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Feasibility of using payroll data to estimate hospital nurse staffing levels

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1 **Feasibility of using payroll data to estimate hospital nurse staffing**

2 **Abstract**

3 ***Introduction***

4 The capacity for a hospital inpatient unit to provide high quality nursing care depends on a complex range
5 of factors. Accurately identifying and measuring these factors is one of the challenges of nursing care
6 quality research. Nursing hours per patient day and skill mix are two quantifiable indicators of capacity to
7 provide nursing care.

8 ***Aims***

9 The aims of the study are to measure fortnightly, unit-level nurse staffing and compare them to target
10 nurse staffing levels.

11 ***Method***

12 Nurse staffing and inpatient unit movement data were sourced for the administrative records of three
13 Western Australian tertiary metropolitan hospitals (2004-2008). The impact of data source on nurse
14 staffing estimates was tested with linear mixed models, adjusting for financial year. Counts, proportions,
15 means, and standard deviations were used to describe nurse staffing data. Bar graphs depict proportion of
16 nursing hours provided by nurses of different skill levels.

17 ***Results***

18 Data source did not significantly affect estimate of nursing hours per patient day ($p=0.788$). Fortnights
19 during which nurse staffing targets were not reached were recorded for all units. Skill mix varied between
20 units with different staffing targets.

21 ***Conclusion***

22 It is feasible to calculate fortnightly nursing hours and skill mix per hospital unit from raw nursing payroll
23 and inpatient unit movement records. Fortnightly, unit-level measurement highlights nurse staffing
24 fluctuations that are masked by annually aggregated data and are relevant for studies which investigate the

1 association between nurse staffing levels and inpatient complication rates. Staffing shortfalls may affect
2 nurses' experiences of working or patients' care experiences.

3 **Keywords**

4 Nurse staffing; Nursing hours per patient day; Skill mix

1 **INTRODUCTION**

2 Nurses provide 24 hour care to inpatients of hospital units as part of the health care team. There is
3 evidence that patient health outcomes are directly influenced by the quality and quantity of nursing care
4 provided on inpatient units (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007; Subirana, Long, Greenhalgh,
5 & Firth, 2014). Nursing hours per patient day and skill mix are two quantifiable indicators of capacity to
6 provide nursing human resources. Currently these factors are not considered when providing and
7 reflecting upon staffing requirements. Complex factors, both within and outside nurses’ control, interact to
8 either enable or hinder their capacity to provide high quality care to patients (Griffiths, Jones, Maben, &
9 Murrells, 2008; Needleman et al., 2011; Van den Heede, Clarke, Sermeus, Vleugels, & Aiken, 2007).
10 Such factors include: appropriate numbers of skilled nurses with adequate experience and expertise; work
11 environment; hospital commitment to inpatient safety; collaboration and communication between health
12 professionals; and nurse burnout (Aiken & Patrician, 2000; Kane, et al., 2007; Lake, 2007; O'Brien Pallas
13 & Hayes, 2008).

14 **BACKGROUND**

15 Skill mix and nursing hours per patient day (NHpPD) are two quantifiable nurse staffing indicators used
16 as measures of capacity to provide nursing care (Griffiths, et al., 2008; Van den Heede, et al., 2007). The
17 term ‘skill mix’ refers to the proportions of hours of nursing care that are delivered by nurses with
18 different skill levels; for example, university educated Registered Nurses (RNs), or vocationally trained
19 Enrolled Nurses (ENs, similar to Licensed Practical Nurses in North America). NHpPD is the number of
20 hours of nursing care required to meet each patient’s care needs in a 24 hour period. The term NHpPD is
21 used in two ways: by researchers to refer to a measure of nursing care (Van den Heede, et al., 2007), and
22 by nurse managers to describe a method of planning appropriate future staffing levels (Twigg & Duffield,
23 2009).

24 Planning appropriate staffing levels for units is challenging and requires a flexible approach in order to
25 respond to changeable patient care needs. Using usual patient profiles for each unit, the NHpPD method

1 takes into account multiple factors that impact on nurse workload to allocate units to categories which are
2 then used to guide nurse staffing requirements (described in Table 1).

3 NHpPD are calculated by dividing productive hours worked by all nurses in a day by the number of
4 patients on a unit in the same day. 'Productive hours' are those worked by nurses on specific inpatient
5 units in direct patient care roles, and exclude hours during which education or leave occur. Specialist
6 nurses (i.e. infection control nurse specialist) are not included here, though their productive hours
7 contribute to patient care their responsibility is usually for a specific aspect of patient care. Productive
8 hours by nurses delivering patient care are the recommended nurse staffing predictor of inpatient
9 complications in statistical modelling (Park, Blegen, Spetz, Chapman, & De Groot, 2015).

