HEALTH POLICY AND SYSTEMS

Nurse Staffing Levels Make a Difference on Patient Outcomes: A Multisite Study in Chinese Hospitals

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Abstract

Purpose: The purpose of this study is to examine the relationship between nurse staffing and patient outcomes in hospitals in mainland China.

Methods: The study was conducted in 181 hospitals across all of the eight economic zones in mainland China using a four-stage sampling design. Two instruments, the China Nurse Survey and the patient satisfaction measurement from the Hospital Consumer Assessment of Healthcare Providers and Systems, were employed in data collection. In this article, 7,802 nurse surveys and 5,430 patient surveys from 600 medical and surgical units were analyzed.

Results: The adjusted joint effects of nurse staffing on patient outcomes from logistic regression analyses showed that more nursing staff per patient had statistically significant positive effects on all necessary nursing care, nurses' reports of quality of care, their confidence on patients' self-care ability on discharge from the hospital, patient adverse events, as well as patients' report of satisfaction. When the nurse-to-patient ratio (total number of nurses on all shifts on the unit divided by total number of patients who stay on the unit) increased to the 0.5–<0.6 category, most patient outcomes were significantly improved, considering hospital and patient factors and nurse skill mix in the logistic regression models.

Conclusions: The findings provide evidence on how inadequate nurse staffing might result in missed but needed nursing care and negative patient outcomes, while better staffing levels could be an effective strategy for improving patient outcomes.

Clinical Relevance: We recommend that the nurse-to-patient ratio on medical and surgical units in Chinese hospitals be increased to at least 0.5–0.6 so as to secure patient safety and the quality of health services.

Quality of care is a focus in healthcare policy worldwide, and patient outcomes are widely accepted as a direct indicator of quality of care (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). Quality of care encompasses the principles of safe, effective, patient-centered, equitable, timely, and efficient health services (Institute of Medicine, 2001). Typical patient outcome measures would include not only nurse-reported adverse events such as patient falls and medication errors, but also patient satisfaction (Aiken, Sloane, Lake, Sochalski, & Weber, 1999). Rationing of nursing care, which was defined as "the withholding or failure to carry out necessary nursing tasks due to inadequate time, staffing level, and/or skill mix" (p. 417), was also proposed as a quality outcome (Schubert, Glass, Clarke, Schaffert-Witvliet, & De Geest, 2007). Nurses reported that the time they spent in non-nursing tasks often resulted in important elements of nursing care being left undone.

Nurse staffing is considered as a structural factor that is closely associated with patient outcomes, among the various factors such as hospital work environment and organizational composition (Donabedian, 1980). The Kane et al. (2007) systematic review of 100 studies concluded that there is ample evidence of an association between better nurse staffing and better patient outcomes, but much of this research was conducted in North America. Further research is needed to explore the effect of nurse staffing on patient outcomes outside of North America.

With a population of 1.34 billion people (National Bureau of Statistics of China, 2011), China had 2.21 million nurses by the end of September 2011 (China News Service, 2011), averaging 1.65 nurses per 1,000 people. The ratio of nurses to doctors in Chinese hospitals averages 1.21:1 (Ministry of Health, China [MOH], 2010). In China, the hospital nurse staffing ratio is calculated as total number of nurses divided by total number of hospital beds. A nurse-to-hospital bed ratio of 0.4:1 was set as the goal by the MOH in 1978 (MOH, 1978), but few studies tested whether it was achieved in the clinical settings and whether it could fulfill the needs of hospitalized patients. Health professionals in many hospitals in China complain about nurse shortages, and during their hospital stay patients would rely on their relatives to take care of them because of lack of nurse resources (Beijing Municipal Committee of Jiu-San Society, 2011). Although there have been some studies on nurse staffing and patient satisfaction in China, the majority of them were conducted in a single hospital or a single region. Knowledge of the impact of staffing on nurse-assessed patient outcomes and patient-reported satisfaction in China is limited. The purpose of this study is to examine the relationship between nurse staffing and patient outcomes in hospitals in mainland China.

Methods

The China Hospital Nursing Workforce Research (CNWR) was carried out by the China Medical Board China Nursing Network member universities' personel. This multisite collaborative study was led by the School of Nursing at Sun Yat-sen University (SYSU) in China with technical support from the Center for Health Outcomes and Policy Research of the University of Pennsylvania in the United States.

