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Churn: Patient Turnover And Case Mix

Executive Summary

- Patient throughput and casemix changes on nursing wards are little understood aspects of nursing's responsibility for nursing wards/units as hospital operations.
- In this study, the movement of patients on and off wards in 27 Australian public hospitals (286 wards) were analyzed over a 5-year period. Casemix change at the nursing unit level was also examined.
- In the data here, medical/surgical patients moved on average more than twice in an average hospital stay of only about 4 days.
- The absence of ward-level metrics compromises the ability of nursing unit/ward managers to meet their own efficiency and quality standards.
- Measurements of churn would give nurses another way to talk about the work of nursing to senior management and would give nurse executives a way to describe hospital operations and throughput and the impact on staff, patients, and resource allocation.

THE MIDNIGHT CENSUS has long been the metric for measuring hospital bed use and thus nursing resources needed. As hospitals worldwide strive to become more efficient and use all available beds to capacity, arguments are being made to treat a bed as a bed and a patient as a patient, as hotels treat guests (Rimar & Diers, 2006). Hospital management and consulting literature exhort managers to improve "capacity management" and "maximize patient throughput" (Kobis & Kennedy, 2006).

Patient throughput is improved when transfer from the emergency department (ED) to the ward is facilitated, but that often means admission to any available bed (known as "hotbedding" in Australia), or moving inpatients about to accommodate new admissions. Administrative movement to fill beds is in addition to patient movement occasioned by clinical needs such as transfer in or out of ICU, transfer to special accommodation (e.g., negative pressure rooms, psychiatric rooms), or off ward for imaging. Shortened length of stay increases throughput, and produces a more diverse mix of patient case types (casemix as DRGs).

Throughput is enhanced if nursing wards/units are not specialized and can receive any type of case, but this is not the usual structure of hospital wards today. However, increased demand for throughput may alter the mix of cases on the nursing ward. As hospitals' market share or local physician relationships change, new patient populations may appear (or disappear) from nursing wards. Technologic changes and

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the rise of surgical specialty hospitals in the United States have increased medical admissions (Bazzoli, Brewster, May, & Kuo, 2006), while in Australian hospitals there are decreased surgical admissions to public sector hospitals, particularly elective surgery, which are not always matched to bed allocations and ward staffing (Department of Health and Ageing, 2006). Sundararajan, Brown, Henderson, and Hindle (2004) studied the effects of increased levels of private health insurance in Victoria (Australia) and found that patients with more severe disease were still more likely to be seen in public hospitals, despite substantial growth in the private sector.

Patient throughput and casemix changes on nursing wards are little understood aspects of nursing's responsibility for nursing wards/units as hospital operations. As part of a larger study, we quantified the movement of patients on and off wards in 27 Australian public hospitals (286 wards) over a 5-year period. We also examined casemix change at the nursing unit level (Duffield et al., 2007).

Review of Literature

Unruh and Fottler (2006) used Pennsylvania hospital-level data in a clever design that calculated patient turnover as the inverse of length of stay (1/LOS). They found that RN-to-patient ratios alone underestimate workload unless account is taken of the movement of patients into and out of the hospital. They argue that patient turnover "should be taken into account in staffing assessment and decision making" (p. 599).

Birch, O'Brien-Pallas, Alksnis, Tomblin-Murphy, and Thomson (2003) concluded that after hospital restructuring in Ontario (Canada) there was an increased number of severity-adjusted patients using fewer beds cared for by fewer nurses. Inpatient episodes per nurse fell slightly (under 2%) while the number of beds was reduced by over 20%. This resulted in the number of patients per bed increasing by 12%. When adjusted for inpatient severity, episodes per nurse increased by over 9% and thus, the caseload per nurse increased. Adjusted episodes per bed increased by over 25%.

There is no widely accepted metric for patient turnover. In early work Jacobson, Seltzer, and Darn (1999) noted that "the frequent turnover of inpatients… coupled with the admission of outpatients staying for a 24 hour period are contributing to a very chaotic environment of care" (p. 55) as they argue for a measurement of "total treated" instead of just the midnight census. More recently Wagner, Budreau, and Everett (2005) report an approach in a large U.S. medical center where "total treated patients" (including sum of admissions, discharges, patients admitted and discharged within the same day, and patients on the unit for 24 hours) was measured to more accurately reflect nursing workload. A classic work by Diers, Torre, Heard, Bozzo, and O'Brien (2000) describes a measure they call "contact census" defined as the midnight census plus all admissions and transfers in during the day — all patients "touched" on the ward. They devised electronic displays of contact census against budgeted and actual census for use by nurse managers in explaining budget variances. Cavouras (2002), reporting on behalf of her consulting firm's (Lawrenz) annual survey, notes increased throughput in 2001, estimated by her sample of hospitals, as requiring between 1 and 1.5 hours of nursing time per admission, discharge, and transfer in or out.

