Harnessing ward level administrative data and expert knowledge to improve staffing decisions: a multi-method case study.

Citation

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ABSTRACT

Aim

To investigate the impact of changes to bed configuration and patient mix on nurses' workload in a single ward.

Design

Multi-method case study.

Method

The study was undertaken in an acute 28-bed ward in a tertiary referral public hospital in Queensland, Australia. Ward-level administrative data were obtained for a two-year period, 12 months before bed configuration changes in October 2015, and 12 months after. These data included patient activity (bed occupancy, transfers, length of stay and casemix) and nurse staffing (budgeted and actual staffing levels, employment status and skill mix). Semi-structured interviews were conducted with ward nurses (n=17) to explore the impact of the bed configuration changes on their workload.

Results

Administrative data showed that the bed configuration changes resulted in more complex and dependent patients, increased patient transfers, and greater variability in casemix. The interview data found these changes to patient complexity and activity intensified workloads, which were further increased by staffing decisions that resulted in greater reliance on temporary staff.

Conclusion

Hospitals already possess the data and expert knowledge needed to improve staffing and bed management decisions without the need for additional, costly workload systems.

Impact

Determining appropriate nurse staffing in light of the complexities and variation of patient needs at the ward level remains a challenge. This study identified increases in patient complexity, dependency, variability and churn that increased workload. Staffing grew but hidden factors associated with temporary staffing and skill mix further intensified nurses' workload. Harnessing existing data and the expertise and experience of nursing unit managers would help staff wards more efficiently and effectively, providing reasonable workloads and appropriate skill mix that can enhance the safety and quality of patient care. To facilitate this, nursing unit managers need access to accurate, timely, data, and authority in staffing and bed management decisions.

Keywords

nursing; workloads; workforce; staffing; ratios; work intensification; patient churn; diagnosis related groups; major diagnostic categories; resource intensity

Conflicts of Interest

No conflict of interest has been declared by the author(s).

INTRODUCTION

In healthcare systems worldwide, the drive for more efficient use of scarce resources has increased nurses' workloads (Needleman, 2017; Tierney, Seymour-Route, & Crawford, 2013). Nursing researchers have used hospital administrative data to demonstrate, at the most fundamental level, that the work performed by registered nurses (RNs) makes a positive difference to the quality and safety of patient care. There is now a substantial body of evidence across different health systems that managing nurses' workload, through higher staffing levels and a richer skill mix, is associated with lower rates of adverse patient outcomes such as mortality, infections and falls (Aiken et al., 2014; Aiken et al., 2017; Fagerström, Kinnunen, & Saarela, 2018; Shekelle, 2013). However, as Leary et al. (2016) argue, there is no simple relationship between nursing staff numbers or skill mix and either outcomes or costs. This is because what drives nurses' workload in each ward or unit is highly complex and variable, and these differences are masked by hospital-level analyses (Duffield et al., 2011; Duffield, Roche, Dimitrelis, Homer, & Buchan, 2015; Needleman, 2017). Duffield et al.'s (2011) analysis of ward-level administrative patient and staffing data combined with nurse surveys in 43 wards across 13 hospitals found that, even in the centralised Australian public hospital system, each and every ward had a unique set of workload challenges and staffing responses to those challenges.

Determining appropriate nurse staffing therefore requires an understanding of the specific factors that drive workload on the ward (Diers, Hendrickson, Rimar, & Donovan, 2013; Douglas, 2010; Fagerström et al., 2018). This paper builds on the multi-method 'diagnostic' approach advocated by Diers et al. (2013) that illustrates how, by using existing administrative data combined with contextual knowledge from expert nurses, staffing can more accurately reflect real workload at the ward level without the need for additional, costly workload systems.

BACKGROUND

Such is the complexity of nurses' work in the ward environment that workload measures able to predict appropriate levels of nurse staffing remain elusive (Fasoli & Haddock, 2010; Swiger, Vance, & Patrician, 2016). For each ward on every shift, the number of nurses and the knowledge and skills required varies by the nature of each patient's needs (Brennan & Daly, 2009; Fagerström et al., 2018). An aging and increasingly multi-morbid patient population means these needs are higher and more complex, with consequences for every aspect of nurses' workload (Huber, Kleinknecht-Dolf, Müller, Kugler, & Spirig, 2017; McGillis Hall & Kiesners, 2005; Swiger et al., 2016). However, the increasing complexity of patients' needs only partially accounts for the upward pressure on workloads. Bed management strategies and staffing decisions intended to improve efficiency have also increased the volume and intensity of nurses' work.

