Original Article

Nursing resources and major respiratory assessment and immobility complications among bedridden patients

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Abstract

Background: Being bedridden is the most common clinical manifestation in people, which results in physiological problems in the body such as, urinary tract infection, deep vein thrombosis, pneumonia, etc. Being bedridden requires regular nursing intervention.

Objectives: There is a deficiency in the unit level information about nursing resource information and immobility problems. To explore China's nursing resources and study the relationship between significant immobility problems and nursing resources, a nationwide, cross-sectional study was designed. A total of 19,531 patients participated in this study.

Materials and Methods: Data was collected through the question-answer method from the nursing professionals and patients. The trained researchers measured the bedridden incidents. Patient characteristics data have been collected from the hospital record book. A multi-regression analysis was conducted to determine the relationship between the nursing resources and the patient's complication.

Results: This study consisted of 19,530 patients. There were 70.88% wards present in the tertiary hospital, of which, 81.7% were critical wards and 88.2% were non-critical wards. 60.9% hospitals have the bed to nurse ratio is 1:0.4. The 51.28% critical ward achieved an average bed to nurse ratio of 1:2.05. Of the total sample, 68.75% are nurses with a BSc or higher qualification (P75: 84.21%, P25: 41.67%). About 25% of nurses have ≤3 years' experience (P75: 38.5%, P25: 16.7%). While 16.7% of nurses were senior or intermediate (P75: 25%, P25: 10.62%). The average age of the patients was 56.4. While a total of 56% of the patients were female patients. 35.9% of patients were bedridden for ≤three days. 4-7 days bed-ridden patients made up 30.92% of the total, and > 8-day bed-ridden patients made up 33.2% of the total. Multivariate analysis proved that wards meeting the bed-to-nurse criteria, had lower immobility complications than the wards not meeting the criteria. (B=0.43, 95% confidence interval =0.01-0.86, Odd ratio= 1.55, 95% confidence interval =1.001-2.39).

Conclusions: A higher number of nursing staff and the senior and intermediate nursing staff chiefly contribute to reducing the significant immobility problems. Nursing experience is significantly related to immobility complications. However, the relationship between nursing education level and major immobility complications requires further research. [*Ethiop. J. Health Dev.* 2021; 35(3): 234-238]

Keywords: Nursing resources; Aging; bedridden patients; pneumonia.

Introduction

Chronic disease development is one of the most prevalent critical characteristics of ageing. In bedridden patients this leads to complications like organ degradation, and other significant complications like deep vein thrombosis, urinary tract infection, ulcer, and pneumonia, are substantial difficulties in bedridden patients. About 1.3-3.3 cases of pneumonia (1) and 14.4% of the long-term bedridden patients are found in China. According to Chen, it has been found that patients who have been bedridden for a period of about 7-12 months are at a high risk of developing Urinary tract infection, pneumonia, and pressure ulcer cases than those who had been bedridden for less than six months (2). Immobility complications seriously affect the family's financial status. According to statistics for 1.6 billion Americans, pressure ulcer patients cost about 2.2 to 3.6 billion dollars annually (3, 4). According to the report, deep vein thrombosis, urinary tract infection, and ulcers are the most common. Effective nursing interventions can reduce these complications significantly. A 2007 study shows that an increase in the staffing level can effectively reduce the complications. This report is also supported by mixed-method research, which shows that an increase in nurse staffing reduces the patients' major immobility complications. Some studies conflict with this point of view, with regards to the relationship between required number of nursing staff and the complication level. In comparison, Numata et al. show that the nurse staffing does not correlate with the complications (5).

More study in this area has been carried out at the hospital level. This is a major shortcoming of the many research. Ward-level data is more relevant than hospital-level data. This study was designed at the unit level to determine the relationship between immobility complications and nursing resources. Deep vein thrombosis, urinary tract infection, pneumonia, and pressure ulcers were selected as significant complications of bedridden patients for this study.