Nursing acuity measures do not generally capture patient turnover since they were intended to measure individual nursing care needs rather than ward operations. TrendCare, used in Australia and New Zealand, captures discharge planning and transfer off ward but not the time required in admission (personal communication, Virginia Plummer, April 30, 2007). New work on "demand management" that couples traditional acuity measures with an understanding of the patterns of patient care by day and even time of day is promising (Pickard & Warner, 2007).

The movement of patients on and off the ward is not only an added responsibility for nursing, but also the movement may compromise the ability to cohort similar patients. Cohorting patients has been shown to improve quality and decrease cost in a growing number of studies. Intensive care units are the most obvious example of cohorting by nursing care needs where the salutary effects of ICUs are firmly established. Psychiatric patients, maternity patients, newborns, and pediatric patients have long been cohorted for public health and hospital licensure considerations. Co-location of general medical or surgical patients is a new area of inquiry.

Several germinal works have been undertaken in this field of enquiry in the past decade. Aiken's study of AIDS units noted that cohorting AIDS patients on dedicated nursing units led to decreased mortality and increased patient satisfaction (Aiken, Sloane, Lake, Sochalski, & Weber, 1999). Czaplinski and Diers (1998) showed that when patients in selected diagnosis-related groups (DRGs) were gathered on a limited number of units, mortality was lower as was length of stay. Diers and Potter (1997) reported a study of one nursing unit before and after it had concentrated its orthopaedic casemix. Length of stay dropped by 2 days and patient satisfaction increased by 8 percentage points. More recently, Rimar and Diers (2006) studied 9,895 patients in 11 DRGs in one hospital, examining the relationship between nursing volume and

clinical and cost outcomes. They found that when nursing volume by unit increased, cost decreased, particularly for elective surgical DRGs.

Early efforts at program development for elder care have produced cohorted nursing units called ACE (acute care for elders) units (Counsell et al., 2000). A randomized trial of one ACE unit produced less physical decline in activities of daily living, fewer restraints, more physical therapy consults, and higher satisfaction with care. The ACE model was expanded to a stroke unit (Allen et al., 2003) with a lower mortality compared with prior data.

Churn: The Concept

That hospital length of stay has fallen worldwide is no longer news. Many analyses of LOS assume that shorter LOS means less nursing is required. Actually, as the leisurely workup and recovery days have been trimmed, more of the patient's stay is "sick" days, necessitating more nursing care. There has been scant attention paid to the effect of decreased LOS on nursing workload. Graf, Millar, Feiteau, Coakley, and Erickson (2003) at Massachusetts General Hospital showed that as LOS decreased, nursing acuity increased. Decreased LOS concentrates the need for nursing but also allows increases in throughput. Thus, shorter lengths of stay produce a double burden on nursing to manage the concentrated nursing needs in shorter time frames and to manage the movement on and off the ward.

"Churn" is the label we applied to the phenomenon of patient turnover on nursing units. Length of stay analyses at the hospital level do not take account of where the minutes or hours of patient care happen on nursing wards. Nor do they account for how many wards a patient might "touch" during a stay of only a few days or within ward transfers to accommodate patients conditions or requests (e.g., a single room). Churn increases requirements for nursing but is rarely part of staffing formulae.

Study Design and Data Collection

The New South Wales (NSW) Department of Health in Sydney (Australia) commissioned a study to examine nursing workload, staffing, skill mix, the work environment, and patient outcomes with a focus on general medical and surgical wards, where the majority of hospital nurses work (Duffield et al., 2007). The study was approved by the human research ethics committee of the University of Technology, Sydney, and 14 other ethics committees at NSW Health and Area Health Services. (Area Health Services [AHS] receive funding from the state and commonwealth for provision of public health and hospital services for a defined population area. When the study began, there were 17 AHS; a restructuring occurred mid-study that produced 8 AHS. Ethics approvals were carried forward to the new structure.) The study comprised a retrospective and a concurrent component.

Five years of hospital discharge data (fiscal years 2001-2005) were acquired in a standard dataset of encounter-level patient data. The hospital discharge data contain the actual minutes on every hospital ward/unit the patient attended including emergency, theater (operating room), imaging, high dependency wards, and medical, surgical, or specialty wards. The data (times) are entered by clerical staff from patients' records. Imaging, theater (operating rooms), and the ED count as "wards" in this context. The ward episode dataset included all public hospitals in the state (N=80). Private hospitals are not yet required to contribute to this part of the dataset called the Health Information Exchange. Private hospital discharges compose about 35% of all hospital discharges in NSW (Australian Institute of Health and Welfare, 2006) but their casemix is primarily low-risk obstetrics and elective surgery.

