

The Relationship Between Nursing Workload, Quality of Care, and Nursing Payment in Intensive Care Units

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ABSTRACT

Background: Nursing workload is highly associated with patient safety. It has been argued that the imbalance between nursing payment and nursing workload in Taiwan National Health Insurance (NHI)-covered intensive care units (ICUs) has resulted in the inadequate allocation of nursing manpower. However, limited empirical data are currently available to support this argument.

Purpose: The aim of this study was to investigate the correlation between nursing workload, quality of care, and NHI-covered nursing payments in ICU settings.

Methods: This macrodata analysis study retrieved data from the existing ICU patient classification system, nursing quality monitoring system, and infection control monitoring system of a medical center in central Taiwan. Data on the Therapeutic Intervention Scoring System-28 (TISS-28) and non-TISS-28 scores, nursing hours, and nursing labor utilization rate were retrieved for the 23-month period beginning in January 2013 and ending in November 2014. The indices of care quality used in this study included incidence of falls, pressure sore density, incidence of restraint use, incidence of tube self-extraction, and infection density.

Results: A total of 92,442 data sets were collected from eight ICUs, with 61% of the direct ICU nursing hours categorized as TISS-28 and 39% categorized as non-TISS-28. Mean nursing hours totaled 12.5 hours. The direct nursing hours, the total nursing hours, the bed occupancy rate, the nursing hours calculated by patient classification system, and the nursing hours calculated by nurse–patient ratio were statistically, significantly correlated respectively with all of the care quality indices except for incidence of falls. The number of items of patient care in the patient classification records was greater than that of NHI-covered nursing payments. The NHI-covered nursing payment for every patient accounted for only 4.77% of the total medical expenses in the ICU.

Conclusions/Implications for Practice: Data from the patient classification database, quality monitoring database, and medical cost database indicate excessive nursing workload and underpayment from the Taiwan NHI program. Current nursing workload was significantly associated with care quality. This study provides empirical data for administrators to consider when revising nursing staffing and NHI payment policies.

KEY WORDS:

nursing workload, care quality, nursing payment, patient classification system.

Introduction

The intensive care unit (ICU) workload affects care quality and mortality (Aiken et al., 2011; Cho et al., 2015; Cho, Hwang, & Kim, 2008; Cho & Yun, 2009; Miranda, de Rijk, & Schaufeli, 1996; Padilha et al., 2007). Care quality is negatively influenced by factors including patient falls, pressure sores, infections, and other adverse events. A systematic literature review investigating resources and adverse outcomes in nursing ICUs indicated that, of 15 studies (1989–2002), only two found a statistical correlation among nursing resources and adverse events, only one found a correlation between nursing resources and mortality, seven found no statistical correlation between nursing resources and mortality, and 10 found a correlation between nursing resources and adverse events, although no statistical tests were performed (West, Mays, Rafferty, Rowan, & Sanderson, 2009). Miranda et al. (1996) developed the Therapeutic Intervention Scoring System-28 (TISS-28) to reclassify and simplify the 76 items of the TISS into 28 items. They also performed an investigation on nursing activities and divided these into six major categories, with TISS-28 as one of the categories. TISS-28 may also be used to predict the therapeutic costs and work assignments of nursing personnel (Goj, Knapik, Kuciewicz-Czech, & Lubon, 2009) as the basis for the workloads of different ICU nursing

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personnel (Padilha et al., 2007). Furthermore, recent studies in Taiwan investigating the correlation between nursing workload and patient safety have shown a correlation between hours of overtime and patient safety indices. In addition, when the patient–nurse ratio exceeds 7, the risks associated with indices such as falls, decubitus, the incidence of tube self-extraction, nosocomial pneumonia, and urinary tract infection increase (Liu, Lee, Chia, Chi, & Yin, 2012). Moreover, the findings of some studies indicate that increasing daily nursing hours by 1 hour decreases the number of patients with infection in wards by 0.02%, decreases the number of patients receiving cardiopulmonary resuscitation in wards by 0.18%, and increases the number of emergency patient success rate of resuscitation by 0.17% (Liang et al., 2010).