10 **Data sources for measuring nurse staffing**

11 Accessing suitable data sources for measuring nursing care indicators like NHpPD and skill mix can be
12 difficult when conducting nursing care quality research (Clarke & Donaldson, 2008). Nursing care quality
13 research can require large datasets for statistical analysis and during the study period records of nursing
14 hours per patient day and skill mix were not routinely collected at the fortnightly level and made widely
15 available for research. Hospital nurse staffing levels are commonly measured using data sourced from two
16 broad categories: firstly, prospective surveys of nurses about staffing levels and/or workload (Aiken,
17 Clarke, Sloane, Lake, & Cheney, 2008; Duffield et al., 2011) and secondly, retrospective access to nurse
18 staffing records (Blegen, Goode, & Reed, 1998; Needleman, et al., 2011; Twigg, Duffield, Bremner,
19 Rapley, & Finn, 2011). Nurse staffing records include hospital data submitted to regulatory bodies (e.g.
20 numbers and educational attainment of nurses employed at a particular facility), operational records
21 obtained specifically for the purpose of a research project (e.g. nurse staffing rosters), or data used for
22 other functions necessary for the running of the hospital (e.g. nursing payroll records). Data may be
23 reported for individual units or may be aggregated and reported at the departmental or hospital level.
24 Records do not always distinguish between nursing staff with direct patient care roles and those caring for
25 outpatients, and may be recorded over varying time periods (e.g. daily, fortnightly, quarterly or annually)

1 (Blegen, 2006). Researchers can find that the calculation of the nurse staffing measure is dictated by data
2 source access limitations, rather than the research question (Harless & Mark, 2006). Careful consideration
3 of the limitations of different nurse staffing data sources is warranted since the measure of nurse staffing
4 used has been found to affect the association between nurse staffing and inpatient complication rates
5 (Brennan, Daly, & Jones, 2013; Jiang, Stocks, & Wong, 2006; Kane, et al., 2007; Spetz, Donaldson,
6 Aydin, & Brown, 2008). For example, payroll data are a record of nurses who must be paid for turning up
7 to work which may or may not match the hours of care that were required by inpatients during the same
8 period. Though systems such as NHpPD aim to ensure the nurses who turn up to work do match
9 changeable patient care needs.

10 **Using payroll data: outline and challenges**

11 Hospital nursing staff payroll records have been used in the international literature to construct measures
12 of nurse staffing (Blegen, et al., 1998; Twigg, et al., 2011). Nurse staffing payroll records for public
13 hospital employees in Western Australia (WA) are centrally housed at the Health Corporate Network, part
14 of the Western Australian Department of Health (WADOH). However, because nursing payroll data are
15 collected for fiscal rather than research purposes, potential limitations include: not capturing nurses who
16 ‘float’ (i.e. are moved from their usual unit to work somewhere different for a shift) to different units
17 without cost-recovery; not accounting for non-direct patient care activities such as nurses being off the
18 unit for short education sessions; and payroll data may not be as carefully updated when changes do not
19 affect payment (i.e. if a nurse moves unit but does not change pay rate, payroll data may not be updated in
20 a timely manner).

21 **Western Australian context**

22 In 2002 the WA government applied the NHpPD staffing method to plan the amount of nursing time
23 required to meet patient care needs, and this effectively mandated minimum staffing levels on units in all
24 public hospitals (Twigg & Duffield, 2009). Specific hospital units were observed and allocated to specific
25 NHpPD target categories using the method. Guiding characteristics considered before a unit is allocated to

1 a category include care complexity, turnover, and intervention levels (**Error! Reference source not**
2 **found.**)(Twigg & Duffield, 2009). There are also specific NHpPD targets for units designated as tertiary,
3 namely: Intensive Care Units (ICU, 31.5 hours), Coronary Care Units (CCU, 14.16 hours) or High
4 Dependency Areas (HDA, 14.16 hours). Patients in category A units (Table 1), for example, typically
5 have highly complex medical conditions and high intervention levels, and usually require 7.5 hours of
6 nursing care each day of their hospitalisation.