NSW Health classifies hospitals by relative proportion of AR-DRGs (Australian Revised Diagnosis Related Groups) and hospital size into peer groups. For this study, four peer group designations were used: (A) Principal/Major Referral and Specialist, (B1) Major Metropolitan, (B2) Major Regional, (C) Other Regional Hospital. "C" hospitals are primarily small rural hospitals. Some services that would be counted as outpatient services in the United States (dialysis in particular) are part of the inpatient hospital dataset which makes LOS statistics reported later look short to U.S. readers.

The study required nursing payroll or scheduling data that could be matched to the nursing ward level data on patients. Forty hospitals gave approval for use of their data; eventually 27 supplied useable nursing staffing/skill mix data for general, medical, or surgical wards (defined by casemix: relative proportion of AR-DRGs) for some part of the 5-year period. Over 4 million (4,964,924) ward episodes from the 27 hospitals were analyzed. A "ward episode" is the amount of time a patient spent on any ward.

The concurrent or cross-sectional component of the study involved a stratified random sample of 80 nursing wards in 19 hospitals across NSW in FY 2005-2006, at the end of the period of retrospective data acquisition. Hospitals and wards were selected to be representative of their hospital peer group categories as listed previously, with a focus on medical and surgical (and combined) wards defined by the hospitals themselves. Original data were collected on both nurses and patients for 7 continuous days. The cross-sectional data reported here come from ward-level data collected by nurse surveys and by nurses trained as data collectors

Table 1.
Length of Stay Across Study Hospitals

	2001	2002	2003	2004	2005	All
N Hospitals	27	27	27	27	27	27
Episodes	585,244	569,543	596,952	608,160	621,031	2,980,930
Ward episodes	950,589	934,234	997,734	1,026,202	1,056,165	4.964,924
ALOS (hours)	96.7	93.7	96.0	96.9	97.0	96.1
ALOS (days)	4.03	3.90	4.00	4.04	4.04	4.00
Turnover *	0.24	0.26	0.25	0.25	0.25	n/a
Ward ALOS (hours)	51.9	48.7	50.6	50.6	49.8	50.3

* Turnover = 1/LOS in days (Unruh & Fottler, 2006)

Table 2.
Average Number of Ward Contacts

	2001	2002	2003	2004	2005
All NSW Public Hospitals					
Average Contacts/Patient	2.00	2.06	2.08	2.11	2.14
Hospitals	80	80	80	80	80
Total Patients	444,655	460,349	459,124	484,818	498,319
Study Hospitals					
Average Contacts/Patient	2.10	2.16	2.19	2.23	2.26
Hospitals	27	27	27	27	27
Total Patients	238,680	230,841	224,143	233,427	242,307

who extracted data elements from administrative data kept at ward level.

The longitudinal and cross-sectional (concurrent) data were used to amplify each other. The study reported here is a secondary analysis of these data.

Results

Average LOS calculated for all patients in all 80 public hospitals in NSW changed from 3.26 days to 3.23 from 2001-2005. For the main study hospitals in this analysis, LOS (for only medical/surgical patients) was higher and more or less stable at around 4.04 days (see Table 1).

There are two observations to be made about these data. First, the ward average LOS is only about half of the total hospital LOS, indicating that patients were moved about considerably during quite a short amount of time. This is churn: the sequential assignment of patients through ward areas. Second, the "turnover" metric (1/LOS in days) produces turnover rates that are uniformly higher than those reported by Unruh and Fottler (2006) for their Pennsylvania hospital-level data (their highest turnover on this metric was 0.22).

Excluding day cases, the average number of ward contacts by patients in all 80 NSW public hospitals grew from 2.00 in 2001 to 2.14 in 2005 (7% increase). In the 27 study hospitals, the average number of ward contacts increased from 2.10 to 2.26 (7.6% increase) over the 5-year period (see Table 2). This figure does not include transfers between beds on the same ward.

There is no way to measure how much churn is due to clinical exigencies (e.g., transfer to ICU, movement to imaging) and how much is not clinically justified.

Increased churn should be reflected in increased nursing hours (Unruh & Fottler, 2006) if hospitals staff to cover churn, an unrecognized but substantial burden on nurses and their workloads. An analysis was undertaken of the relationship between total ward admissions and change in movement off the ward over time in relation to changes in nursing hours by peer groups of hospitals.

