

## ORIGINAL ARTICLE

# Infection and Prevention Control Among Nurses in Dedicated Covid-19 Ward at Private Hospital in Indonesia

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## ABSTRACT

**Introduction:** The COVID-19 pandemic demands stricter implementation of infection control and prevention, especially in breaking the chain of the spread of this disease. This study aims to determine the relationship between knowledge and infection prevention control (IPC) implementation by nurses in the COVID-19 ward at a private hospital. **Methods:** The study is a survey of 36 private hospitals in Indonesia. Knowledge was measured by a questionnaire related to nurses' knowledge about IPC application with 20 questions. Meanwhile, the implementation of IPC is carried out using a checklist from IPC surveillance conducted by infection prevention control nurse (IPCN). Three hundred thirty-six nurses observations were obtained from this study. Data analysis used descriptive and inferential regression to investigate the characteristics, knowledge, and implementation of IPC. **Results:** The results showed that almost all nurses in private hospitals had received training related to the application of IPC. Most nurses' knowledge is good, although all components have not reached maximum values. There are still several IPC components, such as patient placement, environmental, and PPE usage, that still need to be improved. No significant relationship was found between knowledge and the application of IPC in the COVID-19 ward. **Conclusion:** It is necessary to conduct intensive training that involves observation of essential domains of IPC for both nurses and IPCN. This study had some implications on clinical practice that components of IPC training need to more emphasize on observation skills. Further study is needed to investigate the availability of facilities in the treatment room, organizational support, and internal factors to fully capture the IPC implementation.

**Keywords:** Knowledge; Surveillance; Attitudes; Hospital Assisted Infection; infection transmission

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## INTRODUCTION

Hospitals are part of health care facilities that provide quality, accountable, and transparent health services to the community. In addition, the hospital is also a health service that contributes to improving the health status of the community. Therefore, the principle of service that prioritizes patient safety becomes a moral principle in providing health services. One of the efforts to provide health services that prioritize patient safety is implementing Infection Prevention and Control (IPC). On January 8, 2020, the Center for Disease Control and Prevention Health Advisory Network (CDC HAN) announced an Outbreak of Pneumonia of Unknown Etiology (PUE) in Wuhan, China, where the Chinese government has reported 59 patients with PUE to

WHO since January 5, 2020. This case report of PUE, which was later found to be caused by the novel coronavirus SARS-CoV-2, became the starting point for the coronavirus infection disease 19 (COVID-19) pandemic. Global COVID-19 cases as of May 28, 2020, there were 5,593,631 confirmed cases worldwide, with more than 200 affected countries and a global death toll of 353,334. (1)

Two days after the report of human-to-human transmission of infection, WHO held an Emergency Committee (EC) reconvention on January 30, 2020, and recommended the Director-General of WHO declare COVID-19 as a Public Health Emergency of International Concern (PHEIC). The Director-General accepted the recommendation and declared the novel coronavirus (2019-nCoV) outbreak a PHEIC and subsequently declared COVID-19 a global pandemic on March 11, 2020(2).

The rapid and widespread spread of COVID-19 forced

the government to take specific policies to limit human-to-human transmission, including reducing secondary infections among close contacts and health workers, preventing transmission amplification events, and minimizing social impacts of the economy through multisectoral partnerships.

A well-coordinated implementation of hospital operations at every level, clear and accurate internal and external communication, rapid adaptation to increasing demand, effective use of scarce resources, and a safe environment for Health care workers are needed in disaster management (3). Hospital disaster management is an ongoing process that requires planning and response efforts with local and national programs. In prioritizing emergencies that require a quick and effective response, a self-assessment is made using the checklist created by WHO to assist hospital management in ensuring continuity of essential services.

The essential components for hospitals to carry out preparedness planning in dealing with COVID-19 include the presence of a manager or person who is in full-time responsibility in an emergency; the existence of a particular operational task force consisting of frontline health workers (e.g., doctors in the emergency department), infection and prevention control nurses (IPCN), facility management, and other related personnel; a qualified hospital infection prevention and control team; planning related to bed capacity; and regional coalitions with local authorities (4).

Until now, the COVID-19 situation at the global and national levels is still at very high risk. While vaccine development is still in progress, the world faces the reality of preparing to coexist with COVID-19. Therefore, efforts to prevent and control COVID-19 are needed to obtain services that meet standards.