7 **TABLE 1: NURSING HOURS PER PATIENT DAY GUIDING PRINCIPLES (TWIGG & DUFFIELD, 2009)**

8 Twigg, et al. (2011) investigated the impact of the introduction of the NHpPD method on inpatient
9 complications. It was found that when the mandated NHpPD constituted an improvement in nurse staffing
10 it was associated with a decreased incidence of several inpatient complications. However, this research did
11 not specifically investigate whether mandated NHpPD matched actual nurse staffing levels (Twigg, et al.,
12 2011). The WADOH reports target NHpPD for each unit compared to actual annual average NHpPD, but
13 the comparisons are of aggregated averages which provide a much coarser estimate of attainment of
14 NHpPD target staffing levels than is possible with fortnightly payroll and daily patient movement data
15 (Government of Western Australia Department of Health, 2005, 2006, 2007, 2008).

16 The NHpPD method used in WA does not take into account the proportion of total nursing hours provided
17 by RNs or any other indicator of skill mix despite skill mix having been recognised as an important
18 indicator in the literature (Van den Heede, et al., 2007). Skill mix indicators such as proportion of hours
19 provided by novice level nurses (Benner, 1982) and agency nursing staff could provide additional insight
20 into the nursing care capacity of a unit.

21 **AIMS**

22 The aims of this study are threefold:

- 23 1) To validate fortnightly NHpPD calculations conducted using raw nursing payroll and inpatient unit
24 movements data against annual figures released by the WADOH;

- 1 2) To explore the unit-level attainment rates of the NHpPD target staffing levels on a fortnightly, as
- 2 opposed to an annual, basis; and
- 3 3) To explore whether nursing skill mix levels compensate when target NHpPD levels are not reached.

4 **METHODS**

5 The study sample comprised inpatient units at three tertiary metropolitan hospitals in WA from 1 July
6 2004 to 31 December 2008. Ethics approval was granted by the Human Research Ethics Committees of
7 The University of WA (reference: RA/4/1/2469) and the WADOH (Project #2009/56).

8 **Data sources**

9 Hospital payroll and inpatient movement data were selected to examine their feasibility as sources to
10 accurately measure fortnightly nurse staffing levels per hospital unit. The hospital payroll and inpatient
11 unit movement data used to measure nurse staffing for this project were accessible for research purposes,
12 did not incur charges, and offered the prospect of a complete, detailed, and precise staffing exposure per
13 unit per fortnight for all hospital units included in the study sample. Alternative data sources were
14 unsuitable for several reasons: the WA government only make publicly available annual average NHpPD
15 per hospital unit and does not provide information about unit-level skill mix; implementing a prospective
16 questionnaire method was not appropriate because comprehensive patient hospitalisation data was only
17 available for a historical period (up to December 2008); and, the time and financial resources required to
18 administer such a questionnaire to nurses in the study hospitals were outside the scope of the project.

19 Annually aggregated NHpPD levels reported by the WADOH do not show the fluctuations in staffing
20 levels that could be seen if the data were reported divided into shorter time periods. Therefore, fortnightly
21 nursing payroll records and inpatient unit movement data were accessed so that more detailed nurse
22 staffing measures could be calculated. Because raw data were manipulated to calculate the study's
23 fortnightly staffing measures, the results were validated against annually aggregated NHpPD levels
24 reported by the WADOH.

1 Data on hours of nursing care were sourced from nursing payroll records held by the Health Corporate
2 Network, a branch of the WADOH. Hours were averaged over fortnightly pay periods and only productive
3 hours were included (i.e. only hours spent in direct patient care). Hours worked by nurses in
4 administrative, management and education roles, and hours paid for by Health Corporate Network during
5 which direct patient care was not undertaken by the nurse were excluded, such as sick leave, workers
6 compensation, and annual and study leave. Supernumerary shifts were indistinguishable in the payroll data
7 as were education sessions not classified as study leave. The payroll data were recorded in fortnightly pay
8 periods per nurse, which were aggregated to inpatient unit groups.

9 Data on days of inpatient care were sourced from hospital patient administrative information management
10 systems. All inpatient days per unit were included; patient leave days were excluded. Time spent off unit
11 while an inpatient was indistinguishable in the patient administration management system data (e.g. when
12 a patient went to imaging for 2 hours during the day). Fortnights of unit data were excluded if there was
13 not corresponding information in both the unit movement and nurse staffing files for that fortnight.

14 **Data cleaning**

15 After preliminary data cleaning, the separate nurse staffing and inpatient unit movement files were linked
16 by matching on two variables: unit name and time period. This process was not straightforward because
17 the variables describing these characteristics were different in the two sources. The payroll data identified
18 units by cost centre descriptions and the unit movement data used different codes from the inpatient
19 information management software.