Material and Method

A nationwide survey was conducted for this research study. This research is part of the national nursing project. This study aims to establish a standard nursing intervention model through this research. This study was conducted from 2019 to 2020 among the 18 hospitals from 6 different cities of China. Data from the ICU (Intensive care unit) division, orthopedics unit,

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neurosurgery unit, surgery and medicine ward of the different medical colleges and hospitals was included in this study. Out of the 23,638 patients, 19,630 were recruited for this study. Total data was collected from surveys of the 213 wards and 152 hospitals. Selection criteria were based on the age group below 18years, and patients had to be bedridden for at least 24-hours, with no complications like urinary tract infection, pneumonia, or deep vein thrombosis during the study period. The selected patients were not transferred to the other hospitals for treatment. The patients gave their oral consent for data collection.

Data collection

There are four types of data collected from the surveys. The data types are significant complications, patients' characteristics, ward character, and nursing resources.

Nursing resources were collected through self-prepared questionnaire which were responded to by the head nurses, from September to November 2019. The data collected using the questionnaire was about the education level of the staff nurses, staffing pattern of the nurses, nurses to bed ratio, etc. The nurse bed ratio was measured by a total number of the beds divided by the number of the nurses. Nursing experience is calculated as the proportion between nurses and the less or equal to three years' work experience in the ward. Generally, in China, nurses are divided based on job titles like senior (professor nurse), intermediate nurse (nurse in-charge), and junior nurse (nursing practitioner). This study, divided nurses into intermediate and senior nurses based on job title.

The patient's complication data was recorded in each ward by the trained nurse investigators. The investigators collected data on pressure ulcers, deep vein thrombosis, urinary tract infection and pneumonia by the selected procedure. Pressure ulcer data based on the national pressure ulcer advisory classification system was collected. At the same time, data based on the medical record book was collected. We collected patient complication data daily. Those who had any of the complications were classified as the incidence cases. The patient's characteristics data based on the sex, age group, bedridden period, and significant five complications, such as chronic ischemic heart disease, hypertension, heart failure, respiratory disease, cerebral infarction was ordered. The patient's characteristics data was taken from the computer-based record system, and the patient's characteristics data was recorded on the electronic data collection system. The ward characteristics data includes the hospital degree, ward type (critical or non-critical ward). This data came from the responses submitted to the research group by the head nurses of the respective ward.

Hospitals are divided into the three categories, such as community hospitals, secondary hospitals, and tertiary hospitals. The nursing level may vary with the category of the hospitals.

Procedure

A supervisor was appointed in each hospital for the study, who was responsible for the investigator selection for data collection. They trained nurses before including them in the project. The nurses were given three types of training as stated below:

- They were introduced to the aim of the study.
- They were trained regarding the data collection system.
- They learnt how to identify significant complications.

The training was aimed at maintaining uniformity, reliability, and correctness of the collected data. To ensure reliability, the nurses responded to a short questionnaire after each training; following that, those who passed the questionnaire were selected as the investigator. a unique quality control procedure was formulated to maintain the standard quality of the collected data. An electronic data capture system was used for the data collection to reduce error. Researchers support the quality of the medical record database. Additionally, the questionnaire prepared for the head nurses was also utilized for the research data.

Data analysis

The data presented the mean value, the standard deviation for the normal variable. While for the non-normal variable Inter-quartile range and the median value was calculated. The Kolmogorov-Smirnov test did normality assessment. The percentage and frequencies present categorical data. Chi-Square test has been done for the comparable variables. Multilevel modeling has been done for estimating the relationship between nursing resources and immobility complications. $P<0.005$ was set as the statistical significance level. Patient characteristics, hospital, and ward were regarded as risk adjusting variables.

