Intensive Care Unit (ICU) Readmission: A Mixed-Method Systematic Review

Thandar Soe Sumaiyah Jamaludin[1], Nur Syahirah Suhaimi[1,2], Nik Hartini Mohd Noor[1,2], Mohd Said Nurumal[1]*

[1]*Dept. of Critical Care Nursing, Kulliyyah of Nursing, International Islamic University Malaysia, Pahang, Malaysia.*
[2]*National Heart Institute of Malaysia, Kuala Lumpur, Malaysia.*

ABSTRACT

Objective: This review aimed to determine the issue associated with patient's readmission to intensive care units (ICU) within 24 to 72 hours. **Methods**: A mixed-method systematic literature review was carried out with 16 articles which published within the year of 2010 to 2020. **Result:** Three themes were found related to ICU readmission; predictors, factors, and recommendation. The predictors were Acute Physiological Chronic Health Evaluation (APACHE), Stability and Workload Index for Transfer (SWIFT), Therapeutic Intervention Scoring System (TISS) and others. The factors contributing to ICU readmission which are higher score level of tools used, severity of illness, discharge time, hemodynamic monitoring and patient's conditions before discharge. The recommendations to reduce the ICU readmission from this review were ICU follow-up program, new staff nurses should be supported by senior staff, change of ICU discharge process, and introduce an intermediate unit. **Conclusion**: This review findings recommended that there is a need for a follow-up program by ICU nurse-led, the use of semi-intensive units and implementing transition programs of critical care for patients readmitted to ICU within 72 hours. Thus, more effort should be made to reduce the ICU readmission within 24 to 72 hours to improve the quality of patient's life.

Keywords: Predictors, Factors, Recommendation, ICU Readmission

INTRODUCTION

The intensive Care Unit (ICU) readmission rate within 48 hours of ICU discharge for the 49 Ministry of Health (MOH) centres was 1.3% in 2013 however, this rate has varied from 1.2% to 2.1% over the past five years in Malaysia (1). In the United States, a previous study reported that approximately 2% and 3.7% of ICU patients discharged to the ward are readmitted within 48 hours and 72 hours (2). A recent study in Brazil reported a 15% rate of ICU readmission within 48 hours after discharge (3). ICU readmission refers to the second admission to the same ICU from which the patient was discharged during the same hospitalization (2). In this study, we focused on the patients readmitted to ICU within 24 to 72 hours after initial ICU discharge. A study showed that

ICU readmission is a frequent adverse outcome in the critically ill population (4).

In this review, we summarized the findings of recent studies to reduce ICU readmission within 24 hours to 72 hours. We have found that most of the studies were describing predictors, factors and recommendation related to ICU readmission. In this study, predictors are defined as the tools used during admission or discharge by the ICU staff to score the severity of disease and to predict ICU readmission. The factors of ICU readmission in this study refers to the reasons that cause the patients to be readmitted again in ICU within 24 to 72 hours. The recommendation refers to the suggested methods to reduce ICU readmission.

There are poor impacts of ICU readmission for patients with critical conditions which can worsen the patient's conditions. First, the increase of mortality level of patients with increased ICU readmission. In the United States, 34.2% ICU readmission rates were recorded within 48 hours with 21.3% hospital mortality from retrospective cohort study from 2002 to 2010 (5). A study reported a higher risk for hospital mortality with longer hospital stay (6). Furthermore, the length of stay and the total cost can burden the patient's family (7 & 8). Another

* Corresponding author:

Assoc. Prof. Dr. Mohd Said Nurumal
Department of Critical Care Nursing,
Kulliyyah of Nursing,
International Islamic University Malaysia,
Jalan Sultan Ahmad Shah, Bandar Indera Mahkota,
25200 Kuantan, Pahang, Malaysia.

E-mail: mohdsaid@iium.edu.my
Tel no: +6095707288

study found that readmitted patients have a stay in the ICU that is two to three times longer than that of non-readmitted patients (9).

