

# NURSING WORKLOAD IN RELATION TO NOSOCOMIAL INFECTION IN PUBLIC HOSPITAL INTENSIVE CARE UNIT, MALAYSIA

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## ABSTRACT

Nosocomial infections (NIs) is an infection acquired in the hospital and becomes evident 48 hours after admission to the hospital. It continues to be a major problem affecting patient safety and quality of care in Intensive Care Unit (ICU). One of the most pertinent factors leading to NIs is nursing workload. The aim of the study is to determine nursing workload on NIs rate in the ICU, Hospital Serdang. A retrospective cross sectional study was used. Data were collected from NIs surveillance, staff nurses' duty roster and patient census by using a performa. The result in this study shows, 19 % (n=88) cases of NIs were detected in 12 % (n=57) of patient. There was significant moderate positive relationship between the number of infection and the total number of nurses working overtime ( $r= 0.66$ ,  $n=88$ ,  $p = 0.001$ ) and the number of infection and the total number of new staffs ( $r= 0.51$ ,  $n=88$ ,  $p = 0.001$ ). There was significant weak positive relationship between the number of infection and the total number of nurses taking medical leave or emergency leave ( $r= 0.33$ ,  $n=88$ ,  $p = 0.001$ ). This study provide a baseline to improve nursing staffing in ICU. Future planning of ICU staffing should be comprehensive so that patients are not disadvantaged.

**Keyword:** Nosocomial infection, nursing workload, ICU staffing

## INTRODUCTION

Nosocomial infections (NIs) is an infection acquired in the hospital. NIs usually becomes evident 48 hours after admission to hospital or following discharge from hospital otherwise the infection is designated as community acquired (Kouchak&Askarian, 2012). NIs continues to be a major problem affecting the patients in Intensive Care Unit (ICU) and a major public health concern through the world (Bellani *et al.*, 2016). A study had found that NIs prevalent rate in ICU patient, are 5-10 times greater than for patients admitted in the general wards (Mitharwal *et al.*, 2016; Cornejo-Juárez *et al.*, 2015). The utilization of invasive devices and invasive monitoring devices is a major risk factor for the development of NIs in ICU patients, which result in a considerable increase in morbidity, mortality and cost (Umscheid, Mitchell *et al.*, 2011; Soh *et al.*, 2013).

### Literature review

Nurses staffing are the process of determining the appropriate number of nursing staff to meet the workload demand for nursing care on the patient care unit (Papastavrou, Andreou, & Efstathiou, 2014). Nursing workload has been shown to have a significant impact on NIs (Henselet *et al.*, 2017; Yang, Hung, & Chen, 2015). A nurse- patient ratio of less than 1:1 was found to be related to an increased risk

of infectious complications, increase in length of stay, and hospital costs (Amaravadi & Dimick, 2000). Rochefort, Buckeridge & Abrahamowicz (2015) found that nurse-patient ratio below 1.9 is associated with an increased infection risk in ICU. Nurses' shortages is one of the major factors expected to constrain hospitals' ability to deal with future outbreaks of emerging infections (Watson *et al.*, 2016). Therefore, to overcome this problem, more nurses are required to work overtime to reduce the impact of the critical shortage of nurses and the downsizing of a nursing unit in both private and public health facilities (Sawatzky, Enns & Legare 2015). A study by Jones, Hocine, Salomon, Dab and Temime (2015) found that nurses who work overtime will have increase burden on their physical and mental wellbeing which will lead to negative effect on themselves as well as the patients. According to Cimiotti, Aiken, Sloane, and Wu (2012) increased overtime of nurses is associated with higher rates of catheter-associated urinary tract infections and central line intravenous (IV) bloodstream infections. Olds and Clarke (2010) also found in their studied that working overtime had negatively impact tonurses and patient safety. Nurses may not have sufficient time to perform basic nursing tasks if they have high workload which can have a direct effect

on patient safety (Papastavrou, Andreou, & Efstathiou, 2014). The impact of increased nursing workload will directly expose patient to NIs (Tubbs--Cooley et al., 2015). There are limited studies conducted in Malaysia to examine the relationship between nursing workload and NIs rate in the ICU. This study was provide a baseline information for the hospital administration related to the nursing

workload and NIs rate in the current ICU setting. The results can be used to improve the quality of patient care and optimizing patient safety in relation to NIs. It is hoped that recommendations from this study will be of economic benefit to the entire health system as cost, morbidity, and mortality rates are reduced.

