Instability in patient and nurse characteristics, unit complexity and patient and system outcomes.

ABSTRACT

Aims

To explore key factors related to nursing unit instablity, complexity and patient and system outcomes.

Background

The relationship between nurse staffing and quality of patient outcomes is well known. Nursing unit is an important but different aspect that links to complexity and to system and patient outcomes. The relationship between the instability, complexity and outcomes needs further exploration.

Design

Descriptive

Methods

Data were collected via a nurse survey, unit profile and review of patient records on 62 nursing units (wards) across 3 states of Australia between 2008 and 2010. Two units with contrasting levels of patient and nurse instability, and negative system and patient outcomes, were profiled in detail from the larger sample.

Results

Ward A presented with greater patient stability (low occupancy, high planned admissions, few ICU transfers, fewer changes to patient acuity/work re-sequencing) and greater nurse instability (nurses changing units, fewer full-time staff, more temporary/casual staff) impacting system outcomes negatively (high staff turnover). In contrast, Ward B had greater patient instability however more nurse stability (greater experienced and permanent staff, fewer casuals), resulting in high rates for falls, medication errors and other adverse patient outcomes with lower rates for system outcomes (lower intention to leave).

Conclusion

Instability in patient and nurse factors can contribute to ward complexity with potentially negative patient outcomes. The findings highlight the variation of many aspects of the system in which nurses work, and the importance of nursing unit managers and senior nurse executives in managing ward complexity.

SUMMARY STATEMENT

Why is this research or review needed?

- The relationship between nurse staffing and quality of patient outcomes is well established.

- The relationship between unit instability and complexity requires more attention given the pressure it places on nurse unit managers to ensure patient safety.

- No two units present with the same level of patient and nurse stability, hence it is vital to understand the extent of variability to determine the complexity of the nurse unit manager role.

What are the key findings?

- Providing safe patient care is very complex, unpredictable, and subject to a range of nurse, patient and system factors.

- There is considerable variation in units, both unit stability and complexity, due to differences in patient and nurse characteristics.

- Unit complexity, determined largely by patient and nurse instability is associated with negative patient outcomes and system outcomes.

How should the findings be used to influence policy/practice/research/education?

- The extent of unit instability and complexity should not be understated due to the potentially negative effect on patient and system outcomes.

- The role of nurse educators and other ward supports are potentially important.

- Nursing unit managers with the knowledge and skills to manage unit complexity to ensure patient safety play a central role.

Keywords

Instability in patient and nurse characteristics, unit complexity, and patient and system outcomes

INTRODUCTION

There is now a robust body of evidence internationally about the relationship between nurse staffing (the number and proportion of registered nurses) and the quality of patient outcomes (Duffield et al. 2011a, Needleman et al. 2011, Rafferty et al. 2007), including several systematic reviews (Kane et al. 2007, Lankshear et al. 2005). Some of this work has been conducted at the nursing unit (ward) level and has concluded that instability in nurse and/or patient characteristics are major factors which increase unit complexity and as a consequence, may impact negatively on patient outcomes (Duffield et al. 2009a, Duffield et al. 2009b, Dawson et al. 2014). Adams and Bond (2003) argue that greater stability provides opportunities for nurses to develop their practice and that patients should benefit from better quality care. Instability on the other hand, may lead to *complexity compression*, a concept defined as "what nurses experience when expected to assume additional, unplanned responsibilities while simultaneously conducting their multiple responsibilities in a condensed time frame" (Krichbaum et al. 2007, pg. 86), and may have implications for missed care.

This paper uses the Patient Care Delivery Model (PCDM) (O'Brien-Pallas et al. 2002, Irvine and Evans 1995) to illustrate the association between instability in nurse and patient characteristics, and patient and system outcomes. The complexity of the unit, which is largely determined by the instability of nurse, patient and system characteristics (Krichbaum et al. 2007), has been linked to specific patient outcomes such as falls, medication errors and other negative outcomes, together with system outcomes such as tasks delayed or not completed, absenteeism, and turnover intent (Duffield 2007, Duffield et al. 2011a). In order to illustrate and explore pertinent inputs and outcomes, two nursing units have been selected as exemplars on the basis of contrasting levels of instability and rates of falls, medication errors and other adverse patient outcomes.