Rather than growing bed capacity to meet rising patient demand, a variety of bed management strategies have focussed on improving the efficiency of existing bed stocks through maximising throughput by reducing patients' length of stay, and making use of every available bed (Blay, Roche, Duffield, & Gallagher, 2017). Running hospitals with limited spare bed capacity means patients may be admitted to any available bed or general 'surge beds' that open and close in response to fluctuating demand, then transferred to an appropriate ward when possible (Blay, Duffield, & Gallagher, 2012). These bed management strategies have increased and intensified nurses' work, primarily through increased patient movements (described as churn; Blay, Roche, Duffield, & Gallagher, 2017; Duffield, Diers, Aisbett, & Roche, 2009), and greater variability in casemix (Diers et al., 2013).

Patient churn describes the excessive turnover of patients through a hospital ward including direct admissions to, and discharges from a ward as well as transfers between (and within) wards (Blay, Roche, Duffield, & Gallagher, 2017; Duffield et al., 2009; Hughes, Bobay, Jolly, & Suby, 2015). This has two major impacts on nursing workload. First, reducing length of stay has the effect of increasing average levels of patient acuity on the ward, intensifying the nursing care required for each episode of care (Huber et al., 2017). Second, churn creates additional work for nurses since the clinical and administrative execution of admissions, discharges and transfers is primarily a nursing responsibility. Blay et al.'s (2017) observational time study of intra-hospital transfers (i.e. not including direct admissions and discharges) found, based on a 38-hr working week, 11 full-time equivalent nurses were required each month to move patients within the study's 500-bed hospital. The significant additional and intensified workload generated by patient churn is rarely accounted for in systems that use static measures of patient volume, such as the midnight census (Duffield et al., 2009; Hughes et al., 2015; Needleman et al., 2011).

Bed management strategies that encourage the use of every available bed also impact on nursing workload by increasing the variability of casemix [Diagnosis Related Groups (DRGs)] on the ward. Casemix is used to set staffing budgets by estimating nursing resource intensity for each DRG based on the average hospital resources used by similar patients (Twigg & Duffield, 2009). There are also increasingly sophisticated patient classification systems that more accurately estimate nursing resource intensity by measuring the time spent on patients in similar DRGs based on task data entered by nurses (Fagerström et al., 2018; Twigg & Duffield, 2009). Both methods of estimating nursing resource intensity have been criticised for their focus on direct care interventions and a corresponding failure to capture the full range of indirect and non-patient care activities that comprise nursing workloads (Fasoli & Haddock, 2010; Swiger et al., 2016). A further, less examined limitation of these methods is that they do not account for any workload associated with *variability*

in casemix. A small number of studies have found cohorting of patients with similar conditions improves quality of care and decreases cost (Duffield et al., 2009), while two qualitative studies observed that nurses perceive their work to be more complex with more varied casemix due to the increasingly specialist knowledge and skills needed to appropriately care for patients (Diers et al., 2013; Holm-Petersen, Østergaard, & Andersen, 2017).

Staffing decisions made to improve efficiency in response to increased demand can, in themselves, increase and intensify nursing workload. For example the substitution of RNs with less qualified, lower paid nursing assistants is justified on efficiency grounds: to allow RNs more time to focus on more complex clinical tasks (Kleinman & Saccomano, 2006; Spilsbury et al., 2011). However, the efficiency rationale for substitution is by no means proven since both hospital and ward-level studies have associated lower skill mix with poorer patient and nurse outcomes (Aiken et al., 2017; Duffield et al., 2018; Twigg, Myers, Duffield, Giles, & Evans, 2015). Moreover, nursing assistants' lower autonomy and skills means RNs must spend more time on communication and supervision (Duffield et al., 2018; Hasson, McKenna, & Keeney, 2013; Saccomano & Pinto-Zipp, 2011). The strategy of using temporary staff (whether internal casual nurses or external agency nurses) to manage fluctuations in patient demand rather than permanently staffing spare capacity can place similar pressure on nursing workloads. No matter what their skills and experience, temporary staff rarely have the specific set of clinical and organisational knowledge needed to work independently and effectively on the ward, and therefore require the guidance and supervision of permanent ward staff (Bae, Brewer, Kelly, & Spencer, 2015; Batch & Windsor, 2015). This problem is exacerbated when temporary staff are unregulated nursing assistants rather than RNs (Roche, Friedman, Duffield, Twigg, & Cook, 2017; Twigg et al., 2016).