Sample

According to the National Development Research Center, the 31 provinces, municipalities, and autonomous regions (PMAs) in mainland China were divided into eight economic zones (geographic zones; Li, 2004). In the study, the participating hospitals were selected from nine PMAs across all of the eight economic zones to ensure geographical representation of the sample. The Chinese public hospitals are graded into three levels by size and technical complexity (MOH, 1989). Level 3 hospitals are the large, high-tech hospitals and Level 2 hospitals are those with medium size and technology. The study was conducted in 181 hospitals, which included 91 Level 3 hospitals (over 500 beds) and 90 Level 2 hospitals (300–500 beds), using a four-stage sampling design. First, hospitals were stratified by hospital level and location. Twenty general hospitals with equal numbers of Level 2 and Level 3 hospitals were drawn from each of the nine PMAs. Second, at least four units, including medical, surgical, and adult intensive care units (ICUs), within each hospital were drawn by systematic sampling according to a unit list, and finally three to eight units from each hospital participated. A total of 780 units participated, and data from 600 medical and surgical units were analyzed in this article. Data from adult ICUs will be analyzed in other reports. Third, patients who stayed at least 3 nights in the unit, were conscious, and were able to communicate were drawn by systematic sampling based on their bed code. The patient satisfaction measurement from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) were delivered to 7,295 patients, 6,724 (92.5%) of them were returned, and 6,494 (96.6%) of them were found to be valid. Fourth, we attempted to survey all staff nurses on the sampled units, excluding head nurses and nurse managers. A total of 10,221 China Nurse Surveys were delivered to nurses, which probably was the largest sample in China, 9,965 (97.5%) responses were received, and 9,698 (97.3%) of the returned questionnaires were usable. In this article, 7,802 nurse surveys and 5,430 patient surveys from medical and surgical units were analyzed.

Measures

The CNWR employed two instruments to evaluate the relationship between nurse staffing and patient outcomes. One was the China Nurse Survey, which included questions about nurse demographics, nurse-reported quality of care, nurse workload, nursing care, and patient safety. The China Nurse Survey was translated from English to Mandarin and validated through back-translation and content validity testing (Sermeus et al., 2011). It was pilot tested in a hospital in Guangdong province, and good reliability was reported previously (Liu, You, et al., 2011). The patient satisfaction measurement was adapted from HCAHPS. Translation and instrument validity examination for the survey to be applied in China was described elsewhere (Liu, Squires, & You, 2011).

Staffing. Nurse staffing was calculated as total number of nurses on all shifts on the unit divided by patient number who stay on the same unit. The total number of nurses on each unit was recorded by the research nurse who assisted in collecting data. The median number of patients who stay on the units reported by nurses was used as patient number.

The nurse staffing ratio calculation in China is different from that in some countries such as the United States. The nurse staffing ratio in the United States is calculated as the average number of patients per nurse. However, the nurse-to-patient ratio or patient-to-nurse ratio in China is calculated as the total number of nurses on all shifts on the unit or hospital and the total number of patients or hospital beds who stay on the unit or in the hospital. For example, on a medical unit in one of our sampled hospitals, there were a total of 17 nurses and 45 patients. For each day, seven nurses worked on day shift while two nurses worked on evening shift, two nurses on night shift, and one on evening and early morning shift, and five were off duty. For the day shift, the average number of patients per nurse was around 6.43 (=45/7), and the average number of patients per nurse for both the evening shift and night shift was around 18 [=45/(2 + 0.5)]. On this unit, the nurse-to-patient ratio was 0.38 (=17/45) and the patient-to-nurse ratio was 2.65 (=45/17).

For the purpose of the analyses in this article, we divided the medical and surgical staffing into four categories: nurse-to-patient ratios of <0.4, 0.4–<0.5, 0.5–<0.6 and ≥0.6. Then we estimated the impact of different nurse staffing levels on patient outcomes.

Patient outcomes. We examined four patient outcome indicators: rationing of nursing care, quality measures, patient adverse events, and patient satisfaction. The first three were measured with the China Nurse Survey.

In this study, rationing of nursing care was measured with "Which of the following activities were necessary but left undone because you lacked the time to complete them?" For all of the activities, responses of "*yes*" or "*no*" were requested; a response of "*yes*" indicated withholding or failure to carry out this particular nursing care (Schubert et al., 2008).

Quality measures were two single-item measures (Patrician, Shang, & Lake, 2010). Nurses were asked to categorize the quality of care usually received by patients on their unit. Another question surveyed nurses' confidence on their patients' self-care ability on discharge from the hospital. These two questions were graded on a 4-point Likert-type scale from 1 = *excellent or very confident* to 4 = *poor or not at all confident*.