**Table 1: Demographic characteristic of ICU nurses (n=29)**

Characteristic	n (%)
<b>Age: Mean <math>\pm</math> SD</b>	<b>29.5 <math>\pm</math> 5.5</b>
$\leq$ 30	20(69)
31-40 years	8(27.6)
$\geq$ 40	1(3.4)
<b>Marital Status</b>	
Single	7 (24.1)
Married	21 (72.4)
Widow	1 (3.4)
<b>Post Basic Qualification</b>	
Yes	9 (31)
No	20 (69)
<b>Working experience in nursing Mean <math>\pm</math> SD</b>	<b>5.9 <math>\pm</math> 4.1</b>
<1 years	12 (41.4)
1-5 years	7 (24.1)
6-10 years	5 (17.2)
> 10 years	5 (17.2)
<b>Working experience in GICU Mean <math>\pm</math> SD</b>	<b>4.1 <math>\pm</math> 4.0</b>
<1 years	19 (65.5)
1-5 years	2 (6.9)
6-10 years	6 (20.7)
> 10 years	2 (6.9)

## Materials and Methods

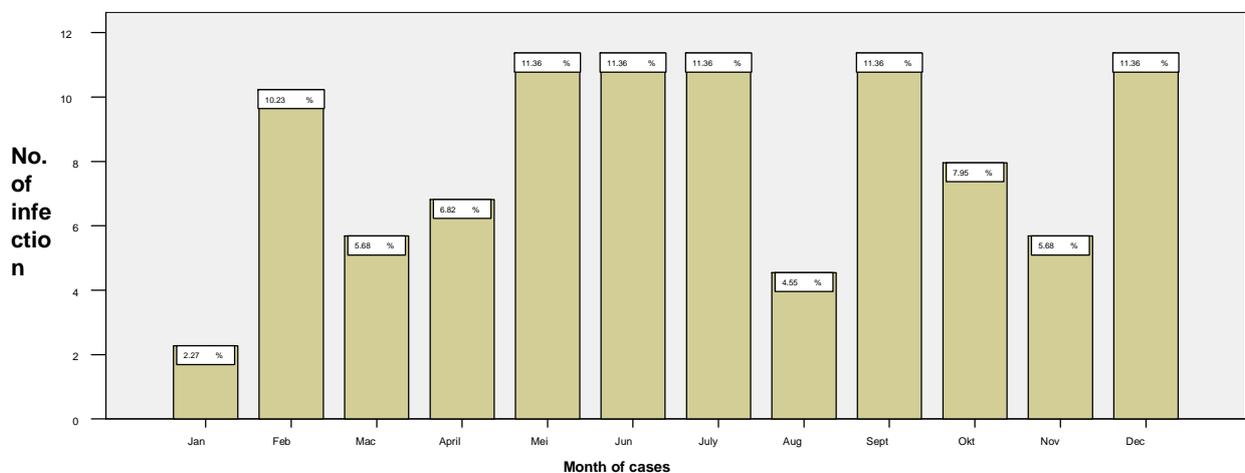
This is a retrospective cross-sectional study to evaluate the NIs rate and staffing pattern in the ICU Hospital Serdang. Data were collected from January to December 2008. A performa adapted from NIs checklist Hospital Serdang was used and Selangor State Health surveillance was reviewed by panel of experts. All experts consulted agreed on the relevancy and clarity of the performa. They also agreed that the sampling of the performa were adequate and reflect the nursing workload on NIs rate in ICU. This study was conducted in the 17-bedded level three ICU in Hospital Serdang. During the study period only seven (7) beds were open for admission. A total number of 29 registered nurses were assigned in this area. All patients with a positive bacteriological culture after more than 48 hours ICU admission and all nursing staffs working in that unit during study period were included in the study. Patients' who have a positive bacteriological culture less than 48hrs of hospital admission were excluded from the study. NIs data was collected from Infection