Moreover, ICU readmission contributes to a negative impact on patients and healthcare workers. A study in Canada reported that participants perceived that strain had negative implications for patients which reduced quality and safety of care and disrupted opportunities for patient- and family-centred care (10). Besides, the health providers which are increased workload, moral distress and burnout. The study on ICU readmission is very crucial as it can improve the quality of care for critically ill patients. However, there is limited research on ICU readmission with 24 hours to 72 hours in Malaysia. Thus, this review focused on what are the reasons that the patients need to readmit to ICU within 24 to 72 hours after their initial discharge from ICU.

MATERIALS AND METHODS

This review aimed to study the previously available literature on the predictors, the factors and the recommendation about ICU readmission within 24-72 hours. We used a mixed-method systematic review approach in this study. The reason of using this method is to maximize the inclusion of studies and to preserve the integrity of the findings of the different types of study's findings (11).

Data sources and search strategies

Searches of the literature were performed by using electronic data bases such as ProQuest, Science Direct, EBSCO and Scopus which offer a large number of articles related to ICU readmission. The literature search was conducted by using the keywords "ICU readmission" AND "factors" AND "predictors" AND "recommendation". The synthesis result for the research journal by using the same keywords using ProQuest Health & Medical shows 2525 results of the articles. By using Science Direct, the search of "ICU readmission" AND "factors" AND "predictors" shows the results of 2280 articles. Besides, the search from EBSCO showed 5861 articles while using Scopus showed 56 articles.

The total articles found are 10,516. The search was narrowed down by selecting the full text, peered review and appeared between 2010 until 2020 which is 100 articles. Forty eight articles were excluded due to study on hospital readmission. Then, only 52 articles were reviewed and 36 articles excluded due to study done on ICU readmission after 72 hours. Finally, 16 articles

were chosen to be analysed for this review that inline with our study objectives which was shown in figure 1.
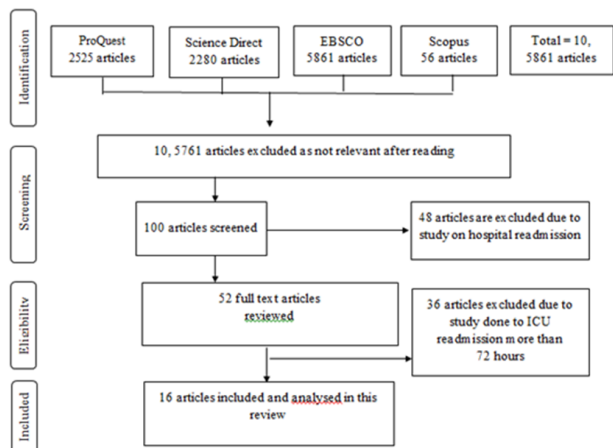

Figure 1: Systematic literature search flow

Selection criteria

The inclusion and exclusion criteria were used to specific and narrow down the search and ensure its relevance to the aims of this review. The review of clinical question for this study was defined using the framework PICO for quantitative studies and PICOS for qualitative study as shown in table 1 and 2 (12 & 13).

PICO element	Inclusion Criteria for review
P (population)	critically ill patient discharged from ICU
I (Intervention)	study that examine on the predictors, factors and recommendation about ICU readmission
C (comparison):	study that examine on ICU readmis-
O (outcome):	study that reduce ICU readmission within 24 to 72 hours

Table 1: PICO framework for quantitative studies

PICOS element	Inclusion Criteria for review
P (population)	critically ill patient discharged from
I (Intervention)	study that examine on the predictors, factors and recommendation about
C (comparison)	study that examine on ICU readmis-
O (outcome)	study that reduce ICU readmission
S (study design)	study that used focus group through semi-structured interviews, in-depth interviews

Table 2: PICOS framework for qualitative study

The following items were excluded in this review such as patients that are died after discharged from ICU, study that examine on the risk factors of ICU readmission, study that examine on ICU readmission more than 72 hours, study that cannot predict patients' ICU readmission rate within 24 to 72 hours.