Despite the high average number of hours spent by nurses on caring for ICU patients, the Taiwan National Health Insurance (NHI) Administration (formerly the Bureau of NHI) approved payments averaging only NT\$16,883 per nurse per month. This amount accounts for less than 40% of the average personnel costs of nursing personnel (NT\$47,000). Moreover, the 42 specific NHI-covered diagnosis/treatment items fully implemented by nursing personnel accounted for only 1% of the overall items of NHI. In addition to “ward nursing payments,” many items covering direct or indirect participation of nursing personnel are included in the coverage points of various diagnosis and treatment items and are paid in a package (nonitemized) format (Ministry of Health and Welfare, Taiwan, ROC, 2012).

In summary, whereas nursing workloads are known to be negatively associated with patient safety, the NHI-covered ICU nursing payments are low and not proportional to workload. Therefore, it is important to acquire empirical data on the correlations among ICU workload, patient safety, and NHI-covered nursing payments. The purpose of this study was to examine the correlation between ICU nursing workload and

care quality and between ICU nursing workload and NHI-covered nursing payments.

Methods

Research Design

This was a macrodata analysis of data retrieved from the existing ICU patient classification system (PCS), nursing quality monitoring system, and infection control monitoring system of a medical center in central Taiwan. Data from January 2013 to November 2014, a total of 23 months, were analyzed. Data of interest included TISS-28 scores, total nursing hours, utility index of nursing manpower (UINM), mortality, relevant care quality data, and NHI-covered nursing payments.

Subjects

Nursing personnel and patients of the eight ICUs (136 beds in total) at the targeted medical center contributed the data. The main data collected from the patient classification information system included indices of nursing workload such as TISS-28 and non-TISS-28 scores, average daily total nursing hours of units, nursing hours by PCS, and UINM. Moreover, this study analyzed nursing hours, which were calculated according to the nurse–patient ratio (NPR) of number of nursing personnel taking care of patients per day and the bed occupancy rate. Care quality data were collected from the hospital nursing quality monitoring system. Data on incidence of falls, incidence density of pressure sores, incidence of patient restraint, incidence of tube self-extraction, and incidence density of infection for analysis were also collected. NHI-covered nursing payment items from the PCS and NHI-nursing payment items under application, as extracted from hospital patient expense files, were also retrieved.

TABLE 1.
Direct Nursing Hours, TISS-28

Unit	Day	Bed	Basic Care		Ventilation Support Care		Cardiovascular Support Care	
			Mean	SD	Mean	SD	Mean	SD
CCU	698	16	37.5	6.8	15.9	4.5	4.5	2.9
MICU	698	17	47.4	5.5	44.8	5.1	4.5	1.6
NSCU	698	16	39.7	4.7	29.3	5.4	3.1	1.3
NICU	697	14	22.9	4.4	27.6	5.8	2.9	1.5
PICU	698	15	24.4	7.0	19.7	6.0	1.6	1.7
RICU	696	24	46.6	7.8	44.5	8.0	3.7	1.7
SICU	698	22	61.9	8.7	49.6	7.4	10.5	2.9
TNCU	698	12	24.4	5.9	17.8	4.8	0.9	0.5
Total	5,581	136	38.1	6.4	31.1	5.9	3.9	1.8

Note. TISS-28 = Therapeutic Intervention Scoring System 28; CCU = coronary care unit; MICU = medical intensive care unit; NSCU = neurosurgical care unit; NICU = neonatal intensive care unit; PICU = pediatric intensive care unit; RICU = respiratory intensive care unit; SICU = surgical intensive care unit; TNCU = trauma-neuro care unit.

Definitions of Terms

1. Nursing activities: activities of ICU nurses, including direct nursing, indirect nursing, relevant nursing, and personal activities.
2. Direct nursing: direct nursing care and services received by patients, including the preparation stage, operational stage, and utensil arrangement stage. This study included direct nursing activities belonging to TISS-28 and direct nursing activities not belonging to TISS-28.
3. Care quality: Mortality and relevant care quality data, including incidence of falls, incidence density of pressure sores, incidence of patient restraint, incidence of tube self-extraction, and incidence density of infection, were collected from a hospital information system.
4. Nursing workload: Direct nursing of TISS-28 and non-TISS-28, nursing hours by PCS (PCS nursing hour), and nursing hours by NPR (NPR nursing hour) [(number of nursing personnel in three shifts \times 8) / (number of beds \times bed occupancy rate)] were used to calculate nursing workload.
5. The statistical formula used for patient classification is described below (Chang, Lin, Lu, Wang, & Chang, 2002):