Result

There are 70.88% wards present in a tertiary hospital, while 81.7% were critical wards and 88.2% were non-critical wards. In the 60.9% of hospitals, the bed to nurse ratio is 1:0.4. Table 1 shows patients' characteristics. The 51.28% of critical wards achieved an average bed to nurse ratio of 1:2.05. Of the total sample, 68.75% of nurses had a BSc or higher qualification (P_{75}: 84.21%, P_{25}:41.67%). About 25% of nurses had ≤3 years' experience (P_{75}: 38.5%, P_{25}: 16.7%). While 16.7% nurses were senior or intermediate (P_{75}: 25%, P_{25}: 10.62%). Table 2 shows the major complications of the patients. The average age of the patient is 56.4. While female patients make up 56% out of the total patients. 35.9% of the patients have been bedridden for ≤three days. 4-7 days bedridden patients are amounted to 30.92%, and > 8-day bedridden patients amounted to 33.2%. Incidence of five diagnoses were as follows, 24.9% of patients are essential hypertension, 11.78% are cerebral infarction, 8.4% patients have chronic ischemic heart disease, and 6.2% have heart failure. Lastly, 6.31% have respiratory disorders. Incidence of the major incompatibility complication was also measured. About 0.78% of patients have a Pressure ulcer, 0.9% have deep vein thrombosis, and 3.4% have pneumonia. Overall, 5.4% have major immobility complications. There is a statistically significant high risk of major immobility complication in the critical ward (15%)

than the non-critical ward (4.13%) (chi-square value is 576.01, p<0.001). Bedridden day length is linked with major immobility complications. In contrast, ≥eight-day bedridden patients have a high risk of complications (chi-square value is 834.01, p<0.001). Also, a high risk of hypertension, cerebral infarction is found in the patients' group (Chi-square value is 88.3-884.9, p<0.001). In comparison, the two groups do not show any statistically significant difference between the hospital grade or patients' gender. Multivariate analysis proved that wards meeting the bed-to-nurse criteria, has lower immobility complications than the wards not meeting the criteria. (B=0.43,95% confidence interval =0.01-0.86, Odd ratio= 1.55,95% confidence interval =1.001-2.39). According to the data, major immobility complication is positively associated with a bachelor's degree B=1.46, 95% confidence interval = 0.3-0.8, Odd ratio= 2.89, 95% confidence interval =1.36-6.1). Major immobility complications are also associated with the intermediate or senior job title (B=-2.12, 95% confidence interval =3.8-0.5, Odd ratio= 1.2, 95% confidence interval =0.02-0.64).

Table 1: **Sample characteristics of the ward, nurses, and patients**

Variables	**Patient number (%)**	**Range of value**	**Mean value (SD)**	**Median value (P_{25}, P_{75})**
Ward features				
Hospital level				
Secondary hospital	63(30.01)			
Tertiary Hospital				
Tertiary Hospital	152(70.9)62(29.11)			
Award category				
Non-critical ward	175(81.7)			
Critical ward	38(17.99)			
Characteristics of nursing resources				
Ratio of nurse staff per bed (bed: patient)				
Critical care	20(51.3)	1:0.7-4.2		1:2.07(1:1.40,1:2.83)
Noncritical care	106(60.9)	1:0.16-1.83		1:0.42(1:0.34,1:0.49)
Intermediate nurse: senior nurses		0%-58.3%		16.7%(10.6%,25.01)
nursesexperience≤3years'		0%-75.01%		25%(16.7%,38.5%)
Nurses with bachelor's degree or higher education		0 %-100%		68.76%(41.7%,84.2)
Patient characteristics				
Males Gender	8600（44.0）			
Females	10930（55.9）			
age		18-109	56.4±16.8	
bedridden duration length				
4-7 days	6,042(31.1)			
≤Three days	7,014(35.92)			
≥ Eight days	6,477(33.11)			
Patients' underlying state				
Cerebral infarction	2,298(11.7)			
Chronic ischemic heart disease	1,635(8.4)			
Essential (primary) hypertension	4,862(24.91)			
Heart failure	1,211(6.21)			
Respiratory disorder	1,234(6.3)			

