RESEARCH ARTICLE

National trends and variation in nurse staffing on inpatient psychiatric units

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Abstract

The purpose of this study was to examine national trends and variation in nurse staffing on inpatient psychiatric units in US general hospitals from 2005–2017. The National Database of Nursing Quality Indicators® provided data on nurse staffing from 1,143 psychiatric units in 610 US hospitals. A weighted linear mixed model was fitted for each of two staffing measures: Registered nurse (RN) hours per patient day (HPPD) and non-RN HPPD. Monthly staffing levels were modeled as a function of study year, unit type, and hospital bed size, teaching status, government ownership, for-profit status, metropolitan location, and US census division. Very gradual upward trends in staffing were observed. Compared with adult units, child/adolescent units had lower RN staffing and higher non-RN staffing. Levels of both types of staffing were lower in for-profit facilities. The Pacific census division had higher RN staffing than every other census division by an estimated margin of 0.52–1.54 HPPD, and census divisions with the lowest levels of RN staffing had the highest levels of non-RN staffing. Despite concerns expressed over the past 15 years about patient violence, staffing levels, and use of seclusion and restraint on psychiatric units, average staffing levels have apparently increased only modestly since 2005, and increases in RN staffing on psychiatric units have not kept pace with increases in general care units. Marked regional differences in staffing merit further investigation.

KEYWORDS
psychiatric care, quality assurance/patient safety, staffing

1 | INTRODUCTION

Nursing is a critical component of inpatient care, and associations between nurse staffing variables and various patient outcomes have been reported in numerous studies (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Aiken et al., 2014; Blegen, Goode, Spetz, Vaughn, & Park, 2011; Griffiths et al., 2014; Needleman et al., 2011). The vast majority of this research, however, has been carried out in nonpsychiatric settings and restricted to patient outcomes that are of limited relevance in psychiatric care. Psychiatric unit staffing has received some attention in relation

to patient violence and staff use of coercive measures, though effects of staffing on these outcomes remain poorly understood (Bowers et al., 2009; Bowers & Crowder, 2012; Staggs, 2013, 2015b, 2016).

Although published evidence of associations between nurse staffing and patient outcomes in psychiatric care is limited, staffing is part of the structure of care, which is considered important to processes and outcomes of care and a source of data for assessing the quality of care (Donabedian, 1966). Thus it seems reasonable to suppose that staffing-outcome links similar to those reported for nonpsychiatric settings may exist in psychiatric care, even if which

outcomes are affected and how remain largely unknown. For example, in its position statement on staffing the American Psychiatric Nurses Association (2011) asserted, "expert [psychiatric mental health] nurses are particularly vital because they have the skills to quickly recognize … unusual or unpredictable patient situations and prevent negative and sentinel events, such as incidents of violence, suicide, or seclusion/restraint" (p. 2). And as Hanrahan (2012) observed, "There is little doubt that adequate psychiatric nurse staffing in hospitals is a critical component of quality inpatient psychiatric care" (p. 28). Unfortunately, the question of what passes for "adequate" psychiatric unit nurse staffing has not been answered by researchers.

Variation in psychiatric unit nurse staffing across time, regions, different sizes and types of hospitals, and unit types is important. Staffing levels may reflect not only differences in patient populations, but also hospital financial resources and priorities (e.g., profitability), state regulation, and beliefs about the association between nurse staffing and the quality and safety of psychiatric care. Although the relative importance of these factors for setting nurse staffing levels cannot be estimated precisely for any single facility, patterns identified from a large national dataset can be helpful in understanding this topic, which is not well-studied. For example, there is evidence that registered nurse (RN) staffing rose on general care units in US hospitals from 2004–2011 (Staggs & He, 2013), but we do not know whether a similar increase has occurred on psychiatric units. Nor do we have a good understanding of how, or why, staffing varies across hospitals and units; published research on psychiatric unit nurse staffing nationally, including variation across regions and types of facilities, is limited to a single study based on 1 year of data (Staggs, 2015a).

The purpose of this study was to examine national trends and variation in nurse staffing on inpatient psychiatric units in US general hospitals from 2005–2017. RN and non-RN staffing levels were examined as separate dependent variables. Potential correlates of staffing examined included unit type and hospital bed size, teaching status, government ownership, for-profit status, metropolitan location, and US census division.