Nurses were asked about how frequently adverse events occurred involving their patients, with seven categories of responses from 1 = *never* to 7 = *every day*. The events were selected from the American Nurses Association's (ANA) Nursing Quality Indicators (ANA, 2000). Responses were coded as binary data, then, "1 = *never*" and "2 = *a few times a year or less*" became one category, and "3 = *once a month or less*" to "7 = *every day*" became another category.

Patient satisfaction was measured by items from the HCAHPS, including one single item, "Dissatisfied with nurses' responsiveness to the call button," and one composite measure, "Dissatisfied with communication about medications," which included two items. These were 4-point Likert-type items: 1 = *never*, 2 = *sometimes*, 3 = *usually*, 4 = *always*. Higher scores indicated greater patient satisfaction. For the single item, patients were classified as satisfied if their score was 3 or 4. For the composite measure, patients were classified as satisfied if the average score of the two items was ≥ 3 (Jha, Orav, Zheng, & Epstein, 2008). Reliability detection of the patient satisfaction measurement was conducted with 750 patients in the sample of Guangdong province. Cronbach's α was 0.795 in the composite measure.

Demographics. Nurses' demographic data included age, gender, working years, education, and employment status. Demographics of patients included age, gender, education, health, and first language.

Procedure

The research project was approved by the Ethics Committee of the School of Nursing at SYSU. Data were collected between September 2008 and June 2010. Before data collection, study directors for the project, who were faculty members from the universities, were trained and reached agreement on procedural details. This training

was intended to ensure that the study would be conducted consistently at all nine sites. Then, approvals from hospital nursing managers were obtained.

In each unit generating data, informed consents from patients were sought before the survey. In order to get patients' honest opinions, patients filled in the survey themselves or were assisted by study directors and graduate students from the universities without the presence of hospital staff. Nurses completed the self-reported survey individually and anonymously and returned the survey in prepared envelopes, which indicated the implied consent of the participating nurses. All questionnaires completed by patients and nurses were returned to SYSU and data were coded and stored securely.

Data Analyses

Descriptive statistical analyses were run on all the variables. Chi-square tests were used to examine the relationship between staffing categories and hospital characteristics and unit type. Logistic regression models were used to estimate the influence of nurse staffing level on each patient outcome after adjusting for a number of potentially confounding factors. For nurse-reported outcomes, hospital characteristics as well as unit type and nurse skill mix were used as covariate variables. Hospitals with facilities for open heart surgery or major transplants were classified as high technical complexity hospitals and contrasted with other hospitals. Hospitals were grouped into three location categories: municipality (a city directly under the central government), capital city, and other cities of a province or autonomous region. For analyses of patient satisfaction, the variables controlled included demographics of patients, hospital characteristics, unit type, and nurse skill mix. All analyses were performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA), and $p < .05$ was considered statistically significant in all analyses.

Results

Demographics of the Nurse and Patient Sample

As shown in **Table 1,** 99.50% of the medical and surgical nurses were female, and their average age was 29.42 years. In our sample, nurses' initial education was mainly secondary diploma (64.29%), and only 4.95% received their initial nursing education from baccalaureate programs. About half (52.13%) of the nurses were employed by the hospitals as contract nurses rather than permanent employees, and their average work experience in nursing was 8.73 years.

The demographics of patients are also shown in **Table 1**. Of the 5,430 patients surveyed, 54.75% were male, and the average age of the patients was 54.24 years. Junior middle school (27.85%) and senior middle school (22.98%) were the main educational levels, and 7.71% of the patients completed baccalaureate or higher education. The proportion of patients with Chinese Mandarin as the main language spoken at home was 51.78%. About 47.90% of the patients rated their overall health as fair or poor. They had been in hospitals for 14.83 days on average when the survey was conducted.

Table 2 shows nurse staffing levels on the units by hospital characteristics and unit type. Chi-square test showed that there is no statistically significant relationship ($p > .05$) between staffing categories and hospital characteristics as well as unit type. This provides the possibility of comparing the effects of different nurse staffing levels on patient outcomes. **Table 2** also shows that 68.83% of the units had a nurse-to-patient ratio of less than 0.4.