20 The accuracy of the matching process was central to creating a meaningful measure of nurse staffing. In
21 the context of these challenges, careful deliberation was undertaken prior to finalising each matching
22 decision. Probable associations were identified and confirmed by nurse managers who were familiar with
23 the cost centre descriptions in the payroll data and the codes used by the inpatient information
24 management software. The nurse managers also confirmed that nurses working on different units were
25 paid for by separate cost centres and nurses in direct patient care roles were paid from different cost

1 centres to those in management and education roles. When nurses ‘float’, their costs would usually be
2 recouped through a process resulting in all worked hours appearing next to the cost centre corresponding
3 to where the care was provided, regardless of where the nurse usually worked.

4 **Data validation**

5 Analyses were performed using IBM SPSS (Version 21, IBM SPSS Inc. 2010, Chicago, IL,
6 www.spss.com). To establish their validity, the fortnightly NHpPD estimates calculated using the nursing
7 payroll and inpatient unit movement data were compared to those published in WADOH NHpPD Annual
8 Reports. The WADOH produced five NHpPD Annual Reports during the study period which listed the
9 target staffing category and the mean NHpPD for each inpatient unit (Government of Western Australia
10 Department of Health, 2005, 2006, 2007, 2008). Linear mixed models were used to test the impact of data
11 source on estimated mean NHpPD, adjusting for financial year. The significance level was $p=0.05$ and
12 repeated measurements within each hospital and unit category were accounted for by applying an
13 unstructured covariance structure.

14 **Descriptive analysis**

15 For each unit category, counts, proportions, means, and standard deviations were used to describe NHpPD
16 and related data. Graphical representations show the proportions of NHpPD provided by RNs, beginner-
17 level nurses, and agency nurses. Beginner-level nurses included ENs and RNs with less than two years of
18 post-university working experience (Benner, 1982).

19 **RESULTS**

20 The validation analysis found no significant difference between the mean NHpPD estimated using nursing
21 payroll and inpatient unit movement data and the means reported by the WADOH ($p=0.788$). There was
22 considerable fluctuation in fortnightly-calculated NHpPD which was masked when NHpPD was reported
23 annually. Unit category was a significant factor in the mixed model, indicating that units with different
24 target category classifications did have statistically significant differences in NHpPD ($p=0.012$). There
25 was no significant difference in NHpPD between hospitals ($p=0.452$).

1 Mean versus target NHpPD per unit category are summarised in Table 2. The average census levels in
2 ICU and CCU/HDA were 13 and 11 patients respectively; the other categories had average census levels
3 between 23 and 26 patients (Table 2, column 5). Overall, units in higher NHpPD target categories met
4 their targets less frequently than units with lower targets, but units in all categories had a proportion of
5 fortnights during which staffing was below target (Table 2, column 7). CCU/HDA and A category units
6 were 11% below NHpPD target levels 58% and 49% of the time respectively. ICU and C category units
7 were approximately 7% below NHpPD target levels 22% and 16% of the time respectively.
8 Approximately 17% of the time, B category units were 5.5% below target. B+ and D category units did
9 not fall short of target by more than 4% on average.

10 **TABLE 2: NHPPD SUMMARIES PER UNIT CATEGORY**

11 Figures 1, 2, and 3 compare the skill mix levels in each unit category when NHpPD targets are met and
12 when they are not met. Measures of skill mix were greater in unit categories with the highest NHpPD
13 targets; a higher proportion of hours of care were provided by RNs (Figure 1) and a lower proportion by
14 beginners (Figure 2). When NHpPD was below target, a greater proportion of hours of care were provided
15 by RNs (Figure 1, all except category D) and beginners (Figure 2, all except ICU). Across all categories,
16 the proportion of NHpPD provided by agency staff was lower on fortnights when targets were not met
17 (Figure 3).

