

A SURVEY OF NURSES' ADHERENCE TO THE BEST PRACTICE OF THE PROPOFOL HANDLING FOR SEDATION IN THE INTENSIVE CARE UNIT

DR TANG YI CHUAN (MMC 69997)

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ABSTRAK

Pengenalan: Propofol merupakan ubat penenang yang biasa digunakan dalam unit rawatan rapi di seluruh dunia. Walau bagaimanapun, ia mempunyai formulasi emulsi yang bukan pirogenik menggalakkan pembiakan mikroorganisma yang secara tidak langsung membawa kepada risiko jangkitan kuman yang berkaitan dengan propofol selepas melebihi tempoh selamatnya. Kami ingin menyukat kepatuhan jururawat terhadap amalan terbaik dalam pengendalian ubat propofol sebagai ubat penenang di unit rawatan rapi dan menentukan faktor yang berkaitan supaya dapat memberi panduan kepada mana-mana persatuan unit rawatan rapi mengambil langkah-langkah yang diperlukan untuk meningkatkan kepatuhan kepada pengendalian ubat propofol yang betul dalam kalangan jururawat rawatan rapi.

Kaedah: Satu set soalan kajian yang mengandungi 15 item berkaitan dengan amalan pengendalian ubat propofol telah diedarkan kepada jururawat unit rawatan rapi di Hospital USM dan Hospital selayang dari Oktober hingga Disember 2021. Soalan selidik dalam bentuk Google Forms telah diedarkan melalui e-mel dan/atau WhatsApp Messenger kepada responden kajian ini.

Keputusan: Kadar respon kajian ini adalah sebanyak 70% (126 daripada 180 jururawat ICU). Lebih kurang separuh daripada jururawat (49.2%) mempunyai pematuhan yang bagus terhadap amalan terbaik dalam pengendalian ubat propofol. Faktor yang mempunyai perkaitan yang ketara secara statistik ialah pengalaman jururawat dan kesedaran tentang garis panduan/protokol pendendalian ubat propofol yang betul dengan nisbah ganjil diselaraskan sebanyak 1.102 (95% CI 1.0624, 1.210) dan 0.307

(95% CI 0.123, 0.697) masing-masing (Kedua-dua $p < 0.05$). Majoriti responden berada dalam katogeri risiko rendah dan sederhana (88.9%)

Kesimpulan: Peraturan pematuhan yang baik terhadap amalan pengendalian ubat propofol dalam kalangan jururawat unit rawatan rapi dalam kajian adalah boleh diterima. Garis panduan tempatan mengenai amalan pendendalian ubat propofol perlu diwujudkan untuk memastikan amalan tesrsebut dapat dilakukan secara mampan untuk mengurangkan risiko amalan pengendalian ubat propofol yang tidak selamat.

Kata Kunci: Propofol, Juruwawat unit rawatan rapi, amalan pengendalian, garis panduan, jangkitan kuman

ABSTRACT

Background: Propofol is a common sedative agent used in ICUs worldwide. However, its nonpyrogenic emulsion formulation promotes the growth of microorganisms, which indirectly carry the risk of propofol-related infection after exceeding its safety period. We aim to evaluate the proportion of nurses' adherence to the best practice of propofol handling for sedation in ICU and its associated factors, to help guide any related intensive care associations to take necessary measures to enhance adherence to proper propofol handling practice among ICU nurses.

Methods: Questionnaires consisting of 15 items related to propofol handling practice were distributed to ICU nurses working at Hospital USM and Hospital Selayang from October 2021 to December 2021. The questionnaires were distributed in the Google Forms via email and/or WhatsApp Messenger to all respondents in the study.

Results: The study's response rate was 70% (126 out of 180 ICU nurses). Approximately half of the nurses (49.2%) had good adherence to the best practice of propofol handling. The statistically significant factors associated with adherence to the best practice protocol in propofol handling were nursing experience and awareness regarding correct propofol handling protocols with an adjusted odd ratio of 1.102 (95% CI 1.0624, 1.210) and 0.307 (95% CI 0.123, 0.697) respectively (both $p < 0.05$). Most respondents fell in the low to moderate risk category (88.9%).