The combination of bed management strategies and the staffing decisions made to manage increased patient demand while improving efficiency, have produced more complex and unstable ward environments that impact on nursing workload (Duffield et al., 2015; Swiger et al., 2016). The consequences of these working conditions for nurse, system and patient outcomes are significant and have been described elsewhere (Blay, Roche, Duffield, & Lu, 2017; Duffield et al., 2011; Duffield et al., 2018).

With this background in mind, and drawing on both the foundational work of Diers and colleagues (Diers et al., 2013; Diers & Potter, 1997), and on our previous research on ward-level instability and complexity (Duffield et al., 2015), this study adopted a multifaceted approach to investigate a ward experiencing workload problems following a change to their bed configuration. The paper illustrates how the information and expertise needed to understand nurses' workload at the ward level already

exists, and highlights the necessity to harness these diverse information sources to inform staffing decisions.

THE STUDY

Aim

The aim of this study was to investigate the impact of changes to bed configuration on nurses' workload.

Design

A multi-method case study design was adopted, incorporating existing administrative staffing and patient data, augmented with semi-structured nurse interviews.

Setting

This study was undertaken in a single ward in a tertiary referral hospital in Queensland, Australia. The 28-bed ward initially consisted of 16 neurosurgical beds, 10 vascular beds and two ophthalmology beds. In October 2015 the ward profile was changed, whereby the vascular beds and two neurosurgical beds were replaced with eight trauma beds and four 'surge' beds. Subsequently, the staff budget was based on 24 beds, to be adjusted when the surge beds were occupied. In 2016, during the last six months of the data collection period, mandatory nurse-to-patient ratios were introduced (Queensland Health, 2016b), and the ward was classified to require a minimum ratio of one nurse to four patients.

Samples & Data Collection

Building on previous ward-level research in a similar context (Duffield et al., 2015), administrative data were obtained for a two-year period, 12 months before the October 2015 bed configuration changes, and 12 months after. The proprietary nature of the hospital's various commercial software packages did not facilitate access to raw data, echoing the experience of similar studies seeking to maximise the utility of existing administrative hospital data (Leary et al., 2016). Consistent with information most readily available to nursing unit managers (Peltonen, Junttila, & Salanterä, 2018), these data were drawn from separate systems in spreadsheet format.

Patient data comprised nearly 3000 patient records with Australian Refined Diagnosis Related Groups (AR-DRGs; IHPA, 2018), length of stay, emergency admission status, and time in intensive care, aggregated by date and AR-DRG. Unit data included weekly measures of 'churn' (bed occupancy, transfers, length of stay) and patient acuity indicators (transfers from the intensive care unit, and medical emergency team calls). Nurse staffing data were obtained as monthly summaries including full-time equivalent staffing budget levels, skill mix (regulated level 1 and level 2 nurses,

unregulated assistant nurses), employment status, turnover, sick leave, and the use of 'specials' (sometimes called 'sitters'; additional staff members used when a patient's physical or behavioural needs require one-to-one supervision). Data pertaining to transfers into the unit were not available across all months. Estimates were therefore created based on the available transfer, admission and discharge figures. This is an acknowledged limitation of the study.

All nurses working on the ward were invited to take part in the study, with a convenience sample taken from those available and willing to be interviewed at the times allotted: 17 nurses. Semi-structured interviews were conducted by two researchers over two days, during day, evening and night shifts to maximise opportunity for participation. Each participant was interviewed once in a confidential setting for between 30 and 45 minutes. Responses were typed into Microsoft Excel© on iPad© by the interviewers in view of the participant. In line with the approach advocated by Diers et al. (2013), and guided by the initial review of administrative data and documentation provided by the hospital, the interview guide focussed on exploring the impact of bed configuration changes on workload, to identify hidden workload and barriers to delivering quality patient care. Questions included: "Can you describe how the your patient workload was allocated?", "Can you describe how your workload might have changed in the past year?", "Thinking back over the past year, can you describe whether and how changes in patient profiles on this unit have influenced how you deliver care?", "Are you aware of any barriers or problems that you need to circumvent or deal with during a shift to deliver care?".