Calculation of PCS nursing hours

Total nursing hours/patient/day (minutes) = direct nursing time (minutes) + indirect nursing time (174.9 minutes) + relevant nursing time (28.8 minutes)

Total nursing hours/unit = [direct nursing time (minutes) of all the patients + number of patients \times 203.7 minutes] / 60 minutes

Calculation of the utility index of nursing manpower

Day Shift Utility Index (D-UINM), Evening Shift Utility Index (E-UINM), and Night Shift Utility Index (N-UINM) were calculated as follows: shift ideal nursing care unit / shift actual nursing care unit \times 100

6. NHI-covered nursing payment items: in compliance with the version of "The National Health Insurance Pharmaceutical Benefits and Reimbursement Schedule," as implemented on July 1, 2014, covering 44 diagnosis and treatments items that are mainly offered by nursing personnel.

Data Collection

After receiving institutional review board approval (No. CE13311), the ICU patient classification information system, nursing quality monitoring system, and infection control system were accessed to extract data, which were then categorized by NHI-covered nursing payment items. Next, the data were arranged and inspected, with items of data that did not meet the exclusion criterion deleted. Finally, definition coding and statistical analysis were performed. Data covering the period from January 2013 to November 2014 were used in the analysis.

Results

Analysis on Intensive Care Unit Direct Nursing Hours

This study collected 5,581 days of patient classification data from eight ICUs covering a period of 23 months (698 days). As shown in Table 1, most of the nursing hours were spent on basic care (38.1 ± 6.4), ventilation support care (31.1 ± 5.9), and metabolic support care (5.9 ± 1.5). The proportions of various items also varied with the characteristics of the various ICUs.

Table 2 lists the average daily direct nursing hours provided by the ICUs that were not related to TISS-28 (i.e., were non-TISS-28). Most of the nursing hours in this category were

Renal Support Care		Neurological Support Care		Metabolic Support Care		Special Interventional Treatment or Procedure	
Mean	SD	Mean	SD	Mean	SD	Mean	SD
1.9	1.3	0.0	0.1	4.3	0.9	4.4	2.7
2.6	1.4	0.1	0.3	6.7	0.9	2.5	1.4
1.2	0.5	3.0	1.6	5.1	1.0	1.5	1.1
0.4	0.4	0.0	0.0	10.6	4.5	0.9	0.8
1.0	1.0	0.1	0.3	3.8	1.1	1.2	1.3
2.6	1.1	0.1	0.2	8.5	1.3	1.8	1.2
4.1	1.5	0.1	0.2	6.8	1.3	1.9	1.5
0.4	0.3	2.5	1.4	3.4	1.0	0.8	0.8
1.8	0.9	0.7	0.5	5.9	1.5	1.9	1.3

TABLE 2.
Direct Nursing Hours, Non-TISS-28

Unit	Day	Support		Communication		Safety		Comfortable		Hygiene	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
CCU	698	7.1	2.6	14.8	4.9	0.5	0.3	1.4	0.7	18.8	3.4
MICU	698	0.9	0.8	9.4	4.0	0.9	0.4	0.9	0.4	22.5	2.6
NSCU	698	0.4	0.6	3.1	1.7	0.8	0.5	0.8	0.4	15.1	2.2
NICU	697	1.2	1.5	6.0	7.2	4.2	3.8	3.2	0.9	15.6	3.5
PICU	698	2.4	1.4	10.4	4.1	0.4	0.3	1.4	0.6	16.6	4.2
RICU	696	2.3	1.5	12.6	4.0	1.2	0.7	1.0	0.4	26.2	4.0
SICU	698	7.5	2.7	14.9	3.7	1.8	0.7	1.8	0.7	21.9	2.9
TNCU	698	0.3	0.4	3.4	1.5	0.3	0.4	0.5	0.2	10.4	2.7
Total	5,581	2.8	1.4	9.3	3.9	1.3	0.9	1.4	0.5	18.4	3.2