Quality assessment

In this review, quality critical appraisal has been carried out with the guideline from the critical appraisal skill program (CASP) tools according to the type of studies of articles selected (14).. The score is represented by 1 point (strong), 2 point (moderate) and 3 points (weak). For global rating for this paper strong (no weak ratings), moderate (one weak rating) and weak (two or more weak ratings). Thus, by assessing quantitative articles included in this review by eight criteria below:

a) The selection bias likely to individual as representative of target population.
b) The randomized of study design.
c) Relevant confounders that were controlled.
d) Participant blinding or not.
e) The validity and reliability data collection methods.
f) Withdrawals and drop-outs.
g) Consistency of Intervention integrity.
h) The appropriate analysis.

The scores by the first and second authors were two of strong-strong, six of moderate-moderate and seven of strong-moderate which do not have a large significant gap between two. Therefore, the 15 articles of quantitative studies were selected in this review. Moreover, the following nine criteria were used to assess the qualitative study:

a) The structured abstract and title.
b) The introduction and aims were clear.
c) Clear method and data.
d) Appropriate sampling targeted.
e) Sufficient of data analysis.
f) Gained ethical approval and bias.
g) Clear results.
h) Transferability or generalizability to a wider population.
i) Implications to policy and practice.

The score given by the first and second authors were 27 and 26 respectively which represent the medium quality of the article. It is acceptable as the score does not have a large significant gap between two. Therefore, an article of qualitative study was selected for this review.

FINDINGS

There were three themes found in this review related to ICU readmission. Those were predictors, factors, and recommendation associated with ICU readmission. The following session explained details about each of them.

Predictors associated with ICU readmission within 24-72 hours

The predictors of client's ICU readmission within 24 hours to 72 hours using Acute Physiological Chronic Health Evaluation (APACHE) which measured the severity of illness (15). The APACHE score is also used on admission within 24 hours (16). Another study reported that APACHE system provides information for ICU performance benchmarking and quality improvement by predicting hospital mortality, ICU length of stay and hospital length of stay by using APACHE IV model (6).

Besides, the Stability and Workload Index for Transfer (SWIFT) scale was used for criterion of discharge from the intensive care unit which facilitates quality care (7). A recent study found that the predictors can be used are Therapeutic Intervention Scoring System (TISS) and independent predictors (16). The purpose of TISS is to know the type and number of intensive care treatments which indicates the workload and calculating costs in the ICU. The independent predictor is severity of diseases or comorbidities of patients which contributed to ICU readmission within 24-48 hours. Severity of illness, ward admission, need for vasopressors during the index ICU stay, and length of ICU stay were independent predictors of readmission to ICU (8).

A study reported the predictors of Simplified Acute Physiology Score (SAPS) used for ICU discharge indicator (15). These studies have found similar results where SAPS II score is used for risk death during admission and discharge of patients as eloquently quoted (17). Another study also portrayed the frequency of patients' ICU readmission followed by higher Acute Physiology Score (APS) which estimated the mortality on day one admission (5). Recently, the predictors of Logistic Organ Dysfunction (LODS) and Nursing Activities Scores (NAS) was used to assess the functional decline of ICU admitted patient (3). The purpose of LODS is to predict the patients; risk of death at the admission and discharge while the NAS is to measure the workload of nursing care. They further reasserted that Barthel Index also used for ADL scores pre-ICU in a month and 24

hours post-ICU (3).

Factors associated with ICU readmission within 24-72 hours

A previous study reported that the patients who were readmitted within 48 hours had higher index admission Mortality Prediction Model (MPM) scores (2). Another study found reported that readmitted patients in the study had lower mean admission Acute Physiological Chronic Health Evaluation (APACHE II) score in the first 24 hours in ICU stay (16). Opposite results found in a convenience study, its shown that readmitted ICU patients presented higher APACHE II which collected within 24 hours of ICU admission (3). They further described that readmitted patients have a lower mean TISS-28 score in the first 24 hour of their ICU stay compared to first admission patients (3).