2 | METHODS

The National Database of Nursing Quality Indicators (NDNQI)® provided nurse staffing data from January 1, 2005 to June 30, 2017 for inpatient psychiatric units in participating US general hospitals. Owned and operated by Press Ganey Associates, Inc., the NDNQI collects monthly and quarterly data related to nursing care from roughly 2,000 hospitals. Participating hospitals pay an annual fee and submit data on measures of their choosing to the NDNQI, whose analysts clean and compile the data from member hospitals and provide them with individualized reports, including national benchmarking data. The University of Kansas Medical Center institutional review board has classified analyses of secondary NDNQI data as Not Human Subjects research.

Monthly staffing data collected by psychiatric units for submission to the NDNQI include patient days (from unit censuses and/or records of hours spent on the unit) and nursing care hours provided (not just scheduled) by nursing staff. Hospitals report hours for RNs and for non-RN staff, including licensed practical/vocational nurses and assistive personnel. Nursing care hours are reported only for staff assigned to the unit who typically spend more than half of their shift in patient care activities (including documentation and treatment planning).

The study sample was limited to nonfederal, general hospitals, and to inpatient psychiatric units of seven types: Child, adolescent, child/adolescent, adult, geriatric, specialty (dual diagnosis), and blended (combining three or more types). For analyses, child, adolescent, and child/adolescent unit types were treated as a single category, as were specialty and blended units. Only units with data on staffing and patient days for at least 12 of the 150 study months were included in the study. Months for which a unit reported fewer than 100 patient days did not count toward this criterion and were excluded from the analysis.

Two measures of staffing were computed for each unit-month of data (i.e., for each month of data for each unit). RN hours per patient day (HPPD) was computed by dividing the reported number of RN hours by the reported number of patient days. Non-RN HPPD was computed analogously by summing the hours for non-RN staff and dividing this total by the number of patient days.

Time trends and effects of the unit and hospital characteristics were estimated by fitting two weighted linear mixed models (one for RN HPPD, one for non-RN HPPD) using the MIXED Procedure in SAS 9.4. In each model, staffing was modeled as a function of study year (to estimate the time trend), unit type (blended/specialty, child/adolescent, geriatric, or adult), unit cohort (a categorical variable for the calendar year of the unit's earliest reported staffing data), and a 12-level categorical variable for calendar month (to adjust for seasonal trends). Hospital-level variables included a three-level categorical variable for bed size (1–199, 200–399, and ≥400); binary (yes/no) indicators for teaching facility (defined as a clinical site for physician interns/residents), government facility, for-profit facility, and location (metropolitan vs. micropolitan or rural); and a nine-level categorical variable for US census division. Because staffing tends to vary nonlinearly by patient volume (i.e., levels tend to be high for months with the lowest volume and then decrease and level out as patient volume increases), inverse patient days (one/patient days) and its square were computed for each unit-month and included as covariates. By reducing error variance, controlling for these extraneous effects of patient volume allows for more precise estimation of the associations between the explanatory and dependent variables.

To adjust for dependence among each unit's monthly staffing levels, a random unit intercept was included in the model, and a first-order autoregressive covariance structure was specified. In addition, the observation for each unit-month was weighted by its patient days to give each unit-month influence on model estimates in proportion to its patient volume. In the absence of such weighting, low-volume

unit-months would receive the same weight as high-volume unit-months in the estimation, potentially resulting in biased estimates of model coefficients.

3 | RESULTS

The analysis dataset comprised staffing data from 1,143 units in 610 hospitals. Data were available for a total of 89,257 unit-months, or 78 months per unit on average. About one-third of units (339; 30%) reported data for the first study year (2005); subsequent cohorts (first reporting in 2006–2016) comprised 36–119 units (3–10%) each. The count of units reporting data in a given month ranged from 217–781 with median 650 (interquartile range, 457–750).

Sample characteristics and mean staffing levels by unit type and hospital characteristics are provided in Table 1. Most nursing units (63%) were adult units; child/adolescent and geriatric units each accounted for 15% of the sample, and blended/specialty units accounted for the remaining 7%. The average staffing level across all units for the 2005–2017 study period was 4.4 RN HPPD (standard deviation [SD]: 1.5) and 3.5 non-RN HPPD (SD: 1.8). Notably, blended/specialty and adult units had the lowest levels of non-RN staffing with averages of 3.1–3.2 HPPD, whereas child/adolescent and geriatric unit averages were 4.6 and 4.4 HPPD, respectively. Average RN staffing was also lower on blended/specialty and adult units (4.2 HPPD vs. 4.8–4.9 HPPD for child/adolescent and geriatric

units), but this difference was apparently driven in part by factors other than unit type and was not observed when controlling for hospital characteristics and time trend in modeling.