Patient Outcomes

As shown in **Table 3**, more than one-third of the nurses (35.30% and 35.00%, respectively) reported that adequate patient surveillance and preparing patients and families for discharge were necessary but left undone. Around one-fifth of the nurses (21.88% and 21.19%, respectively) claimed that skin care and pain management were left undone because of limited time, and 7.48% claimed that treatments and procedures were left undone. In the hospitals, 30.39% of the nurses reported fair or poor quality of care, and 43.74% of them felt not at all confident or somewhat confident about their patients' self-care ability on discharge from the hospital. As to the patient adverse events in the past year, 16.73% of the nurses reported use of physical restraints, 6.71% reported surgical site infections, 4.40% reported that patients received the wrong medication or dose, and 4.16% reported pressure ulcers developed after admission, respectively. Of patient satisfaction, about half of the patients were dissatisfied with communication about medications, and 7.63% of the patients were dissatisfied with nurses' responsiveness to the call button.

Effects of Nurse Staffing on Patient Outcomes

Table 3 shows the estimates of the adjusted joint effects of the four different categories of nurse staffing levels on patient outcomes from logistic regression analyses, when the ≥ 0.6 category is the referent category. In the <0.4 column, the odds ratios (ORs) were 1.22–2.04 for most items in the rationing of nursing care, nurse-reported quality of care, patient adverse events, and

Table 1. Demographics of Nurse ($n = 7,802$) and Patient ($n = 5,430$) Sample in the Medical and Surgical Units[a]

Nurse	Mean (SD)	Patient	Mean (SD)
Age (yr)	29.42 (7.07)	Age (yr)	54.24 (17.65)
Working years as a nurse	8.73 (7.65)	Length of stay[b]	14.83 (18.56)
Gender	n (%)	Gender	n (%)
Female	7,612 (99.50)	Female	2,422 (45.25)
Male	38 (0.50)	Male	2,930 (54.75)
Initial education		Education	
Secondary diploma	4,961 (64.29)	No schooling or primary school	1,569 (29.29)
Advanced diploma	2,374 (30.76)	Junior middle school	1,492 (27.85)
BSN degree[c]	382 (4.95)	Senior middle school	1,231 (22.98)
Highest education		College or higher	1,065 (19.88)
Secondary diploma	1,418 (18.41)	Self-rated health	
Advanced diploma	4,720 (61.28)	Good	2,787 (52.10)
BSN degree or higher	1,564 (20.31)	Fair or poor	2,562 (47.90)
Employment status		First language	
Contract nurse	3,933 (52.13)	Chinese Mandarin	2,779 (51.78)
Permanent nurse	3,524 (46.71)	Dialects	2,588 (48.22)
Other	87 (1.15)		

[a]Sample size for individual item varied because of missing data. [b]Length of stay when the survey was conducted. [c]Bachelor of Science in Nursing degree.

Table 2. Distribution of Hospital Characteristics and Unit Type by Nurse Staffing on the Units (n [%], $n = 600$)

	Nurse staffing on the units (nurse per patient)				
	<0.4	0.4–<0.5	0.5–<0.6	≥0.6	p
Hospital level					.122
Level 3	180 (69.23)	41 (15.77)	25 (9.62)	14 (5.38)	
Level 2	233 (68.53)	53 (15.59)	21 (6.18)	33 (9.71)	
Technical complexity[a]					.679
High	197 (70.61)	42 (15.05)	22 (7.89)	18 (6.45)	
Low	214 (68.15)	50 (15.92)	22 (7.01)	28 (8.92)	
Location[b]					.417
Municipality	72 (64.86)	23 (20.72)	6 (5.41)	10 (9.01)	
Capital city	168 (69.42)	39 (16.12)	16 (6.61)	19 (7.85)	
Other city	173 (70.04)	32 (12.96)	24 (9.72)	18 (7.29)	
Unit type					.081
Medical	228 (72.84)	47 (15.02)	20 (6.39)	18 (5.75)	
Surgical	185 (64.46)	47 (16.38)	26 (9.06)	29 (10.10)	
Total	413 (68.83)	94 (15.67)	46 (7.67)	47 (7.83)	

[a]$n = 593$. High technical complexity hospitals are hospitals with facilities for open heart surgery or major transplants. [b]A municipality is a city directly under the central government. In a province or autonomous region, hospital location was subdivided into capital city and other city.

patient satisfaction measures, implying that the odds for these negative patient outcomes were 1.22–2.04 times more likely in the nurse-to-patient ratio < 0.4 category than in the ≥ 0.6 category. In the 0.4–<0.5 column, the ORs were 1.45–2.23 for most items in the nurse-reported quality of care, patient adverse events and patient satisfaction measures, implying that the odds for these negative patient outcomes were 1.45–2.23 times more likely in the nurse-to-patient ratio 0.4–<0.5 category than in the ≥0.6 category. However, no significant differences were observed in the rationing of nursing care measures between the 0.4–<0.5 and ≥0.6 staffing categories. In the 0.5–<0.6 column, no statistical difference was found between the 0.5–<0.6 staffing category and the ≥0.6 category on most patient outcome measures, with one exception in quality measures. The OR for nurses not being confident about their patients' self-care ability on discharge was 1.54, indicating that the odds were higher in the 0.5–<0.6 category than in the ≥0.6 category.