18 **FIGURE 1: PROPORTION OF NHPPD PROVIDED BY RNS ON FORTNIGHTS BELOW CATEGORY TARGET VS** 19 **THOSE AT OR ABOVE TARGET**

20 **FIGURE 2: PROPORTION OF NHPPD PROVIDED BY BEGINNERS ON FORTNIGHTS BELOW CATEGORY** 21 **TARGET VS THOSE AT OR ABOVE TARGET**

22 **FIGURE 3: PROPORTION OF NHPPD PROVIDED BY AGENCY STAFF ON FORTNIGHTS BELOW CATEGORY** 23 **TARGET VS THOSE AT OR ABOVE TARGET**

24 **DISCUSSION**

25 This study showed that estimates of NHpPD calculated using raw payroll and inpatient unit movement
26 data were not significantly different from those documented in the WADOH NHpPD Annual Reports

1 (Government of Western Australia Department of Health, 2005, 2006, 2007, 2008). Calculating NHpPD
2 from raw data offered two benefits over using the government reported estimates. Firstly, compared to
3 annual aggregates, fortnightly estimates of units' NHpPD are more detailed and capture varying trends in
4 staffing levels over time. Secondly, the variables recorded in nursing payroll data enable measurement of
5 skill mix, a variable not included in the WADOH reports. The validation analysis provided evidence that
6 the data cleaning and file manipulation independently undertaken for this research resulted in more
7 detailed yet analogous NHpPD estimates compared with the WADOH values.

8 Overall, units in higher NHpPD categories experienced below target staffing levels more often than units
9 with lower targets (see Table 2). Patient exposure to shortfalls in nurse staffing levels during an inpatient
10 stay has been associated with increased risk of death (Needleman, et al., 2011) and nursing sensitive
11 inpatient complications (Twigg, Gelder, & Myers, 2015). Before judgements can be made about the
12 seriousness of these shortfalls, the specific context should be considered. It may be unrealistic for staffing
13 levels to never fall below the target levels. The circumstances around which the hours are not met should
14 be taken into consideration, especially since the NHpPD staffing method does not include consideration of
15 skill mix. When NHpPD targets were not reached, skill mix was greater in some regards (i.e. greater
16 proportion of NHpPD provided by RNs, Figure 1) but not in others (i.e. greater proportion of NHpPD
17 provided by beginners, Figure 2). Even though there were more RNs, they had less experience so it is
18 difficult to infer whether skill mix characteristics made up for the NHpPD shortfall on the unit at the time.

19 In certain circumstances, it may have been appropriate that below NHpPD target staffing levels were not
20 acted upon. The shortfalls could have been demand based and a result of nurse managers adjusting staffing
21 appropriately in response to temporary decreases in patient acuity or improvements in nurse staffing skill
22 mix. The results present a mixed view of whether skill mix was better when staffing hours were below
23 target depending on the measure used. Defined as the proportion of nursing hours provided by RNs, skill
24 mix is better; RNs provided a higher proportion of NHpPD in all unit categories except D when staffing
25 targets were not met (Figure 1). Conversely, when defined as the proportion of nursing hours provided by

1 beginner level nurses, skill mix was worse; when staffing targets were not met, beginners provided a
2 higher proportion of NHpPD in all unit categories except ICU (Figure 2). The data collected for this study
3 do not enable us to deduce the magnitude of effect these skill mix differences would have when NHpPD
4 are below target.

5 If staffing does not fall far enough below the target parameters to warrant adding an additional staff
6 member, below target staffing levels may not be acted upon. Though there are thresholds for adding an
7 additional staff member when staffing falls short of a unit's NHpPD target, they do not take skill mix into
8 account; a factor that would potentially be taken into consideration by the nurse manager making staffing
9 decisions.

10 Needleman et al., (2011) measured shift-by-shift nurse staffing and flagged when staffing was 8 hours or
11 more below target. Staffing levels that fall short of target levels have been associated with increased
12 likelihood of experiencing inpatient complications (Needleman, et al., 2011; Twigg, et al., 2015).
13 Arguably, nurses' experiences of working on units and patients' experiences of being cared for may be
14 noticeably affected even if staffing levels fall short of targets by fewer than 8 hours. To illustrate this
15 point, consider units in category A, which are on average 0.85 NHpPD below NHpPD target on
16 approximately half of the fortnights during the study period (Table 2, row 4, columns 7 and 8). This
17 amount of NHpPD equates to 51 minutes of patient care time forgone by patients who have been assessed
18 as requiring 7.5 hours of nursing care per day. What amount of nursing care would a nurse usually achieve
19 in this time and what care is forfeited? Could more highly skilled nurses (i.e. maybe those with more
20 experience or education) make better decisions about what care to prioritise OR could they have more
21 advanced time management skills, enabling them to leave fewer tasks not completed compared with
22 nurses who have lower skill levels? Further research is warranted to explore how nurses make decisions
23 about prioritising care when staffing falls below adequate levels.