After one year of the COVID-19 pandemic, the implementation of IPC in hospitals has undergone adjustments. The increase in COVID-19 cases forced all elements of the hospital to break the chain of COVID-19 infection. The chain of Covid-19 infection includes the spread of viruses in the nasal, mouth, and eye mucosa that is spread to others through contact, droplet, and airborne (through aerosol measures) through the application of standard precautions and transmission (5). Following the regular changes of protocols IPC during COVID-19 that were released by the ministry of health, the health professionals need to adapt and adjust to the implementation quickly. On the other side, the training did not always follow the changes. Thus health professionals especially need to cope with their knowledge and implementation of IPC in the wards. There are still few studies that can provide information on knowledge and implementation of IPC in hospitals. Therefore, further study needs to analyze how health professionals carry out the implementation of IPC. The

research question was, is there any relationship between knowledge and implementation of IPC among nurses in the COVID-19 ward? This study aims to determine the relationship between nurses' knowledge of IPC implementation and investigate related factors to the IPC implementation in the COVID-19 ward at private hospitals in Indonesia.

## MATERIALS AND METHODS

This research is survey research, which was conducted in a private hospital in Indonesia. Private hospitals are actively carrying out infection prevention and control activities during the COVID-19 period. There are 36 hospitals involved, and each has 15-30 nurses working in the COVID-19 treatment room. Sampling used purposive sampling using the sample formula for surveys. The survey was conducted for a month using a google form, where the isolation nurse was asked to fill in according to the link provided. Three hundred thirty-six nurses are willing to fill out the google form, and 336 observations by IPCN using a surveillance checklist.

Statistical analysis used descriptive analysis (mean values and standard deviation) and inferential analysis (regression model). The descriptive analysis was used to analyze the characteristics of the respondents, knowledge, and application of IPC. The inferential analysis is done by applying multiple linear regression analysis. There are two regression models: the influence of respondent characteristics (Gender, Age, Length of Work, and Participation in Training) on knowledge and the effect of knowledge on the application of IPC based on domains/dimensions. This study has been approved by the hospital ethical research committee (IRB 36/H/2021).

This study used a set of IPC surveillance questionnaires released by ministry of health and used by IPCNs and tested for reliability and validity using Pearson product-moment. The validity test result showed an r-value of 0.419–0.798, and the reliability test showed that Cronbach's  $\alpha$  value was 0.810.

## RESULT

This study examines the relationship between nurses' knowledge in private hospitals and the application of infection prevention and control in the COVID-19 ward. The number of research samples was 336, taken from 36 private hospitals. The results of the study obtained a description of the characteristics of nurses: 83.6% of nurses were women, with more than half of them aged < 30 years (54.2%), with a long working period of most of them < 3 years (40.2%), and almost all of them (84.5%) have attended training on Prevention and Control of COVID Infections in hospitals (Table I).

**Table I Frequency Distribution of Demographic Characteristics**

Demographic Characteristics	f	%
Gender		
a. Woman	281	83.6
b. Man	55	16.4
Age		
a. 30 years	182	54.2
b. 31 – 40 years	116	34.5
c. > 40 years	38	11.3
Length of work		
a. 3 years	135	40.2
b. 35 years old	40	11.9
c. 6-10 years	83	24.7
d. 11 – 15 years	43	12.8
e. > 16 years old	35	10.5
PPI Training Participation		
a. Yes	284	84.5
b. No	52	15.5

Table II shows an overview per domain of infection prevention and control application in the COVID-19 ward. In general, all IPC implementation domains have not reached the maximum value. Based on Table 2 shows the mean score of the hand hygiene domain (5.18), Personal protective equipment (PPE) use (3.51), waste handling (6.11), sharps waste handling (2.79), linen management (3.80), environmental handling (4.30), patient injection (3.56), processing used patient equipment (2.34), cough etiquette /sneeze (2.88) and patient placement (1.92). The results show that the standard precautions that COVID-19 isolation nurses must carry out have not been appropriately implemented.

**Table II. Overview of the application of infection prevention and control in COVID-19 wards in private hospitals in Indonesia**

No	Variable	Min	Max	mean	SD
1	Hand Hygiene Domain	3	6	5.18	0.73
2	PPE Usage Domain	1	4	3.51	0.75
3	Waste Management Domain	2	7	6.11	1.10
4	Sharps Waste Handling Domain	1	3	2.79	0.46
5	Linen Management Domain	0	4	3.80	0.58
6	Environmental Handling Domain	0	6	4.30	1.36
7	Patient Injection Domain	0	4	3.56	0.72
8	Patient Used Device Processing Domain	0	3	2.34	0.89
9	Domain of Cough/Sneezing Ethics	0	3	2.88	0.38
10	Patient Placement Domain	0	2	1.92	0.29

Table III shows that related to the 20 questions asked related to nurses' knowledge about the application of IPC, ranging from hospital-acquired infections (HAIs), entry points from the coronavirus, application of standard precautions for PPE, standard handling of injections, standard handling of aerosol use, and patient environmental safety. Of the twenty questions, in general, nurses' knowledge about the implementation of IPC is good, where more than half of the nurses know about the definition of HAIs, entry points from the coronavirus, and standard handling of injections, but there are still several items related to the order of PPE use that is still need to improve.