Table 2: **Major immobility complications of patients**

Variables	Pneumonia	Deep vein thrombosis	Pressure ulcers	Urinary tract infection	Immobility complications		
	Patient number (%)	Patient number (%)	Patient number (%)	Patient number (%)	Patient number (%)	Chi-Squared	Probability value
	665(3.4)	161(0.82)	153(0.8)	167(0.87)	1,057(5.42)		
Level of hospital							
Tertiary Hospital	539(3.41)	138(0.87)	128(0.81)	129(0.8)	862(5.46)	0.88	0.346
Secondary Hospital	126(3.35)	25(0.66)	25(0.66)	38(1.01)	194(5.16)		
Ward type							
Non-critical	421(2.44)	126(0.73)	80(0.46)	133(0.77)	712(4.13)	575.77	<0.001
Critical care	245(10.65)	36(1.57)	74(3.22)	35(1.52)	344(14.96)		
Gender							
Females	389(3.56)	82(0.75)	110(1.01)	69(0.63)	598(5.47)	0.19	0.661
Males	277(3.22)	80(0.93)	44(0.51)	99(1.15)	458(5.33)		
bedridden period length in days							
≤3days	63(0.90)	15(0.21)	6(0.09)	13(0.19)	88(1.25)	837.81	<0.001
4-7days	118(1.95)	23(0.38)	17(0.28)	37(0.61)	186(3.08)		
≥ Eight	485(7.49)	124(1.91)	131(2.02)	118(1.82)	782(12.08)		
Patients' underlying conditions							
Cerebral infarction	158(6.87)	14(0.61)	20(0.87)	31(1.35)	202(8.79)	55.99	<0.001
Chronic ischemic heart disease	105(6.42)	9(0.55)	9(0.55)	22(1.35)	135(8.26)	28.33	
Heart failure	92(7.60)	11(0.91)	12(0.99)	17(1.40)	122(10.08)	54.09	
Essential(primary)hypertension	256(5.26)	51(1.05)	33(0.68)	72(1.48)	380(7.81)	74.73	
Respiratory disorder	248(20.11)	22(1.78)	32(2.60)	32(2.60)	297(24.09)	884.89	

Discussion

In the study, we can observe that nursing staff, education level, and experience are associated with significant complications (6). The number of nurses is associated with a reduction of the considerable immobility complications. While the unexpected result found in the case of the higher educated nurses related to the high complication (7). According to the criteria of the People's republic of China, the bed to nurse ratio in the non-critical ward will be 1:0.4 (8), which implies that there will be 1 for each 2.5 bed and in the critical ward (9), this will be 1:2-3.0 that means 2.5 nurses will attend a single bed. This study proves that there are lower immobility complications where the criteria are fulfilled than were the measures not maintained. About 60.9% of the non-critical ward and 51.3% critical ward keep this guideline of PRC. While 64.9% tertiary level hospital and the 45.2 % secondary level hospital will meet these bed-to-nurse ratios. According to this study, wards having more intermediate nurses or senior-level nurses have a lower-level risk of major immobility complications. Due to higher job titles having more experience, the higher job title nurses were more capable of dealing with the significant immobility complications. Higher job titles have high patients' satisfaction. This result was also proved by other authors (10). This study result shows that higher qualified nurses in wards have a high risk of significant immobility complications. According to Koen Van den Heedeet al. (11), there is no significance between the nurse's degree and the major immobility complications. The possible explanation of this result is that degree holder nurses are mainly engaged in the service at the tertiary level hospitals (12), where patients come with more illness and more significant complications. Though the result also shows that higher incidents of the major immobility complications in the tertiary hospitals (5.5%) (13) than the secondary level hospitals (5.2%). This result is statistically insignificant.

The significant limitations of our study are stated as follows:

- Data of the different factors like work environment, care process, etc was not taken.
- Bed to nurse ratio measurement is taken as the nurse staffing measure instead of the nursing care per hour.
- Six tertiary hospitals are of national levels; this reduces generalizability to a certain level.
- Our study design is cross-sectional which means that the causal relation of the nurse staffing and the patients' complication can't be determined.
- Many hospitals recruited the nurses according to the disease workload and seriousness.
- Future research will cover the nurse recruitment to patients and change the analysis unit from wards to nurses and patients. Despite the limitations in this study, there are some advantages. Because this is nationwide research with various indicators for data validity, multivariate modelling is used to examine the association between nursing resources and severe problems.

Conclusion

We try to indicate some limitations through this research. According to this study, the nurse staffing, education level, and job title are related to the complications. Bedridden patients with intermediate nurses have reduced chances of significant complications. While many bachelor's degree holder nurses are associated with high complications, this is an unexpected result that needs to be researched further.

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