24 Below target NHpPD becomes problematic when supply-based shortfalls mean that staffing cannot be
25 maintained at the target level. This study indicates that agency staff were relied upon to achieve target

1 staffing levels, since higher proportions of nursing hours were provided by agency staff when NHpPD
2 targets were met or exceeded (Figure 3). But agency staff were not always available to ensure target
3 staffing levels were reached. A lower proportion of NHpPD provided by agency staff when targets were
4 not met may have been because there were insufficient agency staff available at these times.

5 **Limitations**

6 There are a number of limitations to this study. Firstly, the skill mix measures selected were constrained
7 by the availability of administrative data and potentially subject to the recording errors associated with
8 using routinely recorded data. Secondly, factors other than skill mix and hours of nursing care impact on a
9 unit's nursing care capacity, but this information is not recorded in administrative data sources and
10 measuring other factors was not within the scope of the study. Thirdly, payroll data does not capture
11 circumstances where nurses are absent from the unit if that absence does not require cost-recovery or if
12 cost-recovery is not done for some reason. Fourthly, the NHpPD method implicitly assumes that care
13 requirements of patients on a unit are homogenous; while this is unlikely it was not within the scope of
14 this project to explore how this is dealt with in practice. Finally, although WADOH reported NHpPD
15 levels were the most feasible comparator for the validation analysis, other comparators may have provided
16 a more rigorous validation baseline.

17 **CONCLUSION**

18 Presenting fortnightly, unit-level measurement of NHpPD highlights the considerable variation in staffing
19 levels that is masked in annually aggregated reports. It is feasible to calculate fortnightly NHpPD and skill
20 mix per hospital unit from raw nursing payroll and inpatient unit movement records and this would
21 provide more detail for decision-making about best nurse staffing levels for optimal patient care. In this
22 study, there was wide variation between NHpPD target categories in the proportion of fortnights that did
23 not reach target NHpPD levels, even though the degree of shortfall did not frequently reach a threshold
24 that would result in allocation of an additional staff member. However, even if a pre-determined threshold

1 was not reached, the staffing shortfall may have affected nurses' experiences of working or patients'
2 experiences of being cared for at these times.

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FIGURE 1: PROPORTION OF NHPPD PROVIDED BY RNS ON FORTNIGHTS BELOW CATEGORY TARGET VS THOSE AT OR ABOVE TARGET