**Table III: Frequency distribution of true and false statements related to IPC application by nurses in COVID-19 wards in private hospitals in Indonesia.**

No	Statement	Right (%)	Wrong (%)
1	Healthcare-Associated Infections are infections that occur during the hospital treatment process, where at the time of admission there is no infection, no incubation period; also infection occurs in the hospital, appears after returning home, and infection in health workers due to work	58.0	42.0
2	The mode of transmission of microorganisms to the human body can be through contact, droplets, and air	66.7	33.3
3	The port of entry for the Sars-Cov virus is the mouth, nose, and eyes	79.2	20.8
4	The impact of healthcare-associated infections is an illness, death, disability, high costs, decreased quality, lawsuits, increased days of care.	77.7	22.3
5	Isolation precautions include two layers, namely standard precautions, and transmission-based precautions	69.6	30.4
6	Hand hygiene is part of standard precautions	53.0	47.0
7	Control of the hospital environment is the control of the hospital environment by cleaning the entire surface of the environment every day and if it is dirty	69.0	31.0
8	The use of PPE for COVID-19 patients is based on exposure to blood and body fluids and based on contact, droplet, and airborne transmission	61.0	39.0
9	Safe injections are no recapping, one needle, one patient, one dose, and applying the correct aseptic technique	81.3	18.8
10	Things that need to be done in the former isolation patient room if the patient has left the room is to do general cleaning first, including air conditioning, curtains, and around the patient's room environment	94.0	6.0
11	Actions that produce aerosols are intubation, extubation, suctioning, tracheostomy, chest physiotherapy, bronchoscopy, high flow nasal cannula (HCNC), dental procedures, CPR, nebulizer, non-invasive ventilation, sputum induction, bagging	64.6	35.4

CONTINUE

**Table III: Frequency distribution of true and false statements related to IPC application by nurses in COVID-19 wards in private hospitals in Indonesia (CONT.).**

No	Statement	Right (%)	Wrong (%)
12	After taking action that generates aerosol, what must be done is to immediately throw away the gloves, throw away the N95 mask, remove the google/face shield, and return to the new medical mask.	69.0	31.0
13	After treating the patient, the thing to do is remove the PPE properly, do hand hygiene, use new PPE if treating a different patient, throw the PPE into the infectious waste bin, PPE that will be reused such as gowns, google/face shields are put in containers infectious agents provided and washed according to the provisions.	63.7	36.3
14	The order of wearing PPE Do hand hygiene, wear a dress, wear a mask, use google and or a face shield, wear gloves	35.1	64.9
15	Order of wearing PPE Take off gloves, take off the gown, do hand hygiene, remove the mask, remove google and or face shield	22.9	77.1
16	If the officer already wears a mask, then the patient does not need to wear a mask again	84.2	15.8
17	All waste from isolation rooms is considered infectious	81.0	19.0
18	All linens from the Covid isolation patient's room are considered infectious	94.3	5.7
19	COVID-19 isolation patient room environment should be cleaned every day at least two times a day and or dirty with water-detergent-air-disinfectant	89.9	10.1
20	The standard precautions that nurses must take in treating patients are maintaining hand hygiene, using PPE, waste disposal, linen management, patient placement, safe injections, cough etiquette, employee health, equipment processing, reasonable environmental control.	76.2	23.8

Table IV shows the results of the regression analysis carried out, where this study found that gender, training, and length of work influence knowledge. Gender affects the number of correct answers, with men tending to have more correct answers than women. Participation in training affects the number of correct answers, with those participating in the training having a greater correct answer than those not participating. Furthermore, the length of work affects the number of correct answers; the correct answers will increase with longer work (more experienced).

**Table IV : Regression Analysis of Correct Answers by Gender, Age, Length of Work and Training Participation**

Variable	B	SE	t	p-value
Gender	-0.838	0.416	-2,015	0.045*
Age	-0.250	0.335	-0.747	0.456
Length of work	0.350	0.165	2,118	0.035*
Training Participation	1.345	0.426	3,156	0.002*

Table V shows the regression analysis results between knowledge and application of IPC. These results show that there is no effect of knowledge with the implementation of IPC (p-value = 0.428).