Control unit by reviewing the surveillance of NIs rate in the ICU. NIs rates were calculated as the number of patient with NIs divided by number of patient in the ICU multiply by 100. The ICU nurses staffing (total number of nurse working, staff on leave, staff medical certificated leave / emergency leave (MC/EL) and nurses on overtime per day) described as the number of nursing required to provide care to the patient. This was obtained from the nurse duty roster. Data were analyzed using Statistical Package for Social Science (SPSS) software version 14 for the window. A descriptive data analysis such as mean, standard deviation and Pearson's coefficient of correlation was used to test the study hypothesis between NI rate and nurse staffing. Statistical significance was considered if p-value < .05. Ethical approval was obtained from the Faculty of Medicine Ethic Committee, Universiti Putra Malaysia, Director of Hospital Serdang, National Institute of Health, and from the Medical Research and Ethics Committee, Ministry of Health, Malaysia.

**Results and Discussion**

There was 462 patients' admission in ICU from 1st January to 31<sup>st</sup> December 2008. A total of 68 patients were identified having 99 (21.4%) positive bacteriological culture. Eleven patients were exclude from this study because they had infection less than 48 hours after admission to ICU. The final number of patient was 57 patients with 19% (n=88) NIs. The highest infection rate was in May, June, July, September, and December 10(11.4%) as indicated in (Figure 1). There are a total of 29 nurses working in this ICU (Table 1). The total number of staff working per shift was five 5-6. The results of this study showed that there were significant positive moderate relationship between the number of infection and the total nurse overtime ( $r=0.66$ ,  $n=88$ ,  $p=0.001$ ). This study found that increases in total number of nurses working overtime are associated with higher number of hospital-acquired infection (see Figure 2). Also, there is a positive relationship with a moderate correlation between the number of infection and the total number of new staffs ( $r= 0.51$ ,  $n=88$ ,  $p = 0.001$ ). This means that an increase in the total number of new staffs are associated with higher of number of infection (see Figure 3). A significant positive relationship with weak correlation exists ( $r= 0.334$ ,  $n= 88$ ,  $p = 0 .001$ ) between number of infection and the total nurses taken medical certificate or emergency leave as indicated in (Figure 4). Out of 462 patients, 57 (12%) of patients had developed NIs in the ICU Hospital Serdang. In this ICU the nurse-patient ratio is commonly more than 1:1. In January 2008 nurse-patient ratio was 1:2 in the morning shift. According to Anesthesia and Intensive Care Service; Operational Policy (2008) in the ICU the nurse patient ratio shall be one nurse to one patient for caring of unconscious patient. Hospital Serdang ICU is the level three ICU based on the Ministry of Health (MOH) hospital (Malaysia Registry of Intensive Care, 2013) and nurse-patient

ratio should be 1:1 or more in complex cases. The result of low nurse-patient ratio can be due to Hospital Serdang is a new developed hospital in 2005, therefore, the shortage of nurses in Malaysia has caused ICU in newer hospitals to remain closed including Hospital Serdang (The Star, 2008). Total number of nurses working overtime and MC/EL are associated with increase in the number of infection. Tubbs---Cooley *et al.*, (2015) found that the negative consequences are not limited to physical health, such as fatigue, headache, and sleeplessness. Normally, when many of the staff taking MC/EL, replacement staff will be needed to care for patient in the ICU. Therefore, some of the staff needs to do overtime to overcome the shortage of staff. A study by Beltempo, Blais, Lacroix, Cabot, and Piedboeuf (2017) reported that nursing overtime was associated with higher rates of health care-associated infections (HCAIs) in the neonatal intensive care unit. Similar study done by Rogowski *et al.*, (2013). Nurses understaffing was associated with increased risks of HCAI. Extensive overtime puts patients at risk of NIs. The more staff taking emergency leave can unbalance the staff size by increasing the workload and implications for the nursing group in terms of physical and emotional exhaustion (Alharbi, Wilson, Woods, & Usher, 2016; Galletta *et al.*, 2016). The number of new staff working in the ICU Hospital Serdang increase from May 2008 onward. They have inadequate knowledge and experience caring for critically ill patients and dealing with infection control in the ICU. This study establishes that the increase in the total new staffs was associated with an increase in the number of hospital-acquired infection. As there was limited study regarding new nurses or less of experience nurses working in the ICU, it would be difficult to compare such finding in this study.