Analysis

Administrative data were transferred into Microsoft Excel© (v16) for analysis. The nature of the data, along with the descriptive nature of the study, meant statistical tests were not applied. Data are presented as monthly averages or totals, with ranges where relevant, before and after the changes to bed configuration. Casemix was described by grouping AR-DRGs into Major Diagnostic Categories (MDC), each of which encompasses several diagnosis groups related to a single organ system or cause (AIHW, 2018). Variation in these categories represents a significant change in casemix on the ward. Resource intensity, a component in setting the ward's staffing budget (Queensland Health, 2016a) was taken from the fourth character in the Diagnosis Related Group format, whereby the letter 'A' indicates highest resource intensity, 'B' indicates second highest resource intensity, and so on (IHPA, 2018). This provided an estimate of acuity and complexity.

A hybrid analytical approach was used for interview data that combined deductive and inductive aspects (Fereday & Muir-Cochrane, 2006; Thomas, 2006). These data were initially read several times and interrogated at a descriptive level in the light of the objectives (Charmaz, 1996). Findings therefore emerged directly from the data, framed by the research aim. Sections of text thus

identified were reviewed and patterns identified. These segments were consolidated into four themes presented alongside the administrative data to demonstrate how the changes to bed allocation impacted nurses' workload and made the ward a more difficult place on which to work. Participants' paraphrased statements or descriptors have been included to support the themes.

Validity and Reliability

Administrative data used widely in similar studies and are considered reliable indicators of case mix and staffing (Sim, Joyce-McCoach, Gordon, & Kobel, 2019). Known limitations include potential misclassification and under-reporting of diagnoses and procedures (Grosse, Boulet, Amendah, & Oyeku, 2010). In this study, data were aggregated reducing granularity. Significant restructure was required to consolidate different levels of aggregation and layout. For example, staffing data were presented with two rows per record while patient and unit data were in single row layout. Interview data were entered at interview, with respondents given opportunity to review, clarify and confirm these data.

Ethical Considerations

Administrative data were in aggregated form with no identifiable information. Participants consented to interviews, with data deidentified on collection with random codes. Quotations were paraphrased to avoid idiosyncratic, identifiable, language. Ethics approval was obtained from the hospital (HREC/16/QGC/253) and university (PRO16-455).

RESULTS

There were noticeable increases across most ward activity measures following the bed configuration changes. The 'establishment' bed number decreased from 28 to 24 beds, with 4 beds converting to surge beds. Occupancy was calculated on the bed-base of 24, and the rate was more than 100% for much of the year after the change (mean 98.6%, Table 1), suggesting frequent use of the surge beds. Occupied bed days (defined as a bed in use at any time within 24 hours) increased by an average of 20.7 per month with a wide range. Direct admissions decreased by an average of 6.2 patients per month but transfers into the ward increased by 17.2, discharges by 9.1, and transfers out by 6.3. This pattern is supported by data showing an increase in emergency cases, and a corresponding decline in elective cases. A greater range in admissions and transfers were also observed, indicating that ward activity became more volatile, a pattern consistent with the use of surge beds. Interviewees noted that there was considerable additional workload associated with transfers in and out of the surge beds, particularly lengthy and repetitive contacts with bed managers and other wards. Participants noted 'discharge and transfer planning has increased', 'admission and discharge

paperwork is lengthy', and 'there are lots of quick transfers', embodied in the theme *Discharge, Transfer and Documentation Processes Increased Workload.*

TABLE 1 WARD ACTIVITY

	Before October 2015	After October 2015
Occupancy	**Mean† (Min-Max)**	
Occupancy %	92.5% (86.0%-96.0%)	98.6% (85.0%-109.0%)
Occupied Bed Days	704.8 (592.0-811.0)	725.5 (612.0-815.0)
Length of Stay	6.1 (4.7-8.1)	6.0 (4.5-7.7)
Patient Movements	**Mean† (Min-Max)**	
Admissions	28.9 (23-33)	22.7 (14-42)
Transfers In	143.1 (118-160)	160.3 (145-186)
Transfers Out	59.5 (51-65)	65.8 (53-80)
Deaths	0.8 (0-2)	0.5 (0-2)
Discharges	107.6 (76-130)	116.7 (99-131)
Total Patient Movements	**335.9 (282-386)**	**366.0 (326-414)**
Emergency Status‡	**Total§ N (%)**	
Emergency	794 (60.8%)	950 (67.3%)
Elective	475 (36.4%)	402 (28.5%)
Unassigned	36 (2.8%)	59 (4.2%)
Total Separations	**1305**	**1411**