Conclusion: The percentage of good adherence to propofol handling practice among the ICU in this study is still acceptable. A local propofol handling practice guideline needs to be established to ensure a sustainable practice to reduce the risk of unsafe propofol handling practices.

Keywords: Propofol, ICU nurse, adherence, handling practice, guideline, infection

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LIST OF SYMBOLS AND ABBREVIATIONS

C.D.C	Centre for Disease Control and Prevention
ICU	Intensive Care Unit
IQR	Interquartile range
<i>P</i>	<i>P</i> -value
SASA	South Africa Society of anesthesia
S-CVI/Ave	Scale level content validity index/ averaging calculation method
S-FVI/Ave	Scale-level face validity index based on the average
SPSS	Social Package for the Social Sciences
USA	Unite State America
USM	Universiti Sains Malaysia

CHAPTER 1: INTRODUCTION

1.1 Introduction

Propofol is one of the most common medications used as a sedative agent in the intensive care unit (ICU) worldwide. It is one of the favourite sedative agents for most doctors due to its properties of relatively short context-sensitive half-time, cost-efficiency and low incidence of delirium (1). The medication is usually administered via infusion method for a certain period. However, propofol is formulated as a nonpyrogenic emulsion containing soybean oil, purified egg phosphatide and glycerol. It is an excellent medium to support the growth of bacteria, especially when exposed to the external environment after exceeding a certain safety period (2). Therefore, there is a risk of nosocomial infection in ICU patients if propofol is mishandled when used as a sedative medication in the ICU (3). Consequently, it is essential to emphasise the correct propofol handling in the ICU. We aim to gauge the nurses' adherence to the best practice of propofol handling in the ICU. The results would help guide local authorities or bodies such as the Ministry of Health or the Malaysia Intensive Care Society so that appropriate measures can be taken to enhance the adherence of ICU nurses to proper propofol handling practice in the ICU.

1.2 Problem statement and study Rationale

Nurses play an essential role in the ICU, including the preparation and administration of medication (4). Propofol sedation is commonly prepared and administered by ICU nurses. Due to its non-pyrogenic formulation, which supports bacteria growth, it is vital to practice safe propofol handling according to the guideline to prevent propofol-related nosocomial infection (5). Furthermore, most patients in the ICU are critically ill and at high risk of having nosocomial infection, which can further

increase their morbidity and mortality (6). Besides that, improper handling of propofol could lead to contamination by multidrug-resistant bacteria found within the ICU environment, which is challenging to treat (7). The unsafe preparation and administration of propofol have been proven to contribute to propofol-related infection among ICU patients (8).

To prevent propofol-related infection, many bodies worldwide, such as the Centre for Disease Control and Prevention (C.D.C), have come out with a few recommendations on correct propofol handling. However, there has yet to be any general guideline review on handling propofol sedation in Malaysia. This survey attempts to fill the gap of the absence of guidelines by providing data on propofol handling practice among ICU nurses. Hopefully, such guidelines can be drawn up and distributed to guide nurses on proper propofol handling in ICU in future. This can indirectly help reduce the risk of propofol-related nosocomial infection, which is preventable with good practice.

1.3 Literature Review

1.3.1 Discovery of propofol-related-infection

Propofol was approved by US Food and Drug Administration (FDA) to use as induction for general anaesthesia in October 1989. Since then, there have been numerous unusual bloodstream infections, surgical-site infections and acute febrile phases after surgical procedures in 4 states of the United States of America (USA), especially in May and June 1990. As a result, the C.D.C investigated seven hospitals between June 1990 and February 1993 and found that 79% of patients who underwent surgery during that period had postoperative infections associated with extrinsically contaminated propofol resulting from unsafe preparation and delivery. In 6 out of 7 hospitals, etiologic microorganisms related to propofol-related infection were identified: *Staphylococcus*

aureus, *Candida albicans*, *Moraxella osloensis*, *Enterobacter agglomerans*, or *Serratia marcescens* (9, 10). Furthermore, the C.D.C reported healthcare-associated hepatitis B and C virus outbreaks during 2008–2014, coinciding with recent propofol exposure (5). There was a total of 20 propofol-related infectious disease outbreaks have been reported globally, affecting 144 patients (5). A review from L.T.Curtis (11) showed that 50 out of 2250 cases of hospital-acquired infections via contaminated substances were reported due to contaminated propofol administration (5). Furthermore, a review by Webb SAR et al. (3) observed an incidence rate of 5.9 % of contaminated propofol syringes in an ICU setting.