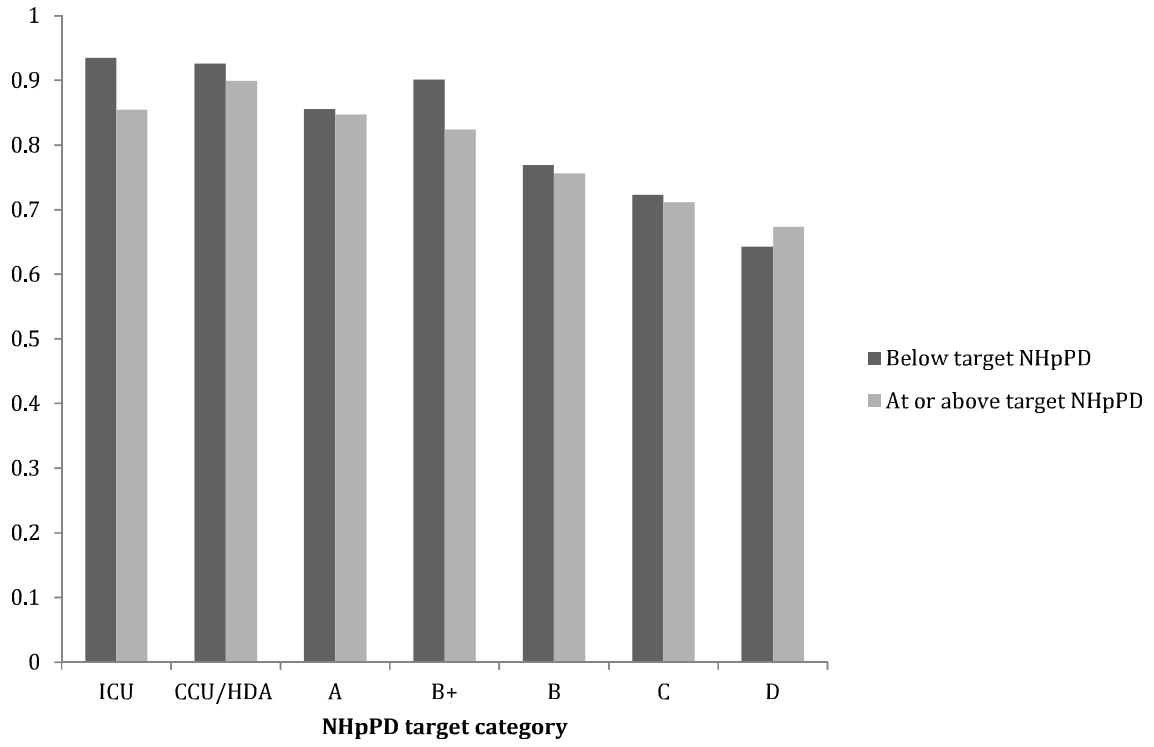


FIGURE 2: PROPORTION OF NHPPD PROVIDED BY BEGINNERS ON FORTNIGHTS BELOW CATEGORY TARGET VS THOSE AT OR ABOVE TARGET

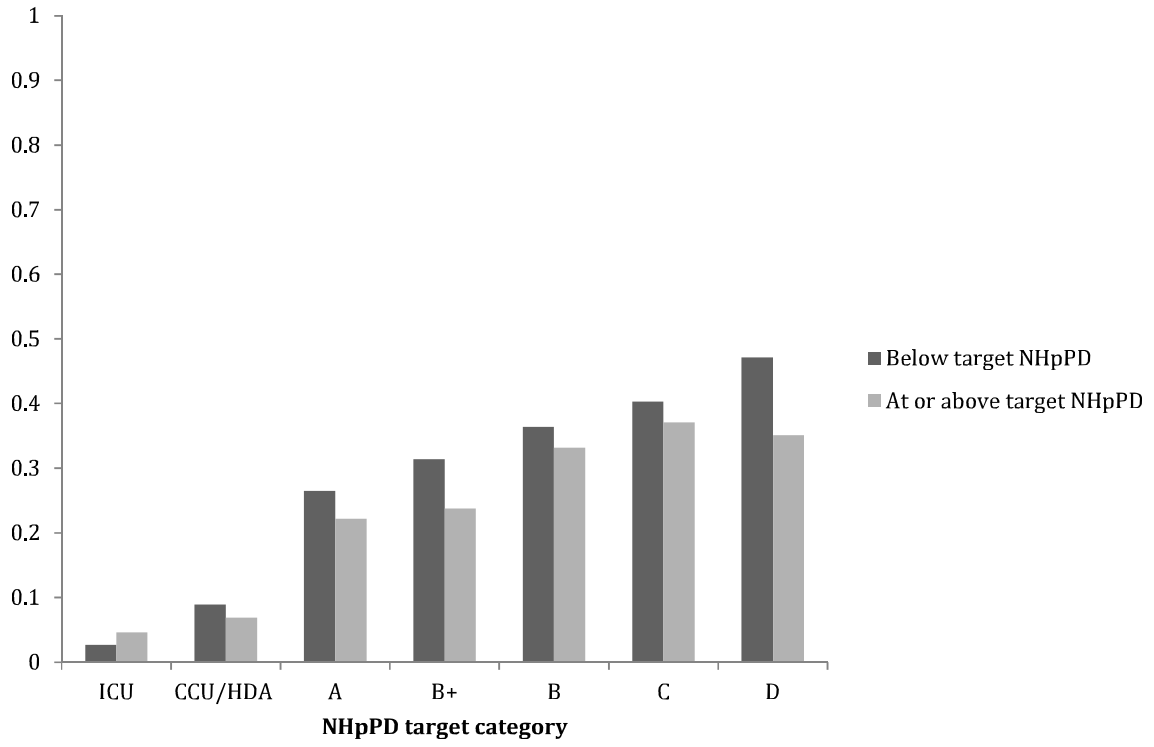
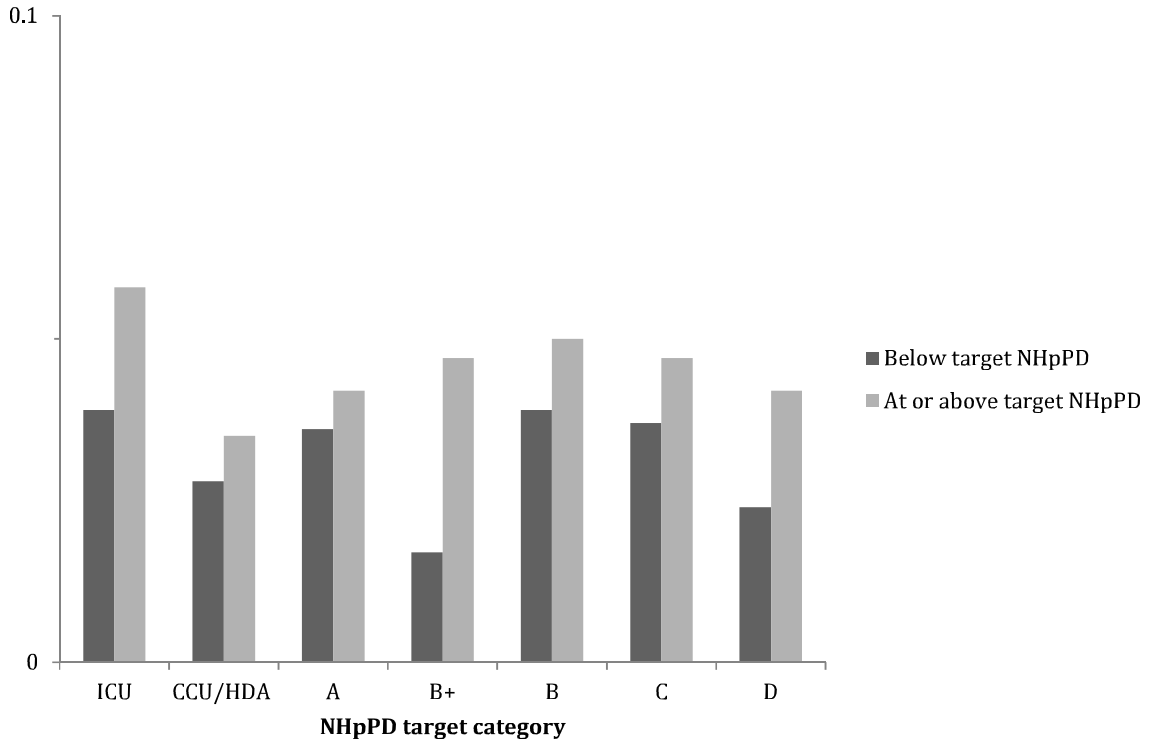