Average RN and non-RN staffing levels are plotted by study month in Figure 1. The average for each month was computed by summing all RN (non-RN) hours across units reporting data for the month and dividing by the sum of all units' patient days for the month. This is equivalent to computing the weighted average of the unit RN (non-RN) HPPD values with each HPPD value weighted by the unit's patient days, giving each unit influence on the monthly average in proportion to its patient volume. Levels of both RN and non-RN staffing appear to have increased gradually across the study period.

Model results are provided in Table 2; p values are reported without comparison to an arbitrary threshold (e.g., .05) in accordance with recent guidance from the American Statistical Association (Staggs, 2019; Wasserstein, Schirm, & Lazar, 2019). RN HPPD increased, on average, by an estimated 0.07 per study year for a cumulative increase of about 50 RN minutes per patient day across the 12.5 study years. According to model estimates, RN staffing levels tend to be lower on child/adolescent units and lower in for-profit facilities. The Pacific division had higher RN staffing than every other census division by an estimated margin of 0.52–1.54 HPPD.

Non-RN staffing increased more slowly during the study period, at an estimated 0.03 HPPD per year (Table 2). Levels of

TABLE 1 Sample characteristics and mean (SD) staffing levels by unit and hospital characteristics

Variable	Level	Hospitals, n = 610 (%)	Units, n = 1,143 (%)	RN HPPD	Non-RN HPPD
Unit type	Blended/specialty		83 (7%)	4.2 (1.3)	3.1 (1.1)
	Child/adolescent		170 (15%)	4.8 (1.5)	4.6 (2.1)
	Geriatric		171 (15%)	4.9 (1.3)	4.4 (1.7)
	Adult		719 (63%)	4.2 (1.2)	3.2 (1.4)
Bed size	1–199	247 (40%)	350 (31%)	4.7 (1.3)	3.5 (1.8)
	200–399	219 (36%)	389 (34%)	4.2 (1.2)	3.4 (1.4)
	≥400	144 (24%)	404 (35%)	4.3 (1.4)	3.8 (1.7)
Teaching status	Nonteaching	249 (41%)	390 (34%)	4.5 (1.3)	3.5 (1.7)
	Teaching	361 (59%)	753 (66%)	4.3 (1.3)	3.6 (1.6)
Ownership	Nongovernment	568 (93%)	1,019 (89%)	4.4 (1.3)	3.5 (1.6)
	Government	42 (7%)	124 (11%)	4.0 (1.4)	4.0 (1.8)
For-profit facility	No	568 (93%)	1,053 (92%)	4.4 (1.3)	3.6 (1.7)
	Yes	42 (7%)	90 (8%)	4.0 (1.0)	3.4 (1.3)
Metropolitan area	No	54 (9%)	68 (6%)	5.1 (1.5)	4.0 (2.4)
	Yes	556 (91%)	1,075 (94%)	4.3 (1.3)	3.5 (1.6)
Census division	New England	51 (8%)	89 (8%)	4.8 (1.2)	3.7 (2.1)
	Middle Atlantic	143 (23%)	267 (23%)	3.8 (1.1)	3.6 (1.5)
	South Atlantic	142 (23%)	240 (21%)	4.8 (1.3)	3.4 (1.4)
	East North Central	52 (9%)	127 (11%)	4.8 (1.4)	3.6 (1.8)
	East South Central	102 (17%)	191 (17%)	4.5 (1.2)	3.3 (1.7)
	West North Central	28 (5%)	57 (5%)	4.4 (1.3)	4.1 (1.8)
	West South Central	46 (8%)	96 (8%)	3.9 (1.1)	4.0 (1.7)
	Mountain	21 (3%)	44 (4%)	3.8 (1)	4.1 (1.7)
	Pacific	25 (4%)	32 (3%)	5.2 (1.6)	3.3 (1.3)

Abbreviations: HPPD, hours per patient day; Non-RN HPPD, Non-registered nurse (e.g., licensed practical nurse, assistive personnel) hours per patient day; RN, registered nurse; RN HPPD, registered nurse hours per patient day; SD, standard deviation.