1.3.2 Factors contributed to propofol-related infection

The contamination of the propofol vials may arise from the environment during manufacturing (internal factor) or after the vial opening (external factor). Many reports found that external factor is the most common cause of contamination. The various outbreaks of serious postoperative healthcare-associated infections that occur worldwide found that quantitative pieces of evidence are linked with extrinsic microbial contamination and cross-contamination (5). Propofol contamination is commonly due to mishandling of propofol by health care workers, primarily the anaesthesia provider, who tend to overlook precautions during propofol administration, including hand hygiene and preventing accidental exposure of propofol to the environment. (12, 13).

Other factors that may contribute to propofol contamination are:

- a) preparation of multiple syringes for use throughout the day
- b) re-use of propofol vials, syringes, or infusion-pump lines on multiple patients

c) use of opened ampules that exceeds the safety period that the manufacturer recommended

d) failure to wear sterile gloves while handling propofol and to dispose of them after each contact.

The syringes, IV stopcocks and infusion lines were the leading sites for propofol contamination. Devon CC et al. (14) found significant bacterial growth from the stopcock used for propofol infusion with visible residual propofol.

1.3.3 Recommendations to prevent propofol-related infection

Many organisations, such as the American Association of Nurse Anesthetists in 2017, the Anesthesia Patient Safety Foundation in 2007, the C.D.C and the South Africa Society of Anesthesia (SASA) have published recommendations on the correct propofol handling practice to reduce the rate of propofol-related infection. (15, 16, 17, 18)

The summary for recommendations is as below: (7, 15, 19, 20, 21, 22, 26)

(a) Use of the strict aseptic technique

(b) Propofol should be inspected before use for particulate matter, discolouration, or evidence of emulsion separation. Do not use if contaminated.

(c) Fill syringes or spike the vial immediately, only before administration to each patient.

(d) Disinfect the rubber stopper with 70% isopropyl alcohol.

(e) Discard unused portions within 6 hours of filling syringes or 12 hours after spiking a large volume vial for infusion.

(f) Emphasize single-use syringes, needles, administration sets, ampoules and vials.

(g) Begin infusion immediately after drawing up or opening the medication vial.

(h) Disinfect with an alcohol swab before breaking the ampoule or penetrating the vial diaphragm.

Furthermore, an additive such as EDTA, which has antimicrobial activity, has been added to propofol formulation as one of the methods to reduce the risk of propofol-related infection. The additive reduces the incidence of propofol-related infection per year in the USA after being approved by US Food and Drug Administration and introduced to clinical use in 1996 (5). However, there is no proper guideline on propofol handling in Malaysia

1.3.4 Adherence to correct propofol handling practice

Few articles have been published on adherence to correct propofol handling practices among anaesthesia providers. Anneme B et al. (17) conducted a survey on propofol injection practice in 2016 among anaesthesia providers in South Africa showed poor knowledge and unsatisfactory adherence to the local SASA guideline. Besides that, a cross-sectional study of propofol handling practices conducted among Columbia anaesthesiologists and anaesthesia residents showed that about 37.9% of anaesthesia providers reused propofol vials, and around 6.2% of anaesthesia providers reused propofol syringes, which are not recommended by C.D.C (23). Another survey among

members of the New York State Society of Anaesthesiologists showed that 31% reported reusing the same single-use vial for multiple patients for at least some time. Among those who reuse propofol vials for numerous patients, 91% reported reading the prescribers' information (18). All these surveys on propofol handling practices were done among the anaesthesiologists and anaesthesia residents who work in the operation theatre. So far, there has been no survey done among ICU nurses on propofol handling in Malaysia and any other country.

1.4 Study Objectives

1.4.1 General

To evaluate the proportion of nurses' adherence to the best practice of propofol handling for sedation in intensive care units and its associated factors.