† *Mean of monthly data*

‡ *Separations: deaths + discharges (excludes transfers out to other units)*

§ *Total for the 12-month period*

Greater variation in the ward's patient activity is evident by examining the separations for each Major Diagnostic Category (Table 2). A substantial change was seen after October 2015, with fewer patients in the nervous system and circulatory system categories, and proportionate increases in eight other MDCs. This marked a clear reduction in patient cohorting on the ward and a much wider span of patient conditions than had been experienced previously.

TABLE 2 CASEMIX – SEPARATIONS BY MAJOR DIAGNOSTIC CATEGORY[a]

	Before Oct. 2015 Total‡ N (%)	After Oct. 2015
Diseases and disorders of the nervous system	507 (38.9%)	494 (35.0%)
Diseases and disorders of the musculoskeletal system and connective tissue	260 (19.9%)	300 (21.3%)
Diseases and disorders of the circulatory system	222 (17.0%)	15 (1.1%)
Injuries, poisoning and toxic effects of drugs	51 (3.9%)	102 (7.2%)
Diseases and disorders of the digestive system	35 (2.7%)	99 (7.0%)
Diseases and disorders of the eye	39 (3.0%)	89 (6.3%)
Endocrine, nutritional and metabolic diseases and disorders	56 (4.3%)	38 (2.7%)
Other MDCs†	27 (2.1%)	47 (3.3%)
Diseases and disorders of the respiratory system	7 (0.5%)	54 (3.8%)
Factors influencing health status and other contacts with health services	19 (1.5%)	42 (3.0%)
Diseases and disorders of the skin, subcutaneous tissue and breast	27 (2.1%)	28 (2.0%)
Diseases and disorders of the hepatobiliary system and pancreas	7 (0.5%)	41 (2.9%)
Infectious and parasitic diseases	18 (1.4%)	25 (1.8%)
Major procedures where the principal diagnosis may be associated with any MDC	19 (1.5%)	19 (1.3%)
Diseases and disorders of the ear, nose, mouth and throat	11 (0.8%)	18 (1.3%)
Total Separations	**1305**	**1411**

† *MDCs with <1% of separations for both periods*
‡ *Total for the 12-month period*

The nurses interviewed were clear that these changes in the ward's casemix had increased their workload in several ways. The surge beds were used for any patient condition and considerable nursing time was consumed in chasing up multiple medical teams for these 'outliers', as well as in communication with bed managers and other wards. The eight trauma beds had a similar impact on workload, as trauma patients had complex and diverse injuries involving a wide range of medical teams and other disciplines. The theme *Outliers and Disparate Clinical Teams Increased Workload* was reflected in statements such as 'this impacts on nursing time because nurses need to liaise with more teams, chase more doctors and teams', 'we need to persuade medical staff to see someone on a ward that is not their own', and 'we don't know all the different teams and they don't know us.'

Furthermore, while the ward had always treated neurosurgical patients with head injuries, the new focus on trauma meant there was an increase in patients with aggressive and unpredictable behaviour, and those affected by drugs and/or alcohol who required close supervision for safety. This was considered more time consuming and mentally draining than it had been with the previous case mix, themed as *Patient Mix, Acuity and Complexity Increased Workload*, explained as 'walking on eggshells', 'tiring', 'time consuming', and 'intimidating…need to second guess so as not to inflame

the situation'. These perspectives are supported by the casemix data where such patients doubled from 51 (3.9%) to 102 (7.2%).