FIGURE 1 Average monthly RN and non-RN hours per patient day (HPPD). RN, registered nurse
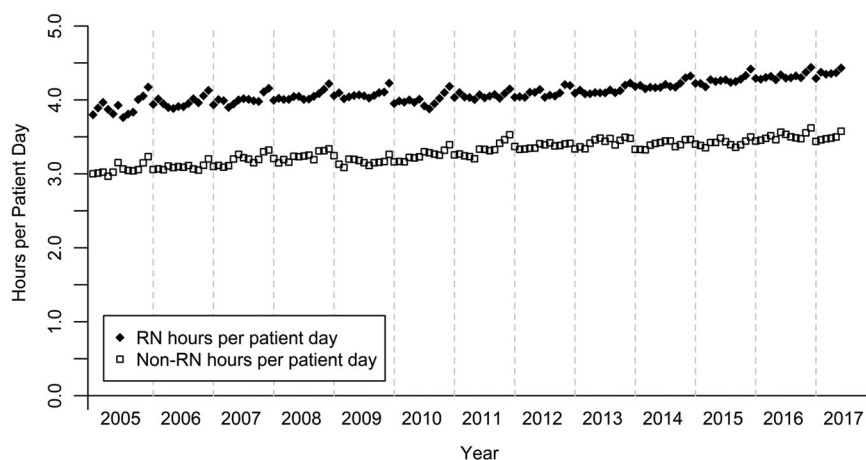
non-RN staffing were higher by about 0.5 HPPD on child/adolescent and geriatric units compared with levels on adult units and tended to decrease with hospital bed size. Nongovernment and for-profit facilities tended to have lower non-RN staffing.

Census divisions with the lowest levels of RN staffing were those with the highest levels of non-RN staffing, and the Pacific census division, notable for its high level of RN staffing had one of the lowest levels of non-RN staffing.

TABLE 2 Model estimates

Explanatory variable	RN HPPD B (95% CI)	p	Non-RN HPPD B (95% CI)	p
Time trend (change per year)	0.07 (0.06, 0.07)	<.001	0.03 (0.02, 0.03)	<.001
Unit type				<.001
Blended/specialty	0.01 (−0.24, 0.26)		−0.09 (−0.43, 0.24)	
Child/adolescent	−0.78 (−0.96, −0.59)		0.48 (0.23, 0.72)	
Geriatric	−0.09 (−0.26, 0.08)		0.51 (0.28, 0.74)	
Adult	Referent		Referent	
Bed size		.128		.033
1–199	−0.12 (−0.14, −0.1)		−0.53 (−0.77, −0.28)	
200–399	−0.23 (−0.25, −0.21)		−0.27 (−0.50, −0.05)	
≥400	Referent		Referent	
Teaching facility	0.23 (0.08, 0.39)	.003	0.07 (−0.14, 0.28)	.496
Government facility	−0.18 (−0.40, 0.04)	.100	0.33 (0.04, 0.62)	.028
For-profit facility	−0.48 (−0.70, −0.25)	<.001	−0.38 (−0.68, −0.07)	.017
Metropolitan location	0.17 (−0.11, 0.46)	.230	0.04 (−0.34, 0.41)	.853
Census division		<.001		<.001
New England	−0.52 (−0.97, −0.07)		0.33 (−0.26, 0.93)	
Middle Atlantic	−1.27 (−1.68, −0.87)		0.37 (−0.17, 0.91)	
East North Central	−0.73 (−1.14, −0.32)		−0.02 (−0.56, 0.52)	
West North Central	−0.76 (−1.19, −0.33)		0.06 (−0.51, 0.63)	
South Atlantic	−0.88 (−1.30, −0.46)		−0.14 (−0.69, 0.41)	
East South Central	−1.02 (−1.50, −0.54)		0.54 (−0.10, 1.18)	
West South Central	−1.43 (−1.87, −0.98)		0.48 (−0.11, 1.08)	
Mountain	−1.31 (−1.82, −0.81)		0.74 (0.06, 1.41)	
Pacific	Referent		Referent	

Abbreviations: CI, confidence interval; HPPD, hours per patient day; Non-RN HPPD, Non-registered nurse (e.g., licensed practical nurse, assistive personnel) hours per patient day; RN, registered nurse; RN HPPD, registered nurse hours per patient day.

4 | DISCUSSION

On the basis of model estimates and the unadjusted means plotted in Figure 1, average RN and non-RN staffing levels on psychiatric units have risen only gradually since 2005. Although the estimated average change of 0.07 RN HPPD per year is negligible in the short term, the implied cumulative effect over the 12.5-year study period was an average of 50 additional RN minutes per patient day. As a point of comparison, RN staffing levels on general care units in NDNQI hospitals rose by 1.1 HPPD during the 8-year period from 2004–2011, or by 0.14 HPPD per year on average—twice the estimated rate of increase during 2005–2017 for the psychiatric units in this study (Staggs & He, 2013).