1.4.2 Specific

- 1) To determine the proportion of nurses' adherence to the best practice propofol handling for sedation in intensive care.
- 2) To evaluate the demographic factors associated with the proportion of ICU nurses' adherence to the best practice in propofol handling for sedation in the ICU.
- 3) To determine the proportion of infection transmission level based on the propofol handling practice using infection risk score among the ICU nurses.

1.5 Research hypothesis

1.5.1 Null Hypotheses

- There is no demographic difference in terms of age, nursing experiences, ICU working experiences, gender, position, level of education and awareness regarding the correct propofol handling guidelines/protocols with the proportion of ICU nurses' adherence to the best practice protocol in propofol handling

1.5.2 Alternate Hypotheses

- 1) Higher proportion of nurses in ICU adhere to the best practice propofol handling for sedation in intensive care.
- 2) There are demographic differences in terms of age, nursing experiences, ICU working experiences, gender, position, level of education and awareness regarding the correct propofol handling guidelines/protocols with the proportion of ICU nurses' adherence to the best practice protocol in propofol handling
- 3) There is a low level of infection risk transmission based on the propofol handling practice among ICU nurse

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CHAPTER 2: STUDY PROTOCOL

2.1 Research Methods and Methodology

2.1.1 Research Design

The cross-sectional study involved a self-administered questionnaire. Data collections were anonymous.

2.1.2 Study Period

1st October 2021 – 31st December 2021.

2.1.3 Study Population

All ICU nurses working in the critical areas in Hospital USM and Hospital Selayang.

2.1.4 Study Area

General ICU in Hospital Selayang and critical area in Hospital USM (Medical ICU, Surgical ICU, Trauma ICU, Neuro ICU)

2.2 Subject Criteria

2.2.1 Inclusion Criteria

All certified nurses with working experience in ICU for more than six months.

2.2.2 Exclusion Criteria

- Attachment nurses from another speciality/wards
- Nurses on extended leave (maternity, study and unpaid leave)

2.3 Sample Size Estimation

For objective 1, the sample size was estimated by using single proportion formula via Dr Wan Nor Arifin's sample size calculator (website: <https://wnarifin.github.io/ssc/ss1prop.html>).

$$n = \left(\frac{z}{\Delta} \right)^2 (p(1-p))$$

Objectives	Parameter	Sample size (n)	Total (n) + 10% drop out
To determine the proportion of nurses' adherence to the best practice propofol handling for sedation in intensive care.	Proportion: 0.23* Confidence interval: 95% Precision: 0.1 Expected drop out 10% *Knowledge, Attitude and Practice of Nurses in Administering Medications at Mansoura University Hospitals (4)	69	77

For objective 2, the sample sizes were estimated using two means hypothesis testing for numerical independent variable demographic factors (age, nursing experiences, ICU working experiences). In contrast, two proportion hypothesis testing was used for categorical independent variables of demographic factors (gender, position, level of education, and awareness regarding the correct propofol handling guidelines/protocols). Each calculation was using Dr Wan Nor Arifin's sample size calculator to determine the sample size (website: <https://wnarifin.github.io/ssc/ss1prop.html>)

Independent variable (numerical)	Standard deviation	Expected differences	Significance level, α	Power (1- β)	Sample size (n)	total=(n) + 10% drop out	Total x2
Age (years)	2.6 *Knowledge of Nurses in the Preparation and Administration of Intravenous Medications (2)	2	0.05	0.8	27	30	60

Nursing experience (years)	2.7 *Knowledge of Nurses in the Preparation and Administration of Intravenous Medications (2)	2	0.05	0.8	29	33	66
ICU working experience (years)	2.7 *Knowledge of Nurses in the Preparation and Administration of Intravenous Medications (2)	2	0.05	0.8	29	33	66