The number of patients transferred into the ward from the intensive care unit (ICU) increased by an average of 6.4 patients per month (Table 3). Nurses commented that 'it takes a long time to get the patients sorted out when they hit the ward' and that these patients had interventions that required high levels of nursing care such as chest drains, complex wounds and patient controlled analgesia, and sometimes required four or more staff to attend to basic needs (e.g. toileting). These trauma patients were much less stable, required closer observation and were more at risk of deterioration than the vascular patients the ward had previously received from ICU: 'the complexity of trauma patients has added to the complexity of neuro patients' and 'patient needs now take more time and staff'. This was borne out in the number of calls to the Medical Emergency Team, where the monthly average increased by 8.7 (Table 3), and in the resource intensity data, where an increase in the number and proportion of high-intensity patients was seen.

TABLE 3 SEPARATIONS BY ACUITY INDICATORS AND RESOURCE INTENSITY

	Before October 2015	After October 2015
Acuity Indicators	**Mean† (Min-Max)**	
Intensive Care Transfers In	35.8 (23.0-48.0)	42.2 (29.0-54.0)
Medical Emergency Team Calls	47.4 (34-72)	56.1 (44-71)
Resource Intensity	**Total‡ N (%)**	
Highest intensity	309 (23.7%)	385 (27.3%)
Second highest	699 (53.6%)	726 (51.5%)
Third highest	231 (17.7%)	205 (14.5%)
Fourth highest	2 (0.2%)	2 (0.1%)
Other (intensity not categorised)	64 (4.9%)	93 (6.6%)

† *Mean of monthly data*
‡ *Total for the 12-month period*

Counterintuitively, nurses commented that the introduction of mandatory nurse-to-patient ratios designed to manage their workload had not remedied the increased work intensity on the ward, reflected in the theme *Staffing and Resource Issues Increased Workload*. They perceived that the ward's categorisation as an acute ward requiring a ratio of one nurse to four patients did not reflect the acuity of the patients transferring from the one-to-one care environment of the intensive care unit. Some explained that strict application of the ratio translated to no one being allocated more than four patients. This inflexible arrangement meant that there was 'no capacity to shift', making it more likely that nurses could be assigned to four very sick patients. They suggested they were 'worse off now than before the ratios'.

Moreover, nurse staffing figures (Table 4) indicate that planned staffing did not accurately predict the impact of the new bed configuration on nurses' workload. After October 2015 the ward was staffed on the basis of 24 beds rather than 28, and despite this decrease in bed numbers, the average monthly full-time equivalent budget increased slightly. This indicated that there was some prediction of the higher resource intensity with the new casemix. However, the shortfall between the planned and actual staffing was consistently higher for the whole of the post-change period because of the decision not to include the four surge beds in the ward's core staffing, and the increased need for one-to-one patient supervision. In one month, the shortfall was 28.3 full-time equivalent staff, almost double the planned budget.

TABLE 4 NURSING STAFFING CHARACTERISTICS

	Before Oct 2015	After Oct 2015
Planned v Actual Staffing	**Mean† FTE (Min-Max)**	
Planned Staffing	31.6 (25.1-35.4)	33.3 (31.5-34.1)
Actual Staffing	40.3 (31.0-46.4)	46.5 (37.6-61.7)
Difference (Planned – Actual)	-8.7 (-16.1--1.8)	-13.1 (-28.3--6.0)
Employment Status	**Mean† % FTE (Min-Max)**	
Full-time	15.5% (4.8%-22.4%)	20.5% (14.0%-28.6%)
Part-time	62.1% (55.7%-70.2%)	52.4% (42.5%-59.8%)
Internal Casual	12.5% (5.9%-21.9%)	17.6% (11.2%-24.4%)
External Agency	9.9% (5.3%-19.7%)	9.4% (3.1%-19.0%)
Skillmix‡	**Mean† % FTE (Min-Max)**	
Registered Nurses	75.1% (69.8%-83.9%)	72.5% (62.5%-79.3%)
Enrolled Nurses	17.1% (11.8%-19.9%)	14.9% (10.4%-17.6%)
Nursing Assistants	7.8% (0.3%-12.9%)	12.6% (7.4%-19.9%)
Specials	**Mean FTE† (Total§)**	
Number of 'specials'	125.7 (1132)	188.6 (1714)

† *Mean of monthly data*
‡ *Excludes external agency staff*
§ *Total for the 12-month period*

The use of temporary staff (internal casual and external agency) increased by 4.6% on average. This was not driven by turnover, which decreased over the period (mean 0.7 to 0.1 full-time equivalent per month), or sick leave, which remained stable (mean 3.5 to 3.6). Rather, interviewees noted temporary staff were a response to the bed configuration changes. The high use of the surge beds often required at least one temporary nurse each shift, while the greater demand for one-to-one patient supervision drove a 50% increase in the use of temporary staff as 'specials'. These were typically nursing assistants and therefore contributed to the dilution of skill mix. Participants noted that 'there is a significant number of specials', and 'specials are usually pool or agency staff.' The unmeasured impact of the increased number of patients needing specials was highlighted when up

to five specials were needed on the same shift. In those instances, the additional tasks of organising meal relief for the specials added considerably to nurses' workload.