Background

Theoretical Framework - Patient Care Delivery Model

The PCDM guides exploration of the relationships between system, nurse and environmental factors that influence variability in nursing work (Meyer et al. 2009) and therefore, system and patient outcomes. The PCDM includes input factors (e.g. characteristics of patients, nurses and system behaviours) and throughput factors (e.g. changes to patients' conditions and nursing activities), which influence or transform output factors (patient, nurse and system outcomes) (Meyer et al. 2009, O'Brien-Pallas et al. 2011, O'Brien-Pallas et al. 2002).

The PCDM framework is based on systems theory and the outcomes therefore feed back to the inputs (Jelinek 1967, Jelinek 1969).

There are several patient, nurse and system characteristics (inputs and throughputs) in the PCDM that have been identified as contributing to increased unpredictability of patients' care needs, increasing instability and contributing to ward complexity. These include unanticipated delays and resequencing of work due to changes in patient acuity (O'Brien-Pallas et al. 1997, Duffield et al. 2011c, Thompson et al. 2008); the size of the unit (Bacon and Mark 2009); patient throughput (Duffield et al. 2011a, Duffield et al. 2009a); occupancy rate (Blay et al. 2012); proportion of planned admissions (Brailsford et al. 2004); proportion of hours of care provided by registered nurses [skill mix] (Duffield et al. 2011a, Roche et al. 2012); and transfers from intensive care units (Twigg and Duffield 2009). These factors in turn can potentially impact patient outcomes. For example increased patient throughput increases the workload of nurses (Schilling et al. 2010, Duffield et al. 2009a) and challenges continuity of patient care (Kanak et al. 2008) increasing the risk of adverse events (Blay et al. 2012, Hendrich and Lee 2004). It increases medication errors (Boockvar et al. 2009), medication delays (Stolte et al. 2006), patient falls (Kanak et al. 2008) and spread of infection (Cunningham et al. 2006). Resequencing brought on by unanticipated changes in the nurses' shift increases complexity as it requires additional time and energy, which is not the case with routine work (O'Brien-Pallas et al. 1997, O'Brien-Pallas et al. 2011, Thompson et al. 2008). Roche et al. (2010) found that when there were more unanticipated changes in patient acuity, nurses experienced more emotional abuse by patients on the ward, which affected their work satisfaction. The workload of nursing unit managers is also increased (Duffield et al. 2009a) as they manage a less predictable (unstable) ward environment.

Staffing characteristics are widely investigated and have been identified as contributing to instability in the ward. A high proportion of nurses who are not working on their usual ward may disrupt continuity of care (Cabana and Jee 2004), which is linked to adverse patient events (Siow et al. 2012). Temporary, agency or bank (casual) staff are generally unfamiliar with the culture and practices on the ward, adding to nurses' workload and contributing to adverse patient outcomes (Duffield et al. 2009b). Managers must provide greater supervision and communication with non-regular staff to ensure all nursing tasks are completed (Duffield et al. 2009a). Staffing levels (number) and skill mix (proportion of registered nurses) have been implicated in tasks left undone (Ball et al. 2013, Duffield et al. 2011a) which can result in adverse patient outcomes. Other factors linked to instability in the workplace include the number of vacancies and actual or expected forced nurse transfers (O'Brien-Pallas et al. 2006, O'Brien-Pallas et al. 2010); nurse experience (O'Brien-Pallas et al. 2010, Duffield et al. 2011a); qualifications (Aiken et al. 2014); and the proportion of full-time staff (O'Brien-Pallas et al. 2010, Duffield et al. 2011a). Similar to many of the patient characteristics described above, these factors have been associated with adverse patient outcomes along with system outcomes such as tasks left undone and increased overtime (Duffield et al. 2011a). Further, nurses on unstable units are also more likely to disengage from work tasks (Laschinger and Leiter 2006) and to take more sick leave (Havig et al. 2011). Both

turnover intent and turnover rates also increase when the unit is unstable (Havig et al. 2011, O'Brien-Pallas et al. 2010).