FIGURE 3: PROPORTION OF NHPPD PROVIDED BY AGENCY STAFF ON FORTNIGHTS BELOW CATEGORY TARGET VS THOSE AT OR ABOVE TARGET



Table

TABLE 1: NURSING HOURS PER PATIENT DAY GUIDING PRINCIPLES (TWIGG & DUFFIELD, 2009)

Unit category	NHppD	Criteria for measuring diversity, complexity and nursing tasks required
A	7.5	High complexity High dependency unit (6 beds within a unit) Tertiary step down Intensive Care Unit High intervention level Specialist unit, tertiary level 1:2 staffing
B	6.0	High complexity No high dependency unit Tertiary step down Coronary or Intensive Care Unit Moderate to high intervention level Special unit including Mental Health Unit High patient turnover ¹ >50%
C	5.75	High complexity Acute care unit Moderate patient turnover >35% OR Emergency patient admissions >50%
D	5.0	Moderate complexity Acute rehabilitation secondary level Acute care unit Moderate patient turnover >35% OR Emergency patients admissions >40%

¹Turnover is defined as the number of admissions, transfers and discharges divided by bed number.

TABLE 2: NHPPD SUMMARIES PER UNIT CATEGORY

NHppD¹ category	Target NHppD	Units	Fortnights with valid data²	Mean number of patients per unit	Mean NHppD (SD)	Proportion of fortnights below target	Mean NHppD below target (SD)
ICU ³	31.5	3	343	13	34.2 (4.03)	0.22	-2.11 (1.62)
CCU ⁴ /HDA ⁵	14.16	4	356	11	13.7 (2.01)	0.58	-1.52 (0.96)
A	7.5	8	847	23	7.6 (1.21)	0.49	-0.85 (0.62)
B+	6.5	2	127	25	7.9 (1.00)	0.08	-0.12 (0.07)
B	6.0	25	1,963	24	6.8 (1.03)	0.17	-0.33 (0.39)
C	5.75	16	1,253	24	6.5 (1.01)	0.16	-0.38 (0.49)
D	5	4	228	26	6.0 (0.77)	0.13	-0.22 (0.13)

¹ Nursing Hours per Patient Day

² Number of fortnights per unit ranged from 8 to 128

³ Intensive Care Unit

⁴ Coronary Care Unit

⁵ High Dependency Area