The nurses interviewed perceived that the constant rotation of temporary staff with varying skill levels had added to and intensified their workload, particularly the communication and supervision they required to work safely on the ward. Interviewees also commented that temporary staff focussed on providing direct patient care, therefore permanent staff had to perform those indirect patient care activities that required continuity and organisation-specific knowledge such as discharge planning, liaising with medical staff and communicating with relatives. There was also a perception that some temporary staff lacked the specific clinical skills needed to manage the complex needs of the ward's trauma patients. Consequently, the ward staff were allocated these sicker, heavier patients, further intensifying their workload.

By combining the analysis of existing administrative data, and the perspectives of workload experts, the nurses themselves, this study was able to explain how and why the ward had become a more difficult place to work. The administrative data show that the bed configuration changes resulted in increased patient churn, more complex and dependent patients, and greater variability in casemix. The interview data show that these changes both increased and intensified workload. This was compounded by the greater demand for one-to-one patient supervision and the decision not to include the surge beds in the core staffing budget, relying instead on temporary staff to address the shortfall.

DISCUSSION

The impact of the bed configuration changes and associated staffing decisions in our case study ward highlight the continued challenge of measuring nurses' complex and dynamic workload at the *ward level* (Douglas, 2010; Duffield et al., 2015). The study shows that wards cannot stay within budget or ensure reasonable workloads when staffing decisions result in a mismatch between the supply of nursing staff and the needs of patients on the ward (Douglas, 2014; Tierney et al., 2013). The staffing budget did predict, to some extent, that the inclusion of trauma beds would increase resource-intensity. However, post-change, available data on high occupancy and patient churn was not used to revise this staffing budget to match patient demand, resulting in a greater reliance on temporary staff. The study hospital is not unusual in this regard. As Leary et al. (2016) highlight, hospitals rarely use the extensive administrative data they collect about the patients and staff on each ward to make evidence-based staffing decisions. To harness existing data, software must be employed that allow data to be extracted, analysed and interpreted in a timely manner to support

staffing decision-making (Leary et al., 2016). Further, while raw data are ideal for intensive analyses, a more pragmatic approach such as consistent levels of aggregation and reporting across datasets could be more useful for busy managers, for example, using uniform periods for aggregation (weekly/monthly). Tools that can unite disparate data sources into meaningful and readily interpretable interactive 'dashboards' or reports already exist and have been implemented in health settings (Kennedy & Tracey, 2018; Lachev & Price, 2018; Lytvyak et al., 2018). However, satisfaction with such deployments has been moderate, with challenges including incomplete or out of date data, system access, and usability (Peltonen et al., 2018). These will need to be addressed in order to facilitate effective integration into hospitals' information systems.

Nevertheless, quantitative administrative data can only ever show trends in ward activity, not their full impact on nurses' workload. In this study, the inclusion of interviews revealed the type of workload that is underestimated in hospital measures of resource intensity (Fasoli & Haddock, 2010; Swiger et al., 2016), and in the nurse-to-patient ratios intended to manage nurses' workload. Such measures assume patient volume is static and therefore render the significant workload associated with patient churn invisible (Blay, Roche, Duffield, & Gallagher, 2017; Duffield et al., 2009; Hughes et al., 2015), as was evident in the interview data. The less examined problem of standard measures failing to capture the heterogeneity of patients' needs was also evident. Greater casemix variability had imposed additional workload in communication and coordination with multiple and disparate medical teams, wards and bed managers. As Allen (2014) argues, nurses play a central role in the coordination of patients' care, particularly as an information broker for other professionals and managers across the hospital and beyond, yet this is rarely acknowledged in workload measures (Diers et al., 2013; Duffield et al., 2011). The use of temporary staff compounds this additional workload since casual and agency nurses often lack the organisational and clinical knowledge to perform these essential indirect care activities independently (Bae et al., 2015; Batch & Windsor, 2015). Additionally, in line with Batch and Windsor's (2015) findings, variable levels of knowledge and skill among temporary staff meant permanent ward nurses were allocated the more complex, dependent patients, another source of increased workload not captured by resource intensity measures.