Independent variable (categorical)	P1	P0	Significance level, α	Power (1- β)	Sample size (n)	total=(n) + 10% drop out	Total x2
Gender	67 % (female) *Knowledge about the administration and regulation of high-alert medications among nurses in Palestine (3)	40%	0.05	0.8	52	59	118
Education	25 % (diploma) *Knowledge about the administration and regulation of high alert medications among nurses in Palestine (3)	55 %	0.05	0.8	41	46	92
Position (staff nurses/head nurses)	67 % (staff nurse) *Knowledge about the administration and regulation of high alert medications among nurses in Palestine (3)	40 %	0.05	0.8	52	59	118
Awareness regarding the correct propofol handling guidelines/protocols	62% (Yes) *A survey of propofol injection practices reveals poor knowledge of and unsatisfactory adherence to the	35%	0.05	0.8	53	59	118

	SASA Guidelines for Infection Control (5)						
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For objective 3, the sample size was estimated using single proportion formula via Dr Wan Arifin's sample size calculator (website: <https://wnarifin.github.io/ssc/ss1prop.html>)

$$n = \left(\frac{z}{d} \right)^2 (p(1-p))$$

Objectives	Parameter	Sample size (n)	Total (n) + 10% drop out
To determine the proportion of infection transmission level based on the propofol handling practice using infection risk score among the ICU nurses.	Proportion: 0.06* Confidence interval: 95% Precision: 0.05 Expected drop out 10% *A survey of propofol injection practices reveals poor knowledge of and unsatisfactory adherence to the SASA Guidelines for Infection Control (5)	87	97

Based on the sample size calculation, the estimated minimum sample to fulfil the requirement of all study objectives was **118**.

2.4 Sampling method

Non-probability sampling method (convenience sampling) will be applied. All nurses who fulfilled the inclusion criteria will be included in the survey as this survey will be conducted among a finite population.

2.5 Subject recruitment

- The Questionnaires will be distributed in Google Forms (https://docs.google.com/forms/d/e/1FAIpQLSdmTTHYfODnaF1t4j0LXylsc5NaTdFm_WOS5euRwkpl6djiTQ/viewform, Appendix A) together with participation information sheet and consent (Appendix B) via email and/or WhatsApp Messenger

- The Google Form link will be shared with the sister-in-charge of critical care in Hospital USM and ICU Hospital Selayang via email and/or WhatsApp Messenger application(app). They will share the link in their nursing critical care unit/ICU group via email and/or WhatsApp Messenger so participants can fill up the questionnaire within the three months period.

2.6.1 Questionnaire

- Questionnaire on propofol handling practice consisted of 2 domains.
- Domain A comprises the demographic data (age, nursing experiences, ICU working experiences, gender, position and level of education) and prevalence of awareness regarding the correct propofol handling guidelines/protocols among ICU nurses.
- Domain B consists of 15 items related to the adherence to the best propofol handling practice, which has been modified and adapted from two surveys by Anneme B et al. in 2015 in South Africa (17) and Andrés ZV et al. in 2016 at Columbia (23). The original questionnaires were conducted among the anaesthesiologists and anaesthesia residents, modified and adapted in this study to reflect ICU nurses working conditions.

*The questionnaire items in domain B were compared with published guidelines/policies in the journals, organisations and company product leaflets. (15, 19, 21, 22, 23, 26)

* Permission to use the items for domain B was obtained from Dr Andrés Zorrilla-Vacaa and Dr Johan (Jeff) F. Coetzee, the authors of both journals via email.

* The survey developed by Dr Andrés (23) was validated and reported good internal consistency with Cronbach α of 0.85. His study had done a comparability test between his questionnaires with the C.D.C guidelines recommendations regarding safe syringes practices and propofol handling. Multiple experts in Columbia have also verified the items. The survey developed by Dr Anneme (17) has not been validated. However, the survey items were taken as references in view that the study has been published at an international level. Due to the lack of validated questionnaires regarding the best practice of propofol handling, the questionnaire used in this study was validated and not validated. The items in domain B will be further tested for content-related validity by expert judgement, and face validity will be conducted among ICU Hospital USM nurses. Besides that, the reliability of the items will be assessed using the Cronbach alpha test.