THE STUDY

Aims

The aim of the study was to explore key factors in nursing unit instability (nurse, patient and system characteristics), complexity, and the potential link with patient (falls, medication errors, adverse patient events) and system outcomes (tasks delayed/not completed, absenteeism, turnover intent).

Design

A descriptive design, profiling two contrasting wards (nursing units), was used to highlight the complexity and variability of the system in which nurses and their managers work. It is part of a larger study that has described the rates and costs of nursing turnover in Australia (Roche et al. 2014, Duffield et al. 2014), and explored nurses' views of turnover (Dawson et al. 2014).

Sample

Data were collected on 62 randomly selected wards in 11 public acute care hospitals across three Australian states from September 2008 to August 2010. Medical, surgical and mixed medical/surgical units were included in the study. Data were collected from each ward in two 3-month 'waves', 12 months apart. The two wards selected for this paper were chosen from the larger sample on the basis of the rates of adverse patient and system outcomes observed on each, and on the level of instability measured by patient and nurse factors (Table 1, Table 2). Ward A reported adverse outcomes in the lowest 5% of units, negative system outcomes and unstable nurse factors (high vacancy rate, high temporary contracts). In comparison, Ward B reported a high rate of negative patient outcomes (in the highest 5% of wards), with unstable patient factors (high critical care stays, high unanticipated changes) but stable nurse factors. This dissimilarity provided the opportunity to offer insight into the factors that may contribute to ward instability and as a consequence, increase ward complexity and impact patient outcomes.

TABLE 1 HERE

Data Collection

All nurses on each ward were asked to complete the nurse survey during each 3-month wave, with an overall response rate of 44.4% (n=1673) across the 62 wards. Patient outcomes were collected from the medical record, weekly during each of the study waves, with over 5000 records being audited. The unit profile

incorporated data related to the system and environment and was completed on all wards with the assistance of the unit manager or hospital administration (see Table 2).

Instruments

The nurse survey was adapted from previous research in Australia (Duffield et al. 2011a) and captured nurse and system inputs and outputs as described in the PCDM (Table 2). Data included nurse qualifications, experience, employment status, absenteeism, turnover intention, the number of tasks delayed or not completed on the nurse's most recent shift, and the nurse's perception of the quality of care on the unit. The nurse survey also included the widely-employed Practice Environment Scale (PES) (Lake 2002), that measures specific factors in the practice environment such as nurse-doctor relationships, staffing adequacy and nursing leadership, and also provides the composite scale reported here, which provides an overall estimate of the environment on a scale of 1-4, with higher values indicating a more positive environment. The survey also incorporated the Environmental Complexity Scale (ECS) (O'Brien-Pallas et al. 1997, O'Brien-Pallas et al. 2005), a 25 item tool that measures the tensions that nurses experience in their daily work as a consequence of *re-sequencing of work* or *unanticipated changes in patient acuity*. These subscales are scored on 0-10 scale with values over 5 indicating a negative impact of the factor, and higher values demonstrating greater impact. Unit characteristics such as bed numbers, support services, occupancy, turnover and vacancies were collected on the unit profile. Trained data collectors collected falls, medication errors and patient adverse outcome data from the patient record. Negative patient outcomes were derived from un-coded medical records with strict criteria that the outcome was confirmed by laboratory or other test, was first diagnosed 24 or more hours after admission, and was not present on admission. These outcomes included urinary tract infection [UTI], pneumonia, wound infection, deep vein thrombosis [DVT], decubitus ulcer, shock and gastrointestinal [GI] bleed (Needleman et al. 2011, Needleman et al. 2002, Needleman 2001). They are reported here as a composite: *the presence of any of these outcomes* (Table 2).