Furthermore, patients who readmitted to the ICU were more likely to be males, displayed higher seriousness of illness (Simplified Acute Physiology III score) at index ICU admission, and were admitted more often for medical reasons (6). A study also found that the frequency of patient's ICU readmission followed by higher Acute Physiology Score (APS) which estimated the mortality on day one admission (5). In recent study, it was reasserted that lower Barthel Index score was associated with ICU readmission (3). The other factor that can contribute to ICU readmission is severity of illness of patients. The most common readmission diagnoses were 42.3 % respiratory and 24.4% cardiac arrest or failure (2). Moreover, comorbidities such as chronic lung failure, cachexia, previous stroke and chronic neurological diseases (16).

Studies have shown that the most common cause of readmission was acute and chronic respiratory failure, sepsis, pre-existing anxiety/ depression, immobility, nasogastric nutrition, high white cell count and discharge time in non-weekend (9, 18 & 19). The acute and chronic respiratory score and kidney failure were substantially higher of Sequential Organ Failure Assessment (SOFA). However, this claim can be contended by a study which indicated that the most common readmissions were from the Solid Organ Transplant ICU (22.8%), Trauma ICU (17.7%), or medical ICU (15.4%) (20).

Furthermore, the findings have shown that the discharge time of patients also associated with ICU readmission where the patients discharged from the ICU in afternoon or at night were prone to readmitted within 72 hours compared to those who discharged in the morning (2 & 15). Besides, the deterioration of hemodynamic monitoring such as lower Glasgow Coma Scale (GCS) on the day of discharge were likely to be readmitted back to the intensive care unit (7). Prolonged INR (>1.3) 24 hours before discharge, non-mobilization, discharge with the nasogastric tube, elevated peripheral white cell counts 24 hours before discharge and non-weekend discharge have risks for ICU readmission (18). Recent study showed that the patients with poor functional status and lower pinch strength are more prone for ICU readmission (3). Last but not least, those with readmission were significantly older, have comorbidities, nonoperative diagnoses, dialysis and had emergency surgery (6, 17).

Recommendation to reduce ICU readmission

Nurse-led ICU follow-up program proved cost-effective, saving an estimated US$ 145,614 for a 13-month period, and a strategy to prevent ICU readmission in patients with respiratory problems (21). A study finding also claimed that the ward nurses in their interview study suggested that they felt better and happier when the Post Intensive Care Group (PIG) team visited the patient and felt that this visit was also valued by the patient (22). According to them, this interaction has contributed to shared nurses learning and increased ward competency, which has benefited vulnerable patients (22).

Redesigning the ICU nursing discharge process decreased ICU discharge delay, reduced mortality or ICU readmission rates within 72 hours (15). The improvement process includes appointing a change agent, developing patient handover sheet, designing a daily ICU discharge alert sheet including expected date discharge. Even though the result showed there was no difference in hospital mortality and ICU readmission however, there reduction in average patient discharge delay time of 3.2 hours compared to 4.6 hours before (15). Previous study suggested the use of intermediate units or known as semi-intensive units for the discharge ICU patients which follow several characteristics (17).

The purpose is to rationalize the ICU beds quantity and facilitate the work of management and multidisciplinary teams. In addition, IUs have facilities for those who need close nursing care with optimizing cost and promoting positive outcomes where the visitors are more frequently allowed. Furthermore, in an observation-based study proposed that implementing critical care

transition programs on ICU readmission patients within 72 hours to improve the safety of patient discharge from ICU (24). However, the result showed that there was an immediate non-significant decrease for ICU readmission in both study groups (three hospitals implementing standardized critical care transition programs) and control groups (five hospitals that did not implement the program).

DISCUSSION

The purpose of this review is to identify the predictors, factors and recommendation of ICU readmission. The studies in this literature were done mostly in the United States and Brazil countries which recorded four studies in this review paper. Two articles from Australia, one each study from Poland, Hong Kong, Sweden, Canada, The Netherlands and South Korea. However, there are no studies done in Malaysia regarding ICU readmission.