Table 3. Effects of Nurse Staffing on Patient Outcomes[a]

		Nurse staffing on the units (nurse per patient)		
	n (%)	<0.4	0.4–<0.5	0.5–<0.6
Nurse assessed quality outcomes (n = 7,802)[b]				
Rationing of nursing care[c]				
Adequate patient surveillance	2,713 (35.30)	1.22 (1.02–1.46)*	1.04 (0.84–1.29)	0.81 (0.62–1.04)
Prepare patients and families for discharge	2,691 (35.00)	1.42 (1.17–1.71)**	1.09 (0.88–1.36)	1.02 (0.79–1.32)
Skin care	1,682 (21.88)	1.35 (1.09–1.68)**	0.97 (0.75–1.26)	0.92 (0.68–1.24)
Pain management	1,629 (21.19)	1.33 (1.07–1.66)*	1.17 (0.91–1.51)	1.18 (0.88–1.59)
Treatments and procedures	575 (7.48)	1.47 (1.02–2.11)*	1.12 (0.73–1.71)	1.25 (0.78–2.00)
Quality measures				
The daily quality of care reported by nurses as fair or poor	2,351 (30.39)	1.49 (1.21–1.83)**	1.65 (1.31–2.09)**	1.01 (0.76–1.34)
Nurses are not confident about patients' self–care ability on discharge	3,384 (43.74)	1.34 (1.05–1.72)*	1.45 (1.07–1.96)*	1.54 (1.08–2.20)*
Patient adverse events				
Use of physical restraints	1,274 (16.73)	1.38 (1.06–1.80)*	2.09 (1.57–2.70)**	1.36 (0.97–1.92)
Surgical site infections	504 (6.71)	1.55 (1.04–2.30)*	1.55 (1.00–2.42)	1.23 (0.73–2.07)
Patient received wrong medication or dose	337 (4.40)	1.23 (0.78–1.95)	1.68 (1.02–2.78)*	1.17 (0.63–2.15)
Pressure ulcers develop after admission	319 (4.16)	1.89 (1.09–3.28)*	1.85 (1.01–3.38)*	1.19 (0.57–2.50)
Patient satisfaction (n = 5,430)[d]				
Dissatisfied with communication about medications	1,771 (49.35)	1.88 (1.33–2.65)**	2.23 (1.52–3.26)**	1.48 (0.95–2.30)
Dissatisfied with nurses' responsiveness to the call button	410 (7.63)	2.04 (1.09–3.81)*	1.69 (0.86–3.33)	0.75 (0.32–1.78)

[a]Odds ratios, indicating the risk associated with the change from higher staffing level (referent category was nurse-to-patient ratio ≥ 0.6) to lower staffing level, and confidence intervals were derived from logistic regression analyses. [b]Adjusted models included controls for hospital characteristics (hospital level and location), unit type (medical vs. surgical), and nurse skill mix (initial nursing education, working time as a nurse, and employment status). [c]N (%) of rationing of nursing care indicated rationing of the particular nursing care, which meant nurses withheld or failed to carry out their necessary nursing tasks due to limited time. [d]Adjusted models included controls for hospital characteristics (hospital level and location), unit type (medical vs. surgical), aggregated nurse skill mix (initial nursing education and working time as a nurse), and patient demographics (gender, age, length of stay when the survey was conducted, self-rated health status, educational level, and first language). *p < .05; **p < .01.

Discussion

Our findings showed that the nurse-to-patient ratio in more than two thirds of medical and surgical units did not meet the 0.4:1 standard that had been set for decades. Though the nurse-to-hospital bed ratio reported by the MOH reached 0.42:1 on average nationwide in 2009 (MOH, 2010), this ratio was calculated by the total number of nurses in hospitals divided by the total number of hospital beds. In other words, the total number of nurses included both the nurses who worked in clinical first-line positions and those who worked in nonclinical positions. Our study examined the nurse-to-patient ratio in medical and surgical units that were the actual staffing level at clinical settings and indicated that there is a shortage of clinical first-line nurses in Chinese hospitals.