Validity and Reliability

The internal consistency of the ECS subscales *re-sequencing of work* and *unanticipated changes in patient acuity* were adequate with Cronbach's alphas of 0.74 and 0.85 respectively. The overall PES alpha was high at 0.94. Although rates of other patient outcomes were derived from un-coded medical records, the criteria described above were stringently adhered to, and the rates across the sample wards were similar to those found in previous Australian research that used administrative data (Duffield et al. 2011, Roche et al. 2012).

TABLE 2 HERE

Data Analysis

The intention here is to provide a description of two units to highlight the complexity and variation of aspects of the system in which nurses and their managers work. Therefore, no statistical comparisons are made between the units being studied. Nurse survey and patient outcome data were aggregated to the unit level and added to the profile data. They are presented as mean values, percentages per unit, or as full-time equivalent positions. The corresponding value across all 62 nursing units is included so as to provide a comparison to the overall sample. Results are presented in accordance with the structure of the conceptual model.

Ethical Considerations

The nursing survey was voluntary and anonymous, and coded only by unit to permit aggregation to the ward level. Both the unit profile and patient data were coded only by unit. The study was approved by seven Human Research Ethics Committees, representing the participating hospitals and the university.

RESULTS

Both wards were mixed medical and rehabilitation units; Ward A with 20 beds and Ward B with 26. The average age of patients on both wards was approximately 60. Occupancy on Ward B was 97.1%, with Ward A notably different at 73.7% (Table 3). Both wards A and B had very high planned admission rates relative to the overall sample. No patients on Ward A experienced a critical care stay compared to one-sixth of those on Ward B. There were substantial differences across the wards in regard to unit instability, with 71.4% of nurses on Ward A indicating that they had been forced to, or were anticipating being forced to, change units during the preceding or next 12 months. This compared to 41% of nurses on Ward B, similar to the overall percentage. A much higher proportion of nurses on Ward B worked long hours; nearly double the percentage of the overall sample. There were also differences in the number of vacancies carried on the wards, with 3.5 vacant positions on Ward A and half that on Ward B.

TABLE 3 HERE

Skill mix (RN%) was rich on both wards at greater than 80%, although Ward A reported a higher percentage than Ward B, and than the overall sample. There were differences in both the level of experience and in qualifications; with Ward A having a greater proportion of bachelor degree qualified nurses and Ward B having a more experienced workforce. The wards were the inverse of each other in relation to the percentage of full time staff, although in both cases it was an approximate 50/50 split. The majority of nurses across the entire

sample were employed on permanent contracts, with Ward A notably different with greater than one-fifth in temporary positions and 10% casual staff. In terms of additional senior supportive nursing positions Ward A had a full time nurse educator and Ward B a half-time clinical nurse consultant (senior specialist nurse approximately equivalent to a clinical nurse specialist in the United States).

The nursing practice environment is positive on both wards, with Ward A reporting an overall PES score higher than is often reported in the literature (Warshawsky & Havens 2011). However, there is a contrast in relation to the two environmental complexity factors. Ward A scores closer to the *neutral* value of 5 in both of the reported subscales of the ECS, while on Ward B the negative impact of unanticipated changes in patient acuity and in the re-sequencing of work in response to others is higher than the overall average.

In regard to system outcomes, a high quality of care was reported by approximately one-third of nurses on both wards, and they were also generally alike in regard to turnover intent and the percentage of nurses looking for a new job. However, nurses reported delaying an average of twice as many tasks on Ward B relative to Ward A, although the mean number of tasks not completed was very low in both cases. Ward A had a very high staff turnover rate (66.9%) relative to all other wards and to Ward B. Absenteeism, defined as absence from work on 6 or more shifts in the last 12 months, also varied substantially with nurses on Ward B reporting approximately 3 times the rate of those on Ward A.

In regard to patient outcomes, one of the criteria by which these exemplars were chosen, the contrast is stark. Ward B had more than 18% of patients experience a fall during the sample period, while Ward A had 1.3%, lower than the average figure. Similarly, half the patients on Ward B experienced a medication error and none on Ward A, relative to one-fifth overall. Approximately one-quarter of patients on Ward B experienced an adverse outcome, 3 times the average, with none of these events on Ward A.