In Hong Kong, the researchers studied the ICU-follow up program and measured the outcome of ICU readmission within 72 hours. Meanwhile, in South Korea, the researchers established a prediction index for ICU readmission using the five verified risk factors.

Predictors associated of ICU readmission

Specifically, four articles in this review study about Acute Physiological Chronic Health Evaluation (APACHE) score related to ICU readmission. One article used Stability and Workload Index for Transfer (SWIFT) scale for criterion of discharge from the intensive care unit and another one study used Therapeutic Intervention Scoring System (TISS). Independent predictors of readmission to ICU were also used in one study. Meanwhile, two studies used predictors of Simplified Acute Physiology Score (SAPS) for ICU discharge indicator and Acute Physiology Score (APS) to determine the mortality rate on day one admission. Barthel index is used in one article that is associated with ICU readmission. Moreover, there is one study that used predictors of Logistic Organ Dysfunction (LODS) and Nursing Activities Scores (NAS).

Factors associated with ICU readmission

There are nine articles discussed about the factors of ICU readmission. There is one article which stated that higher index admission Mortality Prediction Model (MPM) scores, higher APACHE II, higher Simplified Acute Physiology III score and higher Acute Physiology Score (APS) are the factors associated with ICU readmission. Besides, lower mean admission Acute Physiological Chronic Health Evaluation (APACHE II) score, lower mean TISS-28 score in the first 24 hour of their ICU stay are found in readmitted patients, lower Barthel Index are the factors of readmission. Five articles discussed that severity of illness are causes of the ICU readmission. Higher Sequential Organ Failure Assessment (SOFA) is the common factor of readmission found in one article. However, one article mentioned the most common factors of readmission from Solid Organ Transplant ICU, Trauma ICU, or medical ICU. Meanwhile, two articles stated that ICU readmission is related to discharge time of patients. Four articles discussed the patient's conditions before discharge determined the ICU readmission.

Recommendation to reduce ICU readmission

The recommendation to reduce ICU readmission was a follow-up program for ICU nurse-led, tagging new nurses with experienced nurses, improving ICU nursing discharge, the use of semi-intensive units and implementing transition programs of critical care for patients readmitted to ICU within 72 hours. Furthermore, this review has similar finding like previous study, more efforts should be made to improve the quality of life in critically ill patients with comorbidities such as cardiac disease to prepare them physically, mentally and sociologically to adapt themselves during their critical situation (23). Also, the nurse-led follow-up service is a step towards strengthening critical care in the ward setting (22). Moreover, taking care of a newly discharged patient by newly registered nurses should be under the monitoring of experienced nurse (25).

Limitation

Nevertheless, this review also has its limitations including the narrow range of the study years, full text and use of English-based articles, which might miss out other important articles that discuss predictors, factors and consequences and recommendation of ICU readmission. Secondly, this review did not include the patient's severity of illness at the ICU discharge and adverse events occurring post-ICU discharge that led to ICU readmission. Thirdly, the search for relevant data from limited research for ICU readmission within 24 hours and 72 hours as most of research about the readmission within the same hospital which is not specific to ICU readmission.

CONCLUSION

Based on our systematic review of data from articles, it can be concluded that the variety of predictors of ICU readmission can be used. A broad range of factors contribute to patients readmitted to ICU. These studies would provide useful information for health systems to reduce the ICU readmission to improve the quality of life and decrease morbidity and mortality especially in critically ill patients. Besides, this study can help the healthcare providers, especially nurses, to prepare mentally and physically to provide nursing intervention to critically ill patients.

A module for ICU readmission is recommended to provide the updated guidelines regarding ICU readmission to healthcare providers especially the critical nurses and general ward nurses to reduce the incidence of ICU readmission. Overall, this review helps in creating future research study which is assessing predictors, factors and consequences of ICU readmission. It is recommended for future studies to examine the effectiveness of predictors that are used during initial ICU admission that contributed to ICU readmission.

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