As a result of lack of staff, nurses frequently reported that a number of nursing tasks that were relevant to patient safety and good nursing care were left undone. The rates of some tasks were much higher than what was reported in other countries. For example, 35% of the nurses in our study reported that preparing patients and families for discharge was left undone, as compared with 13% on average in a study involving 43,329 nurses in

five countries (Aiken et al., 2001). When asked about the frequency of patient adverse events, more nurses in our sample reported the use of physical restraints and surgical site infections than what was reported in previous research (Hanrahan & Aiken, 2008). About 30% of the nurses reported that the quality of nursing care was poor or fair, and more than two-fifths of the nurses were not confident about their patients' self-care ability on discharge. These rates were much higher than what was reported in the United States, United Kingdom, and Germany (Aiken et al., 2011). Most patients reported satisfaction with nurses' responsiveness to the call button, but there was a great deal of dissatisfaction with the communication of hospital staff with respect to medications. All of these findings indicate that the quality of care and patient safety need to be improved in Chinese hospitals.

In our findings from 600 medical and surgical units, different nurse staffing levels make a difference on patient outcomes, considering hospital and patient factors as well as the nurse skill mix. Specifically, more nurse staff per patient had statistically significant positive effects on patient outcomes. The results are comparable with those from studies in the United States and Europe. A research conducted in Pennsylvania found that each additional

patient added to a nurse's workload was associated with a 7% increase in mortality following common surgical procedures (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). Schubert et al. (2007) found a significant correlation between lower nurse-to-patient ratio and higher levels of implicit rationing of nursing care, which may explain how the structural factors affect outcomes.

As to different nurse staffing levels on patient outcomes, our findings showed that rationing of nursing care, nurse-reported quality of care, patient adverse events, and patient satisfaction were improved with the nurse-to-patient ratio ≥0.6 category as compared with the <0.4 category. When the nurse-to-patient ratio continued to increase to ≥0.4, nurse-reported quality of care, patient adverse events, and patient satisfaction were still more likely to be better with the ≥0.6 category than the ≥0.4 category. Then, the only significant improvement between the ≥0.5 category and the ≥0.6 category was the nurses' confidence about their patients' self-care ability on discharge. The relationship between different staffing levels and patient outcomes demonstrates a logical ordering, indicating that the rationing of nursing care was first relieved when the staffing level increased from <0.4 to ≥0.4, and other aspects of patient outcomes were further improved along with the increase in staffing at different levels.

Through exploring detectable differences in adjusted patient outcomes indicators with different nurse staffing levels in hospitals across mainland China, our findings indicate that the increase of the nurse staffing standard to a sound level should be a priority in health reform. We suggest that the minimum nurse-to-patient ratio on medical and surgical units in Chinese hospitals be increased to at least 0.5–0.6 to reduce preventable adverse consequences, ensure patient safety and quality nursing care, and increase patient satisfaction.

Recently, the MOH set a new standard for clinical first-line nurse-to-hospital bed ratio, which is 0.6:1 for Level 3 hospitals and 0.4:1 for Level 2 hospitals, and the goal is to be achieved by 2015 (MOH, 2011). Nurse staffing levels were not significantly different between Level 3 and Level 2 hospitals in our sample. However, considering the different patient acuity in Level 3 and Level 2 hospitals, having different staffing levels seems reasonable. The implementation of the new standard and its effectiveness in practice needs to be examined in the future.

One limitation of this study is that the data are mainly from nurse and patient reports. In the future, when the hospital information system is improved in China, objective evidence (such as records for patient adverse events, patient mortality, and failure to rescue, etc.) will be collected to gain a complete understanding of patient outcomes.

Conclusions

Our findings demonstrate that there is a shortage of clinical first-line nurses in Chinese hospitals and the quality of care and patient safety needs to be improved. The relationship between different staffing levels and patient outcomes demonstrates a logical ordering, which indicates that the rationing of nursing care was first relieved when staffing level increased from <0.4 to 0.4, and other aspects of patient outcomes were further improved along with the increase in staffing at different levels. Our findings suggest that improvement of nurse staffing level could be a highly effective strategy for improving patient outcomes. We recommend that the minimum nurse-to-patient ratio on medical and surgical units in Chinese hospitals be increased to at least 0.5–0.6 to ensure patient safety and quality nursing care, and increase patient satisfaction.

Acknowledgments

Clinical Resource

- Ministry of Health, China: http://www.moh.gov.cn

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