Note. TISS = Therapeutic Intervention Scoring System; CCU = coronary care unit; MICU = medical intensive care unit; NSCU = neurosurgical care unit; NICU = neonatal intensive care unit; PICU = pediatric intensive care unit; RICU = respiratory intensive care unit; SICU = surgical intensive care unit; TNCU = trauma-neuro care unit.

spent on hygiene (18.4 ± 3.2), activities (17.8 ± 2.6), and communication (9.3 ± 3.9). The average daily direct nursing hours provided by each ICU was 137.6 ± 20.8 , with 83.7 ± 13.8 hours categorized as TISS-28 (61%) and 53.9 ± 9.4 hours categorized as non-TISS-28 (39%).

Intensive Care Unit Nursing Hours and Utility Index of Nursing Manpower

As shown in Table 3, subjects received an average of 12.49 nursing hours per day per ICU; the average number of nursing hours was 12.39 at adult ICUs and 12.81 at pediatric ICUs. In terms of UINM, the night-shift UINM was $114.78\% \pm 16.41\%$, the day-shift UINM was $113.66\% \pm$

18.89% , and the evening-shift UINM was $108.8\% \pm 16.83\%$, indicating that the UINM of night and day shifts was higher. In other words, there was a relative lack of manpower and significant work overloading.

Correlation Between Intensive Care Unit Nursing Workload and Care Quality

As shown in Table 4, the average Acute Physiology and Chronic Health Evaluation (APACHE) II score of the five adult ICUs was 20.57 ± 3.21 . The APACHE II scores of the medical and respiratory ICUs were higher. In terms of care quality, only four patients at the cardiac ICU experienced falls, whereas other patients did not experience any

TABLE 3.
Nursing Hours and Utility Index of Nursing Manpower

Unit	Day	Bed	Mean Patient Number/Day	Total Nursing Hour		N-UINM		D-UINM		E-UINM		Nursing Hour by PCS
				Mean	SD	Mean	SD	Mean	SD	Mean	SD	
CCU	698	16	13.60	178.19	30.02	117.35	15.59	129.08	26.47	121.29	20.42	13.18
MICU	698	17	15.97	221.34	18.70	122.91	15.46	118.19	14.87	113.05	13.95	13.88
NSCU	698	16	15.26	175.87	15.79	115.83	12.06	101.19	11.97	108.93	13.05	11.55
NICU	697	14	11.42	142.86	24.14	116.37	19.76	120.85	22.38	112.49	17.61	12.61
PICU	698	15	10.15	131.54	32.14	110.72	17.91	117.66	24.52	113.91	21.62	13.01
RICU	696	24	21.74	252.64	32.05	115.17	15.80	100.60	12.07	100.92	13.89	11.63
SICU	698	22	21.09	288.37	28.81	119.12	15.98	116.92	16.77	108.85	16.54	13.75
TNCU	698	12	10.63	114.22	23.75	100.78	18.76	104.79	22.05	90.99	17.58	10.33
Total	5,581	136		188.13	25.68	114.78	16.41	113.66	18.89	108.80	16.83	12.49

Note. CCU = coronary care unit; MICU = medical intensive care unit; NSCU = neurosurgical care unit; NICU = neonatal intensive care unit; PICU = pediatric intensive care unit; RICU = respiratory intensive care unit; SICU = surgical intensive care unit; TNCU = trauma-neuro care unit; N-UINM = night-shift utility index of nursing manpower; D-UINM = day-shift utility index of nursing manpower; E-UINM = evening-shift utility index of nursing manpower; PCS = patient classification system.