- Among 15 items in part B: 14 items regarding propofol handling practice and 1 item (item number 11) to identify factors for using the same vial for different patients.
- A four-point Likert scale was used for all items except for item numbers 11,13 and 15, with 0 indicating 'never', 1 'rarely', 2 'often' and 3 'always'.
- Item numbers 14 and 15 will score 1 for the correct answer '6 hours' for item number 13 and '12 hours' for item number 15 while the incorrect answer and unsure is 0.
- Item number 11 is not included in the score; it just needs to identify the factor for using the same vial for a different patient.
- All scores will be summed up as the total score (38). The ICU nurse with a more than 80% practice score considers good practice. (24)

2.6.1(a) Pre-test for the questionnaires

- Questionnaire for domain B was tested for content-related validity by six experts from USM Anaesthesiology and Critical Care department. They reviewed the tools for clarity, relevance, understanding, and applicability for implementation. According to their critiques, the modifications were done.

* S-CVI/Ave (scale level content validity index/ averaging calculation method) gained from 6 experts was 0.93.

- Reliability for domain B was measured among 30 ICU Hospital USM nurses, and acceptable internal consistency with Cronbach α was gained, which is 0.63
- Face validity test was conducted on 30 critical care Hospital USM nurses to examine the tools' clarity and applicability. These nurses were excluded from the study sample. Tools were modified based on the nurses' comments, making the items clear and understood. S-FVI/Ave (scale-level face validity index based on the average method) in the test was 0.94.
- Questionnaire attached as appendix B

2.6.1(b) Questionnaire allocation marks

- The mark allocated for each component of the questionnaire is as follows:

Score	3	2	1	0
1. Do you wipe the neck of a propofol glass ampule with an alcohol swab before breaking it?	Always	Often	Rarely	Never
2. Do you allow alcohol to dry before breaking open?	Always	Often	Rarely	Never
3. Do you use gloves to prepare propofol infusion?	Always	Often	Rarely	Never

4. Do you use a face mask to prepare propofol infusion?	Always	Often	Rarely	Never
5. Do you use protective wear (gloves and face masks) while administering propofol via infusion pump to the patient?	Always	Often	Rarely	Never
6. Do you re-use the same syringe used for infusion to draw new propofol for the same patient?	Never	Rarely	Often	Always
7. Do you re-use the same syringe used for infusion to draw new propofol for the different patients?	Never	Rarely	Often	Always
8. Do you use a new needle to draw propofol several times for the same patient?	Always	Often	Rarely	Never
9. Do you pre-prepared propofol infusion before the patient is admitted to ICU?	Never	Rarely	Often	Always
10. Do you share leftover contents of a propofol glass ampule with another patient? *if the answer is never, move to question 12	Never	Rarely	Often	Always
11. Why do you use the same vial of propofol for different patients?	No Score given			
12. Do you carry any unused pre-prepared propofol to the next day?	Never	Rarely	Often	Always
13. What is the longest time you have used the same ampule of propofol (after it opened)?			6 hours	Unsure and 12,24,48 hours
14. Do you re-use the same infusion tubing for more than 1 patient in ICU?	Never	Rarely	Often	Always
15. What is the longest time you have used the same infusion tubing with propofol for continuous intravenous sedation?			12 hours	Unsure and 6, 24, 48 hours

- Maximum possible score is 38; the nurses with scores greater than 30 are considered to have good adherence to best practice protocol on propofol handling (80%) (25).

2.6.1(c) Calculation of infection of a risk score to determine the proportion of infection transmission level based on the propofol handling practice

- A risk-scoring system from the possible replies to 14 items regarding handling propofol ampules, syringes and infusion tubing was designed to also reflect infection risks. Risk scores were applied to the answers by the respondents, who indicated their practices.

-For example, in reply to the question ‘Do you wipe the neck of a propofol glass ampule with an alcohol swab before breaking it?’, scores of 0, 1, 2, 3 and 4 were allocated to the replies ‘always’, ‘almost always’, ‘sometimes’, ‘rarely’ and ‘never’ respectively.

-The maximum total was 42.