**Figure 1: Distribution of NIs throughout year 2008 in ICU (n=88)**

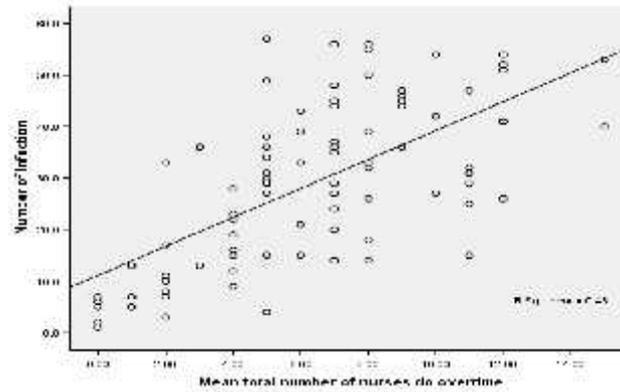


Figure 2: Relationship between the total number of infection and total nurse do overtime

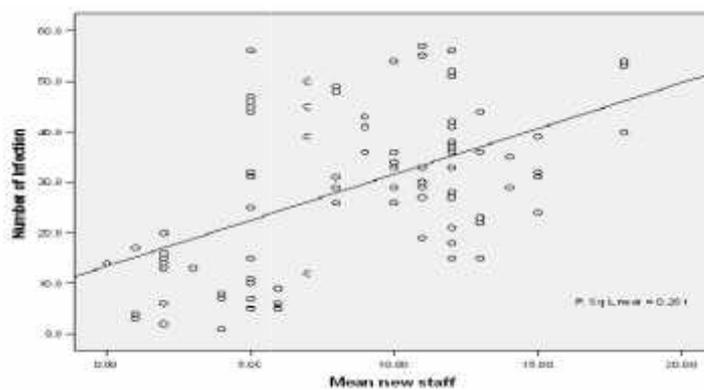


Figure 3: Relationship between the total number of infection and total new staff nurses

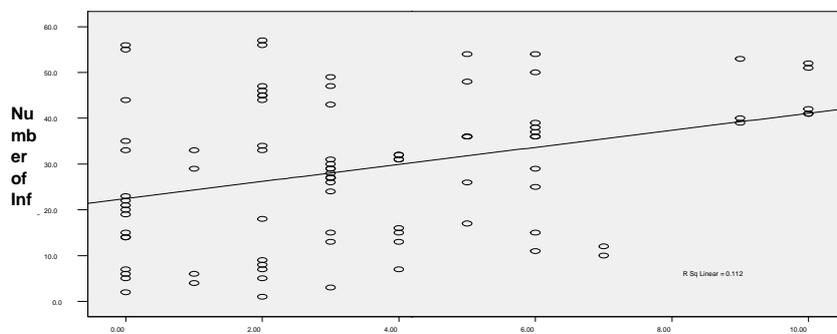


Figure 4: Relationship between the total number of infection and total nurses takes MC/EL

**Conclusion**

Based on the present research’s result NIs rate is not at decreasing trend in Malaysia ICUs (Rai, *et al.*, 2016). The relatively high incidence of NIs was reflection of the intermediate risk severity of patient illness, understaffing, and overcrowded ward and, possibly, poor adherence to aseptic measures (Cimiotti *et al.*, 2012). The finding of this review suggested that evidence supporting positive relationships between working long hours, new staff and understaffing tonasocomial infection. Adequate staffing in ICU is important in order to ensure

infection control practices were in place and to implement effective infection control practices such as hand hygiene. Furthermore, scholars also reported that nurses in specialty units need good staffing towards their practice environment compared with those practising in general wards (Choi & Boyle 2014). All of the health care provider must be collaboratively to improve the nurses practice environment and optimized quality of patient care. A comprehensive planning of ICU staffing should be implemented to optimize nursing care provided to

patients.

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