Activities		Movement		Assistance		Subtotal TISS-28		Subtotal Non-TISS-28		Total TISS	
Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
16.3	3.1	4.5	2.3	1.1	1.4	68.5	13.9	64.5	12.9	133.0	24.3
21.5	1.6	1.4	0.9	1.5	1.0	108.6	11.2	59.0	7.2	167.6	15.9
19.6	1.7	1.0	0.8	0.9	0.7	82.8	11.0	41.6	4.4	124.4	13.3
7.7	2.6	0.8	0.6	0.3	0.4	65.3	12.5	39.0	11.0	104.3	18.3
12.0	3.1	1.1	0.8	0.6	0.5	51.9	14.3	44.9	11.7	96.8	24.6
24.6	3.0	1.2	0.7	2.6	2.5	107.7	17.6	71.8	10.5	179.5	25.8
28.9	3.2	2.2	1.0	4.0	1.7	134.9	18.2	82.9	10.7	217.8	26.5
12.2	2.8	0.5	0.5	0.3	0.3	50.0	11.9	27.8	6.6	77.8	17.8
17.8	2.6	1.6	1.0	1.4	1.0	83.7	13.8	53.9	9.4	137.6	20.8

falls. The incidence density of pressure sores was 0.18% (range = 0.14%–0.24%), the average incidence of patient restraint was 5.24% (range = 0%–8.35%), the average incidence of tube self-extraction was 0.29% (range = 0.11%–0.87%), the average incidence density of infection was 8.29% (range = 3.97%–12.36%), and the average mortality rate was 10.35% \pm 8.21% (range = 3.21%–22.15%). Examined using Pearson correlation, the variable PCS nursing hours was positively correlated with NPR nursing hours ($r = .51$, $p < .01$), the incidence of patient restraint was significantly correlated with higher APACHE II scores ($r = .63$, $p < .01$), and the incidence of self-extubation was significantly negatively correlated with incidence of patient restraint ($r = -.25$, $p < .01$). In terms of bed occupancy rate, direct nursing hours, total nursing hours, NPR nursing hours, the incidence of patient restraint, and APACHE II scores were positively correlated with mortality rate. However, the incidence density of infection was negatively correlated with higher nursing hours (Table 5).

Correlation Between Intensive Care Unit Nursing Workload and National-Health-Insurance-Covered Nursing Payment

A total of 92,442 items of data from daily ICU patient classification records were collected. The results showed that the number of PCS-covered items was significantly higher than the number of NHI-covered nursing payment items. The five items with the greatest disparities included respiratory tract suction (times), perineal rinsing, nasogastric tube feeding, nursing care surveillance fee of physical restraint days, and use of a heat lamp. The top five NHI-covered nursing payment items were feeding pump (days), a small amount

or retention of enemas, 24-hour ECG monitor, ice blanket (within 12 hours), and drug sensitivity tests. Twelve NHI-covered nursing payment items were not recorded (27.3%; 12/44 = 27.3%). The average NHI-covered ICU payment was NT\$186,141. However, an average of only NT\$7,246 was paid under NHI-covered nursing payments. Approximately 2% of the patients (210 patients) did not apply for NHI-covered nursing payment items. The NHI-covered nursing payment of every patient accounted for an average of 4.77% of the total ICU medical expenses.

Discussion

Intensive Care Unit Workload

The average daily total direct nursing hours provided by each ICU were 61% TISS-28 and 39% non-TISS-28. This result is consistent with the results of prior research (Chang, Lin, Yu, Lu, & Chang, 2009; Chang, Yu, Shih, & Pong, 2013) and reflects the stability of this PCS. For ICU nursing hours, Yeh and Chao (2010) conducted a focus group. In their study, the nursing supervisors suggested that the ideal nursing hours of ICU should be >12 hours. A questionnaire survey of the Taiwan Union of Nurses Association in December 2010 showed that the average patient–bed ratio for ICUs in 17 medical centers was 2.51 and that the average nursing hours were 12.66 (Foundation of Medical Professionals Alliance in Taiwan, 2010). This study showed that the average number of nursing hours in the eight ICUs based on patient classification was 12.49. This finding indicates that increasing nursing manpower remains an issue awaiting effective resolution. In terms of UINM, night-shift UINM, day-shift UINM, and evening-shift UINM were 114.78% \pm 16.41%, 113.66% \pm 18.89%, and 108.8% \pm 16.83%, respectively, which improved significantly compared