The difference in findings across hospital types suggests that in some peer groups, the change in level of patient contacts on the ward has not been adequately compensated by increased nurs-

Table 3.
Change Nursing Hours to Ward Admission (Contacts) 2001-2005 – All Wards

Peer Groups	Number of Wards with Increased Nursing Hours per Patient Contact	Number of Wards with Decreased Nursing Hours per Patient Contact	Total Wards	Statistical Direction of Change	Probability Level *
A	119	67	186	Increase	0.000
B1	35	11	46	Increase	0.000
B2	8	18	26	Decrease	0.038
C	14	14	28	No change	0.575
Overall	176	110	286	Increase	0.000

* Statistical testing was done with the Binomial Distribution and contingency tables.

Table 4.
Change in Nursing Hours to Change in Rate of Ward Contacts over Time by Ward Type

Ward Type	Number of Wards with Increased Nursing Hours per Patient Contact	Number of Wards with Decreased Nursing Hours per Patient Contact	Total Wards	Statistical Direction of Change	Probability Level *
General	38	14	52	Increase	0.001
Medical	20	13	33	No change	0.148
Surgical	17	20	37	No change	0.371
Other	101	63	164	Increase	0.002
Overall	176	110	286	Increase	0.000

* Statistical testing was done with the Binomial Distribution and contingency tables.

ing resources (see Table 3). Hospitals were not staffing to cover churn.

Analysis by ward types shows the relative increase in nursing hours available on the ward is significant for general wards (combined medical/surgical) or other (specialty) wards but not for medical and surgical wards (see Table 4).

Another way to look at churn is by the number of patients per bed. Patients per bed was calculated for the 80 wards in the cross-sectional part of the study where there were denominators for staffed beds. This calculation does not include movements within the ward. The number of patients flowing through the nursing wards was, on average, 1.25 the number of beds per day. When examined on a day by day basis rather than averaged across the ward sample period, the maximum number of patients per bed per ward per day rose to 1.6.

To pursue the casemix aspect of churn, we used data from the longitudinal study that counted the average number of AR-DRGs across all 80 NSW hospitals and 286 nursing wards over the 5-year period (see Figure 1).

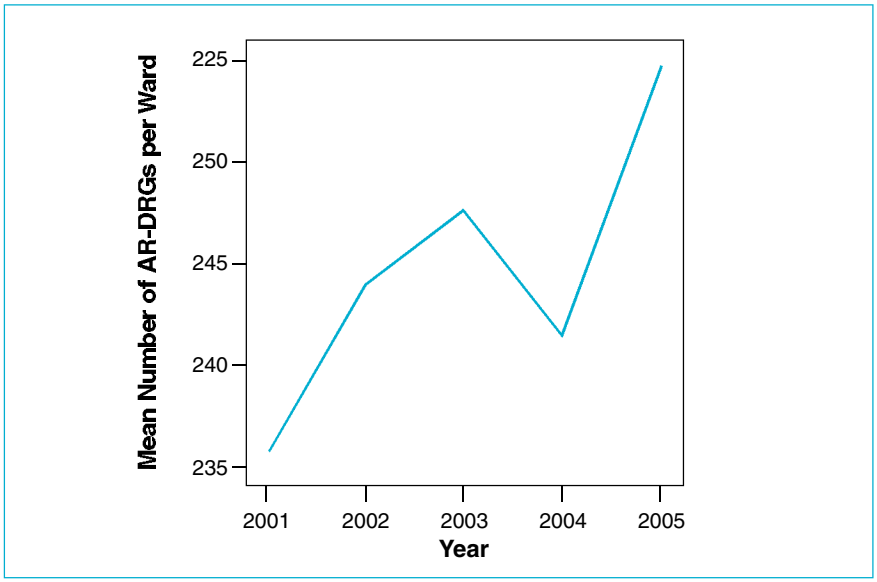
There are 666 AR-DRGs in the Australian system. Excluding psychiatric, maternal, and newborn, error and pre-MDC AR-DRGs, the total potential number of DRGs that general, medical/surgical units might see is approximately 603. That the average number of AR-DRGs seen on nursing units begins at about 235 and rises to 255 — over 40% of all available medical/surgical AR-DRGs — indicates an increasing level of care complexity on nursing units.

Discussion

The U.S. hospital system is overbedded, that is, there is excess capacity. The Australian hospital system is by design underbedded (Organisation for Economic Co-Operation and Development, 2007), which creates waiting lists, especially for elective surgery. Managing an underbedded system requires moving patients about to maximize hospital efficiency. Patient movement is a nursing responsibility.