In summary, patient characteristics (inputs) on Ward A indicate greater patient stability (low occupancy, many planned admissions, few ICU transfers, less changes to patient acuity/work re-sequencing) than in Ward B (Table 3). However, nurse characteristics (inputs) paint a different picture. Instability is displayed in a very high proportion of nurses having had to, or expecting to, change units; fewer full-time staff; and high percentages of temporary and casual staff. The stability in patient input factors but high instability in nursing input factors appears to have some relationship to outputs, in particular with system outcomes. There is very high staff turnover, and while the number of staff intending to leave/looking for a job sits around the mean for all wards, this is still relatively high at over 20%.

Conversely, Ward B has more instability in patient input factors (high occupancy and ICU admissions, higher unanticipated changes in patient acuity and re-sequencing of work) and more stability in nurse input factors such as experienced, permanent staff and no casual nurses. Unit instability is only slightly above the mean and the ward carries fewer than average vacancies. However it has very high rates for falls, medication errors and other adverse patient outcomes. This contrasts with relatively low rates for system outcomes: approximately average nurse turnover and lower than average intention to leave/looking for a job, albeit with a very high rate of absenteeism.

DISCUSSION

The premise for this study was that instability in nurse and/or patient input factors increases ward complexity, with a negative impact on outputs – patient and system outcomes. These results illustrate the intricate relationships between the various input characteristics (nurse, patient and system) and highlight the association they have with serious patient adverse outcomes such as falls and medication errors, and with negative system outcomes like tasks left undone, absenteeism, and turnover intent and rate. These exemplars demonstrate the challenges of managing a ward to ensure positive patient and system outcomes. On the surface it appears that there is a potential choice between instability in patient inputs and negative patient outcomes, or instability in nurse inputs and negative system outputs. However, it would be more correct to state that broadly, greater instability of **either** patient or nurse input factors increases complexity and is linked to adverse outcomes for **either** patients or the system. The interplay between these factors and the potentially serious consequences that may arise cannot be understated.

The findings also demonstrate that a wide variation in patient and nurse characteristics exist across wards but in combination, can impact stability. Systematic approaches to reduce these aspects of instability may have considerable benefit for patients and the system. One of the most critical functions of the nursing unit manager is ensuring that unit staffing is appropriate to ensure safe patient care. No matter how well planned staffing may be for a shift, day, or week there are patient and nurse factors on the ward which when unstable, increase unit complexity. This in turn can result in constantly changing nursing work which adds to what Solomon et al. (2011) define as the complexity of care. Managing this complexity requires great skill and competence. It also requires access to data such as has been used in this analysis. Although factors such as bed occupancy, the percentage of planned admissions, and critical care stays are unlikely to be able to be readily addressed by the nursing unit manager, other aspects of instability such as extended work hours and the number of vacancies carried by a unit, may be within a manager's remit. Of particular importance for nursing unit managers is their role in ensuring a positive work environment given its link to improved job satisfaction, and decreased intention to leave (Duffield et al. 2011c), thereby improving staff stability and perhaps more importantly, improved patient outcomes (Flynn et al. 2010, Aiken et al. 2008).

An important factor evident in these exemplars is the presence of senior clinical nursing support. Both wards had some support of this type. However, perhaps crucially, the support available on Ward A was full time - double that of Ward B. However, Ward A, with considerable nursing instability, displayed low rates of negative patient outcomes. This corresponds with previous research that found a relationship between senior support and improved patient outcomes (Duffield et al. 2011a). The presence of full time senior nursing support may be the defining characteristic in explaining the contrast between these wards. Both positions described in this study (nurse educator and clinical nurse consultant) are likely to provide significant experience and knowledge to a less experienced workforce, but the nature of each role may also be a factor, with the role of a nurse educator being different to that of a clinical nurse consultant, for whom education is only part of their function (Roche et al. 2013). Regardless, the role of these positions in patient outcomes deserves further investigation.