TABLE 4.
Nursing Workload and Care Quality Indices of the Eight ICUs

Item	CCU (<i>n</i> = 16)		MICU (<i>n</i> = 17)		NSCU (<i>n</i> = 16)		NICU (<i>n</i> = 14)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Indices of nursing workload								
Bed occupancy rate	0.85	0.06	0.94	0.03	0.95	0.04	0.82	0.10
Total direct nursing hours	133.08	11.64	167.56	9.32	124.48	7.98	104.31	10.64
Total nursing hours/unit	178.27	14.35	221.36	10.26	175.94	9.55	142.97	14.40
Nursing hours by PCS	13.18	0.51	13.88	0.49	11.55	0.36	12.61	0.95
Nursing hours by NPR	10.72	0.45	11.81	0.55	10.72	0.38	10.86	0.82
APACHE II			25.00	1.28	19.96	1.22		
Indices of care quality								
Incidence density of pressure sores (%)	0.24	0.24	0.17	0.17	0.22	0.21	0.21	0.26
Incidence of patient restraint (%)	4.96	1.27	8.35	1.70	5.47	1.37	0.00	0.00
Incidence of falls (%)	0.04	0.10	0.00		0.00		0.00	
Incidence of tube self-extraction (%)	0.24	0.48	0.19	0.21	0.12	0.20	0.87	1.53
Incidence density of infection (‰)	4.83	3.15	8.58	3.58	10.59	4.37	3.97	4.04
Mortality rate (%)	3.21	1.33	20.13	5.43	7.63	4.32	6.79	6.04

Note. PCS = patient classification system; NPR = nurse–patient ratio; APACHE II = Acute Physiology and Chronic Health Evaluation II.

with the night-shift UINM, day-shift UINM, and evening-shift UINM (128.04%, 128.34%, and 121.78%, respectively), as analyzed based on the research team's patient classification in 2012 (Chang et al., 2013). However, the use of patient classification to calculate nursing hours precisely to reflect nursing workload showed that the appropriate UINM is 90%–110%. Therefore, it is still necessary to increase manpower.

Intensive Care Unit Nursing Workload and Care Quality

The research results showed that the bed occupancy rate, the direct nursing hours, and the nursing hours as calculated by both NRP and APACHE II were statistically significantly correlated with mortality rate, showing positive correlations between both higher occupancy rates and patient severity and the rate of mortality. This result is similar

TABLE 5.
Correlations Between Nursing Workload and Care Quality (*N* = 5,581)

Variable	①	②	③	④	⑤
①Bed occupancy rate	1				
②Total direct nursing hours	.490**	1			
③Total nursing hours/unit	.523**	.995**	1		
④Nursing hours by PCS	−.180*	.530**	.455**	1	
⑤Nursing hours by NPR	−.290**	.322**	.298**	.514**	1
⑥APACHE II	−.113	.275**	.267**	.389**	.240**
⑦Incidence density of pressure sores	.010	−.085	−.091	−.001	−.149*
⑧Incidence of patient restraint	.242**	.413**	.430**	.079	.252**
⑨Incidence of falls	−.086	−.027	−.039	.091	−.040
⑩Incidence of tube self-extraction	−.214**	−.142	−.158*	.109	−.042
⑪Incidence density of infection	.349**	.119	.128	−.198**	−.133
⑫Mortality rate	.293**	.517**	.536**	.107	.214**

Note. PCS = patient classification system; NPR = nurse–patient ratio; APACHE II = Acute Physiology and Chronic Health Evaluation II.

a = Cannot be computed because at least one of the variables is constant.

p* < .05. *p* < .01.

PICU (<i>n</i> = 15)		RICU (<i>n</i> = 24)		SICU (<i>n</i> = 22)		TNCU (<i>n</i> = 12)		Total (<i>N</i> = 136)	
Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
0.67	0.11	0.91	0.06	0.96	0.02	0.93	0.07	0.88	0.11
96.76	14.53	179.62	16.44	217.87	15.20	77.85	13.71	137.69	46.07
131.44	19.56	252.71	20.88	288.45	16.23	114.27	19.16	188.18	59.60
13.01	0.49	11.63	0.36	13.75	0.63	10.33	0.99	12.49	1.31
11.53	0.75	11.06	0.31	11.96	0.25	10.41	1.56	11.13	0.90
		22.43	1.08	18.43	1.04	17.96	1.55	20.57	3.21
0.14	0.20	0.14	0.15	0.14	0.12	0.21	0.24	0.18	0.20
4.96	1.50	8.01	1.55	5.22	1.20	4.93	1.27	5.24	2.71
0.00		0.00		0.00		0.00		0.01	0.10
0.55	0.89	0.11	0.18	0.15	0.19	0.11	0.26	0.29	0.70
6.83	2.53	7.44	2.93	11.71	3.69	12.36	6.22	8.29	4.85
4.45	3.31	22.15	6.02	11.52	5.16	6.95	5.53	10.35	8.21