Data at the nursing ward level are very difficult to obtain in large administrative datasets. That means that there has been very little ward-level investigation of churn or casemix change. Yet, the nursing ward is where a hospital's operations are largely undertaken. In the absence of a way to measure turnover, it is not surprising that nursing resources might not fol-

Figure 1.
Mean Number of AR-DRGs per Ward 2001-2005



low nursing work, especially in the general medical and surgical nursing units, which traditionally do not attract much attention.

In the data here, medical/surgical patients moved on average more than twice in an average hospital stay of only about 4 days. We applied Unruh and Fottler's (2006) index (1/LOS) to the nursing ward level, and not surprisingly, found higher rates (see Table 1) than when the index was applied to U.S. hospital level turnover rates. Length of stay impacts the work of nursing at the nursing ward level. Because churn has not been part of the staffing formula, the provision of nursing resources has not followed increased patient movement to the medical and surgical units in the data reported here.

The average length of stay on a nursing unit in this study was about 50 hours. In that time, the nurses must welcome patients to the ward, assess them for nursing needs, settle them, deal with their families, turn to the patient care needs indicated by medications or treatments, start preparing patients for leaving the hospital and, always, documenting. The process simply reverses as the patient is prepared for discharge. When patients require off-unit services, nurses organize this, including often accompanying the patient. Moving patients about unnecessarily risks gaps in communication, loss of records, and wastes time. Families and physicians may well be upset when they cannot find the patient.

None of this work is captured in nursing acuity data systems. Further, casemix at the nursing ward level has been little studied recently. However, early work indicates that cohorting of patients with similar conditions (selected DRGs) leads to decreased mortality, increased patient satisfaction, and shorter LOS (Aiken et al, 1999; Diers & Potter, 1997; Czaplinski & Diers, 1998). Nurses cannot be expected to care for increasingly wide varieties of patients (different DRGs) who require different medications and treatments (now becoming very specific) to say nothing of different physicians involved in the care, with easy equanimity.

Implications

Hospitals are not hotels where apart from special circumstances of fame or age (children) or disability (or perhaps idiosyncracy) that might require special accommodations, one guest is just like another. The hotel industry standard for efficient occupancy is around 50% to 60% (Price WaterhouseCoopers, 2006). Hotel turnover requires resources for registration and cleaning, but services in between are the guest's choice (room service, the fitness room, etc). All patients in hospitals require nursing care. In Australia, hospitals typically run at 95% occupancy (Australian Medical Association, 2007).

Churn can be measured in administrative data systems as the inverse of LOS; or as number of patients per staffed bed over whatever time period is of interest, or as "total treated" or "contact census." When churn is measured, especially at the nursing-ward level, nurse managers have a metric to use in managing their businesses. An arbitrary standard (say an hour per turnover) added to estimates of staffing requirements would provide a staffing standard that might more closely approximate the amount of nursing required. What cannot be measured cannot be managed. Simply keeping track of casemix changes by nursing ward/unit might be the first step in equipping nurse managers with a way to talk about the work of their units in terms financial managers understand, AR-DRGs in this instance.

The notion of churn is one way to make the demands on all hospital personnel more visible. Nurses are not the only ones affected. Patient registration personnel are also affected by having to keep track of all these patient moves. Medical staff also complain that they cannot find their patients. Ancillary services such as labs and x-ray are also having more throughput. Discharge planners and case managers' caseloads are growing.

Buerhaus et al. (2007) documented how nurses, physicians, and hospital executives have different impressions of the extent to which patient safety is affected by nursing. Nurses and physicians attributed more responsibility for patient safety to nurses than did chief nurse executives (CNO) and a good deal more than chief executive officers (CEO). This is a disturbing report, which coupled with the data here, suggests that resource allocation (which would be done by the CNO and CEO) has not followed changes in patient care patterns.

For executives to act responsibly they require accurate information. Churn is a little recognized and relatively unmeasured phenomenon so it is not surprising that resource allocation has not matched the increase in workload. Because churn has not been measured, it has not been managed in terms of resource allocation, leaving nurses to complain that they are overburdened or under-resourced. To manage wards for quality and safety, the entire workload must be captured.

Conclusion

The operational management of hospitals occurs on the inpatient wards. The absence of ward-level metrics compromises the ability of nursing unit/ward managers to meet their own efficiency and quality standards. Nurses know how their operational world turns. Measurements of churn would give nurses another way to talk about the work of nursing to senior management and would give nurse executives a way to describe hospital operations and throughput and the impact on staff, patients, and resource allocation. **$**

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