-Scores were grouped into low-risk (0-9), moderate-risk (10-18), high-risk (19-27), very high-risk (28-42)

-Item number 11 will not be included in the risk-score calculations

- The risk score allocated for each item of the questionnaire is as follows:

Score	0	1	2	3
1. Do you wipe the neck of a propofol glass ampule with an alcohol swab before breaking it?	Always	often	rarely	Never
2. Do you allow alcohol to dry before breaking open?	Always	often	rarely	Never

3. Do you use gloves to prepare propofol infusion?	Always	often	rarely	Never
4. Do you use face mask to prepare propofol infusion?	Always	often	rarely	Never
5. Do you use protective wear (gloves and face masks) while administering propofol via infusion pump to the patient?	Always	often	rarely	Never
6. Do you re-use the same syringe used for infusion to draw new propofol for the same patient?	Never	Rarely	Often	Always
7. Do you re-use the same syringe used for infusion to draw new propofol for the different patients?	Never	Rarely	Often	Always
8. Do you use a new needle to draw propofol several times for the same patient?	Always	often	rarely	Never
9. Do you pre-prepared propofol infusion before the patient is admitted to ICU?	Never	Rarely	Often	Always
10. Do you share leftover contents of a propofol glass ampule with another patient? *if answer never, move to question 12	Never	Rarely	Often	Always
11. Why do you use the same vial of propofol for different patients?	No score given			
12. Do you carry any unused pre-prepared propofol to the next day?	Never	Rarely	Often	Always
13. What is the longest time you have used the same ampule of propofol (after it opened)?	6 hours			Unsure and 12,24,48 hours
14. Do you re-use the same infusion tubing for more than 1 patient in ICU?	Never	Rarely	Often	Always
15. What is the longest time you have used the same infusion tubing with propofol for continuous intravenous sedation?	12 hours			Unsure and 6, 24, 48 hours

2.7 Operational definition

- Any ICU nurses with a practice score of more than 80% (score total of 30) from a possible maximum score of 38 considers to have good adherence to best practice protocol on propofol handling (25)
- For infection risk score calculation, categorised as low-risk (0-9), moderate-risk (10-18), high-risk (19-27), very high-risk (28-42) (17)

2.8 Data collection method

- Questionnaire was distributed to participants using Google Forms.
- The first section of the Google Forms has information about surveys, such as the introduction, a component of the survey, participant criteria, risks and potential benefits of participant, confidentiality and contact of the principal investigator and ethics committee involved (Appendix B).
- On the bottom part of the first page, if participants agree to participate in the survey, they click 'yes'. They can proceed to the second and third sections of the Google Form to answer the questionnaire (implied consent applied).
- It is estimated that the participants will take approximately 15 minutes to answer the questionnaire. The questionnaire was distributed in Oct 2021, and participants have three months (till 31st Dec 2021) to consider taking part in this survey. They can answer the questionnaire whenever they are free.
- Once participants had answered the questionnaire, the responses of participants were recorded in the table in Google Sheets, which is easily used for data collection and interpretation later.

link: <https://docs.google.com/spreadsheets/d/1RBRny-FuQPdiL-JqTm8DXCPiGMxEjRtC8q6jgoeseW0/edit?resourcekey#gid=1114906960>

- Responses collected underwent accuracy crosscheck for source document verification by investigators, then transferred into SPSS Window version 26.0. The data was collected from Oct 2021 to Dec 2021

2.9 Proposed data analysis

- The collected data were coded and analysed using PC with the Statistical Package for Social Sciences (SPSS version 26). Continuous and interval data were presented as mean score and standard deviation for normal distribution data, while the median and interquartile range for skewed distribution data. Nominal data were presented in the forms of frequency (n) and percentage.
- Objective 1: Number and percentage used to evaluate descriptive data on good adherence to the best practice propofol handling for sedation in intensive care.
- Objective 2: Simple and multiple logistic regression was used to evaluate associated demographic factors with adherence to best practice propofol handling. Significance was accepted as $p < 0.05$
- Objective 3: Number and percentage will use to evaluate the proportion of infection transmission level based on the propofol handling practice via infection risk score.