to that of West et al. (2009), which correlated higher occupancy rates and lower nursing hours with higher infection densities. The outcomes of this study are also similar to those of Liu et al. (2012). The further finding of this study that the incidence density of pressure sores in patients rose with lower nursing hours suggests that better staffing is beneficial to pressure sore prevention. This is consistent with the result of the systematic literature review of West

et al. A recent study in Taiwan investigated the correlation between nursing workload and patient safety, where nurses used a diary to record personal working conditions for 2 weeks. The results showed that, when the NPR exceeds 7, the risks of indices such as falls, decubitus, intubation tube slippage, posthospitalization infection of pneumonia, and urinary tract infections increase (Liu et al., 2012). However, Liu et al.'s subjects were primarily patients in general wards,

⑥	⑦	⑧	⑨	⑩	⑪	⑫
1						
-.065						
.631**	-.036	1				
a	.070	-.029	1			
.031	.055	-.249**	.027	1		
-.302**	.046	.178*	-.126	-.092	1	
.651**	-.090	.480**	-.119	-.105	.042	1

and data were collected over a short period by nursing personnel. Conversely, the disease severity and risk of rapid changes in the disease conditions of ICU patients are typically greater than those of general ward patients. In addition, our study highlighted a statistically significant correlation between nursing hours and all of the care quality indices except for the incidence of falls (Tables 4 and 5). This provides further support to address the importance of maintaining an appropriate NPR and equitable nursing hours to maintain the quality of patient care.

Intensive Care Unit Nursing Workload and National-Health-Insurance-Covered Nursing Payment

The present research results showed that the number of patients in patient classification records was greater than that of patients receiving NHI-covered nursing services. As five items, including respiratory tract suction (times), perineal rinsing, nursing care surveillance fee of physical restraints, and use of a heat lamp, are packaged in ICU nursing payments and as various items are capped by a maximum number of applications per hospitalization, these data are largely inconsistent with data obtained from patient classification records. Twelve NHI-covered nursing payment items were not recorded (27.3%). Some of these items are not used in the ICUs, whereas others are seldom used (e.g., alcohol swab bath and warm water cleaning). This study found that the NHI-covered nursing payment for each patient accounted for 4.77% of the total ICU medical expenses. Compared with ICU patient classification items, there were more direct nursing items and fewer NHI-covered nursing items. The nursing hours in the ICU were high. However, NHI-covered ICU nursing payments averaged 3,840 points/bed per day. NHI-covered nursing payments to hospitals total approximately NT\$19.9–20.3 billion annually. According to calculations, approximately 87,750 nursing personnel take care of inpatients in medical institutions. The NHI Administration covered an average of NT\$16,883 per nurse per month, which accounts for less than 40% of the average cost of nursing personnel (NT\$47,000), indicating that NHI coverage for nursing care is notoriously low (Foundation of Medical Professionals Alliance in Taiwan, 2010). Thus, either ICU nursing payments should be increased to conform to the actual costs of patient care or NHI-covered nursing payment items should be increased to calculate the proportional distribution of nursing contributions according to treatment items and thus accentuate the importance of nursing.

Conclusions

Data from a patient classification database, a quality monitoring database, and a medical cost database support that nurses are saddled with significant work overloading under

the current NHI payment system. In addition, nursing workload was shown to be significantly associated with care quality. This study was limited by the short, 2-year history of the PCS, which restricted data collection to a 2-year period only. In the future, we suggest that research should increase the time span of data collection. This study represents only a preliminary survey of the shortfall in NHI-covered nursing fee items and should be used as a reference to elicit further evidence-based data. This study provides empirical data for administrators to consider when revising nursing staffing and NHI payment policies.

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