Non-RN HPPD on psychiatric units increased at less than half the rate that RN HPPD did. On the basis of the estimated rate of change, the cumulative increase across the study period was roughly 20 min of non-RN care per patient day, on average. By contrast, non-RN staffing on general care units in NDNQI hospitals fell slightly from 2004–2011 (Staggs & He, 2013).

If nurse staffing levels on psychiatric units have been influenced by concerns expressed over the past 15 years about patient violence and use of seclusion and restraint (American Psychiatric Association, American Psychiatric Nurses Association, & National Association of Psychiatric Health Systems, 2003; American Psychiatric Nurses Association, 2018; Busch, 2005; Substance Abuse & Mental Health Services Administration, 2003), the effect has apparently been modest at best. This is not to assert that psychiatric unit staffing is generally inadequate, or that higher staffing is a panacea for reducing violence and curbing the use of seclusion and restraint. Potential associations of psychiatric unit staffing with patient violence and use of coercive measures by staff are not well-understood (Bowers et al., 2009; Bowers & Crowder, 2012; Staggs, 2013, 2015b, 2016).

It is, however, widely (and reasonably) believed that inadequate staffing levels can make psychiatric settings unsafe (e.g., Shattell, 2013), reflecting conventional wisdom that staffing and patient violence are linked; Staggs (2013) reviewed studies of staffing and violence/aggression going back to the 1960s. For this reason, we might have expected more dramatic increases in staffing over this time period in response to discussions of the problem of violence on psychiatric units. The most likely explanation for the gradual increase in RN staffing on psychiatric units may be that it is part of the larger trend of increasing RN staffing across various nursing unit types, which lasted at least into 2011 (Staggs & He, 2013). Increases in psychiatric unit staffing may have been muted in part because psychiatric care has received less attention than general inpatient care in efforts to improve healthcare quality and safety (Marcus, Hermann, & Cullen, 2018).

Staffing levels were rather variable in the study sample. On the basis of both unadjusted means (Table 1) and model estimates adjusted for unit type and hospital characteristics (Table 2), patients in three census divisions received, on average, over an hour less care from RNs per day than patients in the Pacific division. These same census divisions had somewhat higher levels of non-RN staffing, meaning RN skill mix was generally lower. Perhaps not coincidentally, the Pacific division includes the only state (CA) with a mandated minimum staffing level for psychiatric units (one licensed staff member per six patients, equivalent to 4.0 HPPD), though average RN staffing for the Pacific division in this study exceeded this level by over a full hour per patient day.

It is reasonable to expect variation in staffing across unit types, but large regional variation in staffing levels merits further study. Perhaps the psychiatric inpatient population in Pacific division states differs markedly from that in other regions in the US. But whatever the reason, patients in large parts of the country are receiving substantially less direct care from RNs. If this variability is not entirely attributable to differences in patient mix, it may prove fruitful to identify the other factors underlying it.

There was some tendency for lower RN staffing levels to be accompanied by higher non-RN staffing levels (e.g., for child/adolescent units and in several census divisions), consistent with a previously reported negative correlation between unlicensed and licensed staffing levels on psychiatric units (Staggs, 2015a). Interestingly, this was not the case for units in for-profit facilities, where average levels of both RN and non-RN staffing were lower. Further research is needed to explain this finding.

One limitation of the study is the nature of the sample. Psychiatric units providing data to the NDNQI are not a random or fully representative sample of psychiatric units nationwide. Although NDNQI hospitals tend to differ in some ways from hospitals more generally (e.g., they tend to be larger, and teaching and Magnet-designated facilities are overrepresented), a diverse array of units and hospitals was well-represented in the study sample. Nevertheless, in the absence of a more comprehensive source of nationwide staffing data, we can generalize only with caution.

Reliance on self-reported staffing data from hospitals is a second limitation. Although NDNQI staffing data are not used in public reporting, they may be used in the Magnet accreditation process. Thus, there may be some incentive in hospitals seeking to earn or maintain Magnet designation to report inflated staffing levels to the NDNQI.

In conclusion, it may be worth asking why staffing on psychiatric units seems largely impervious to calls and efforts to improve safety and curb use of coercive measures. Although the importance of nurse staffing for patient care more generally is widely recognized, psychiatric staffing has received limited attention from researchers. As a result, links between staffing and patient outcomes are not well-established, and evidence to inform optimal staffing models is lacking. Research is needed to understand how the structures, processes, and outcomes of psychiatric care are related so that we can move beyond descriptive studies of psychiatric staffing to prescriptive staffing guidelines designed to ensure the quality and safety of psychiatric care.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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