2.10 Gantt chart

Table 6: Projected Chronological Progress of Cross-Sectional Study (2021-2022)

Activities	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mac	Apr	May	Jun	Jul
Developing questionnaire														
Preparation for data collection														
Pretest														
Data collection														
Data Entry														
Writing Introduction														
Writing literature review														
Writing methodology														
Analysing data														
Writing results														
Writing discussion														
Writing conclusion & recommendation														
Submission of thesis														X

2.11 Study flowchart

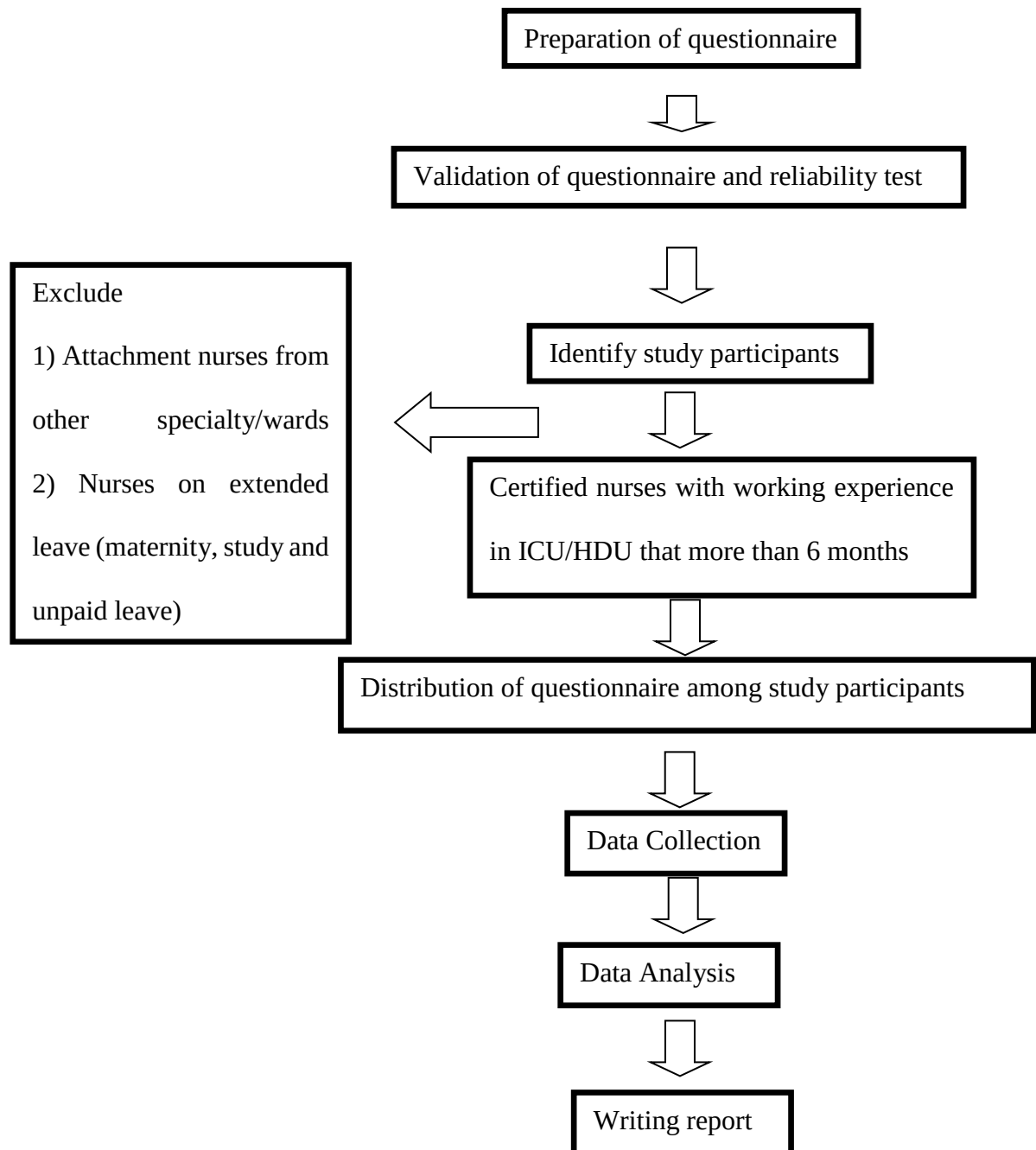


Figure 2: Study flowchart