As Douglas (2010, 2014) contends, it is hard to imagine any formula that could account for the heterogeneity of patients, medical teams, nursing staff and bed utilisation on a ward for any given shift. Yet, if an expert nurse is asked the staffing needs for a group of patients, they could give an accurate answer accounting for all of these factors, and more (Douglas, 2010). Thus evidence-based staffing decisions need to incorporate both the comparative and longitudinal trends offered by quantitative administrative data, with the perspectives of expert nurses who can contextualise that

data to provide a full picture of nursing workload at the ward level. This is consistent with the International Council of Nurses' *Position Statement on Evidence-Based Safe Nurse Staffing* (ICN, 2018) that emphasises the requirement for local assessment of staffing. The front-line nursing unit manager (NUM) is the most appropriate expert nurse both to maintain a quantitative overview of ward activity, and to contextualise its impact. Nursing unit managers are responsible for ward staffing, they create rosters and allocate patients to appropriately skilled staff to ensure safe and effective care, yet they often have limited influence over the budget they must work within (Labrague, McEnroe, Leocadio, Van Bogaert, & Cummings, 2018; Scott & Timmons, 2017). Moreover, despite being core to the NUM role, healthcare organisations rarely provide adequate training in how to interpret the administrative data needed to manage staffing budgets effectively (Shirey, McDaniel, Ebright, Fisher, & Doebbeling, 2010; Townsend, Wilkinson, Bamber, & Allan, 2012). Nursing unit managers therefore require access to administrative data, the skills to use and interpret it, and a greater voice in budget decisions to advocate effectively for staffing that reflects the real workload of ward nurses (Douglas, 2010; Tierney et al., 2013). This includes the ability to negotiate increases to nurse-to-patient ratios if, as in this study, the minimum standard set by industrial arbitration is not adequate for the ward's activity. They must be supported by visible nurse executives who can advocate for the decisions of ward nurses and nursing unit managers (Duffield, Kearin, Johnston, & Leonard, 2007).

However, empowering nursing unit managers to negotiate appropriate resources for the staff and patients on their ward does not address the underlying mechanisms that are constantly driving nursing workloads upwards. Bed management decisions aimed at improving efficiency, such as surge beds and maximising bed occupancy, are often made by those who spend the least time with patients (Scott & Timmons, 2017). Consequently, 'efficiency' is defined in a way that treats the increase and intensification of nurses' workload as externalities, especially when it is the type of workload invisible to hospital resource intensity measures. Nursing unit managers therefore also need a greater voice in bed management decisions, so that the ward-level costs of patient churn and casemix variability are properly accounted for, making safe and quality healthcare more sustainable in the long term. This necessitates positive organisational cultures, for example those embodied in Magnet hospitals (Kelly, McHugh, & Aiken, 2011). Key features include visible nursing leadership, a nursing voice in the hospital executive, and nurses' participation in decision making at all levels (Aiken et al., 2014; Swiger et al., 2017; Wei, Sewell, Woody, & Rose, 2018).

Limitations

This study highlights the importance of merging contextual knowledge with administrative data to improve staffing decisions, and as such, makes no claims regarding generalisability. Data were

available only in aggregated form, were inconsistent in layout, and were incomplete, necessitating preparatory data manipulation and the estimation of some monthly figures.

CONCLUSION

As Diers et al. (2013) note, it is essential to use nurses' lived experience alongside data mining and analysis techniques in order to understand and address nursing unit workload. This ward-level, context-specific approach is not limited to a specific country or hospital type. Although information systems may vary, hospitals worldwide already possess sufficient data and the expert nursing knowledge needed to make better staffing and bed management decisions, to ensure reasonable workloads, and more sustainable healthcare, without the need for additional, costly workload systems. To do this hospital managers must empower their front-line nursing unit managers with the access and skills needed to use existing administrative data on their patients and staff, and harness their expert knowledge on the complex, and often hidden drivers of nursing workload at the ward level.

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