Also critically important is the role of senior nurse executives not only in being 'visible', a significant factor in retention (Duffield et al. 2011c) but perhaps more importantly, in the allocation of sufficient and appropriate human and financial resources to meet the specific needs of each clinical unit. There is a worrying trend to decrease the number of senior nurse positions and their influence. There are significant rates of turnover in these positions adding to organisational instability with adverse effects on staff morale and patient care (Duffield et al. 2011b). The influence of the senior nurse executive role in the outcomes and level of stability/instability observed in the present study can therefore not be understated and should be explored further.

Limitations

This paper is descriptive and provides exemplars that highlight the issues of instability and complexity. It makes no claims regarding generalizability and should be viewed in that light. Several data elements not captured here would have permitted more detail in the comparisons, and perhaps further guided the selection of units. In particular, a larger range of patient characteristics such as formal diagnosis and comorbidities would have offered a stronger understanding of the casemix of the units and potentially of patient outcomes. Unfortunately these data were not available to the study.

CONCLUSION

In summary, the findings in this study probably confirm what most nurses know and understand – *a ward is not a ward is not a ward* – and providing safe patient care is very complex, unpredictable, and subject to a range of factors. Importantly many of the patient and staff input factors over which nurses may have little control, increase ward instability and therefore complexity, and can have negative financial and human

consequences. However this may not be the message that many non-nurses understand. The role of senior nurse executives in disseminating this message cannot be understated, nor can the importance of having a *nursing* unit manager, with the knowledge and skills to manage complexity, responsible for ward staffing. Both senior nurse executives and nursing unit managers must also acknowledge the value of ward-based nurse educators. Nursing unit manager and senior nurse executive positions must be retained and greater autonomy and authority afforded to these roles.

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Table 1 Summary of Exemplar Wards: Nurse/Patient Factors and Outcomes

	Ward A	Ward B
Patient Factors	Stable	Unstable
	- no critical care stays	- high critical care stays
	- average unanticipated changes	- high unanticipated changes
Nurse Factors	Unstable	Stable
	- high vacancies	- low vacancies
	- high temporary contracts	- no casual staff
	- high forced unit changes	- average forced unit changes
Outcomes (rank*)	Low rate of negative patient outcomes	High rate of negative patient outcomes
	- no medication errors (62)	- high medication errors (1)
	- low falls (50)	- high falls (1)
	- no adverse outcomes (62)	- high adverse outcomes (1)
	High rate of negative system outcomes	Low rate of negative system outcomes
	- high turnover (2)	- average turnover (28)
	- low absenteeism (54)	- high absenteeism (15)

* Overall rank for this patient or system outcome

Table 2 Key Variables (adapted from the Patient Care Delivery Model (O'Brien-Pallas et al 2002; 2010))

