A., Hodge, M., Olson, V., Romano, P.S. and Kravitz, R.L. 2004. Nurse-patient ratios: a systematic review on the effects of nurse staffing on patient, nurse employee, and hospital outcomes. *The Journal of Nursing Administration*, 34(7-8):326-37.
- Mackay, M. 2001. Practical experience with bed occupancy management and planning systems: an Australian view. *Health Care Management Science*, 4(1):47-56.
- Pettinger, N. 1997. Calculating hospital activity. Measure for measure. *Health Service Journal*, 107(5548):26-7.
- Queensland Health. 2008. *Business planning framework a tool for nursing workload management*. Queensland Government. Brisbane.
- Rathert, C. and May, D.R. 2007. Health care work environments, employee satisfaction, and patient safety: Care provider perspectives. *Health Care Management Review*, 32(1):2-11.
- Twigg, D. and Duffield, C. 2009. A review of workload measures: a context for a new staffing methodology in Western Australia. *International Journal of Nursing Studies*, 46(1):131-9.
- Willmer, M. 2007. How nursing leadership and management interventions could facilitate the effective use of ICT by student nurses. *Journal of Nursing Management*, 15(2):207-13.