Item/Variable	Details (Mean per ward, % per ward, full-time equivalent [FTE] per ward)	Source
INPUTS		
System Characteristics & Behaviours		
Beds	Number of beds on the unit	UP
Occupancy	Number of patients on the ward divided by number of beds (as a %)	UP
Planned admissions	Percentage of patients with a planned admission	UP
Any critical care stay	Percentage of patients with a critical care stay	UP
Nurse educator	Nurse educator position attached to this ward (as FTE)	UP
Clinical nurse consultant	Clinical nurse consultant (senior specialist nurse) attached to this ward (as FTE)	UP
Nurses working on their usual ward	Percentage of nurses who worked last shift on their usual ward	NS
Worked >40 hours last week	Percentage of nurses who worked more than 40 hours on this ward in the past week	NS
Worked >10 hours unpaid last week	Percentage of nurses who worked more than 10 hours unpaid overtime in the past week	NS
Unit instability	Percentage of nurses who were (or anticipate being) forced to change wards	NS
Vacancies	Number of vacant positions (as FTE)	UP
Nurse Characteristics		
Registered nurses	Percentage of registered nurses per ward	NS
Bachelor degree or higher	Percentage of nurses with a baccalaureate or higher	NS
Years worked as a nurse	Mean years of experience as a nurse	NS
Years worked in this hospital	Mean years of experience as a nurse in the current hospital	NS
Full time	Percentage of full time nurses	NS
Temporary	Percentage of nurses employed on a temporary contract	NS
Casual	Percentage of nurses employed as a casual/pool/bank nurse	NS
THROUGHPUTS		
Environmental Factors		
Unanticipated changes in patient acuity	ECS subscale e.g. urgent tests, extra vital signs, greater demand for psychosocial support for patient (*scores >5 indicate a stronger negative influence*)	UP
Re-sequencing of work in response to others	ECS subscale e.g. clarifying doctor's orders, medication, supplies or drug keys missing (*scores >5 indicate a stronger negative influence*)	UP
Practice environment	PES composite score (*higher scores = positive environment; range 1-4*)	NS
OUTPUTS		
System Outcomes		
Quality of care	Percentage of nurses who reported good or excellent patient care last shift	NS
Tasks delayed	Mean number of nursing care tasks delayed last shift	NS
Tasks not done	Mean number of nursing care tasks left undone at the end of last shift	NS
Absenteeism	Percentage of nurses who missed 6 or more shifts in the past year due to illness	NS
Intent to leave	Percentage of nurses intending to leave their current nursing position within the next year	NS
Actively looking for a new job	Percentage of nurses who were actively looking for a new nursing position	NS
Annual turnover	Full time equivalent terminations (voluntary transfer or resignation of nursing staff from their primary employment position) divided by budgeted full time equivalent positions (as a %)	UP
Patient Outcomes		
Falls	Percentage of patients with a fall recorded in the patient record	MR
Medication Errors	Percentage of patients with a medication error recorded in the patient record	MR
Adverse Patient Outcomes	Percentage of patients with any of the following diagnosed (e.g. via laboratory results), 24 or more hours after admission and not present on admission: UTI, pneumonia, wound infection, DVT, decubitus ulcer, shock or GI bleed	MR

Note: ECS: Environmental Complexity Scale (O'Brien-Pallas, et al 2002); PES: Practice Environment Scale (Lake, 2002); UP: Unit Profile; NS: Nurse Survey; MR: Medical Record.

Table 3 Exemplar Wards & Overall Sample

	Ward A	Ward B	Total Sample
INPUTS			
System Characteristics & Behaviours			
Beds	20	26	27.1
Occupancy (%)	73.7	97.1	95.7
Planned admissions (%)	98.8	98.6	34.2
Any critical care stay (%)	0	17.1	15.0
Nurse educator (FTE)	1.0	0	0
Clinical nurse consultant (FTE)	0	0.5	0.5
Nurses working on their usual ward (%)	90.0	97.5	93.5
Worked >40 hours last week (%)	12.5	24.9	14.2
Worked >10 hours unpaid last week (%)	10.0	7.9	4.5
Unit instability (%)	71.4	41.7	37.7
Vacancies (FTE)	3.5	1.8	2.4
Nurse Characteristics			
Registered nurses (%)	90.0	83.7	80.7
Nurses with Bachelor degree or higher (%)	35.0	28.1	51.6
Years worked as a nurse	11.2	14.7	9.3
Years worked in this hospital	5.4	4.0	4.1
Full time (%)	45.0	54.0	59.8
Temporary (%)	22.5	8.4	9.5
Casual (%)	10.0	0	5.9
THROUGHPUTS			
Environmental Factors			
Unanticipated changes in patient acuity	5.4	6.4	6.2
Re-sequencing of work	5.5	6.1	5.7
Practice environment	3.0	2.8	2.8
OUPUTS			
System Outcomes			
Quality of care (%)	32.5	28.8	14.2
Tasks delayed	1.8	3.5	3.5
Tasks not done	0.3	0	0.5
Absenteeism (%)	12.5	35.6	26.2
Intent to leave (%)	20.0	17.0	23.7
Actively looking for a new job (%)	22.5	19.3	21.0
Annual turnover (%)	66.9	15.0	16.4
Patient Outcomes			
Falls (%)	1.3	18.3	5.0
Medication Errors (%)	0	50.0	19.9
Adverse Patient Outcomes (%)	0	26.4	7.9