**Table V: Knowledge Regression Analysis and Application of IPC in COVID-19 wards in private hospitals in Indonesia**

Variable	B	SE	t	p-value
Knowledge	0.058	0.73	0.794	0.428

## DISCUSSION

This study investigates the relationship between nurses' knowledge and IPC implementation in the COVID-19 ward. The study shows that nurses' knowledge of almost all knowledge is well-owned by nurses, but some still need to be improved, such as nurses' understanding of HAIs, the application of hand hygiene, and the sequence of using PPE. The percentage of correct answers for nurses' understanding of HAIs (58%), the application of hand hygiene (53%), the order of wearing PPE (35.1%), and the order of removing PPE (22.9%).

HAIs cause significant morbidity and mortality in patients and increase the financial burden on the health care system. Appropriate implementation of universal precautions by health workers effectively reduces the transmission of microorganisms and subsequent acquisition of healthcare-associated infections(6). Prevention of HAIs is the responsibility of health workers and the responsibility of the hospital as an organization. All health workers must have adequate knowledge of IPC, including understanding HAIs, preventive procedures such as hand washing, and PPE use (7).

Prevention of HAIs has recently become a global priority, which has resulted in the evolution of infection prevention and control. In this study, only 58% of

nurses had a good understanding of HAIs. In addition, the implementation of handwashing hygiene is still not close to the maximum values, where HAIs are an indicator of patient safety, and HAIs can be prevented by handwashing.

Hand hygiene is the most effective measure to prevent infection transmissions to patients from health care workers and protect health care workers from contracting a disease from body surfaces, body fluids, or blood of infected patients(9). Knowledge of hand hygiene as universal precautions in this study is low (53%); even WHO states that hand hygiene compliance in hospitals can be below 40%. Poor hand hygiene practices have been associated with forgetfulness, ignorance of guidelines, insufficient time, high workload, skin irritation by hand hygiene agents or latex gloves, and low risk of contracting an infection from patients, and many nurses may feel that gloves impede their skilled performance, especially in situations that require immediate intervention(10).

One of the factors that influence adherence to wearing PPE is knowledge. In this study, it was seen that nurses' knowledge was still low on the sequence of using and removing PPE. PPE is one part of infection prevention and is considered an integral part of preventing Covid-19. A study shows that nursing knowledge about PPE in treating COVID-19 patients is partly poor (11). The knowledge of nurses determines the ability and readiness nurses in providing health services. This inadequate knowledge of nurses can be caused by differences in standards and procedures in providing health services(12) Furthermore, this study's results found that there was no effect of knowledge on the application of infection (p-value = 0.428). Therefore, although the knowledge of nurses on infection prevention was good enough in this study, it did not affect the application of infection prevention. A good level of knowledge does not always translate into good application because many factors cause it. These factors include limited human resources, increased workload, and limited time(10).

A study on compliance in the application of IPC related to the implementation of hand hygiene, use of PPE, standards for handling syringes, and waste management in-home care services in the UK states that there are several individual factors such as age, gender, level of education, training and length of work have relationship with IPC implementation behavior(13). This study also found the effect of gender, length of work, and Participation on nurses' knowledge of infection prevention measures. In line with this study, it was found that the factors related to nurses' knowledge in the application of IPC were gender, length of work, and the IPC training that had been followed. Thus, it indicates that individual factors positively contribute to nurses' knowledge in the current application of IPC in private hospitals in this study.

The implementation of IPC in hospitals usually follows the guidelines set by the hospital, which are adapted to the guidelines from the central government. IPC implementation during COVID-19 has been followed and adjusted to the constantly updated guidelines from the Ministry of Health. One of the obstacles nurses face in the field is an increase in workload and fatigue where they have to use PPE plus additional cleaning procedures. Health workers described their feelings about the IPC guidelines as influenced by the level of support they felt they received from their management team. Therefore, clear communication and instructions on using IPC are needed, and regular training for both Health workers and IPCN is needed. A lack of PPE and provision of poor quality equipment was a serious concern that needed to adjust the volume of supplies as infection outbreaks continued.

Healthcare workers also found masks and other equipment uncomfortable to use. The workplace culture could also influence whether healthcare workers follow IPC guidelines or not. Across many of the findings, healthcare workers pointed to the importance of including all staff, including cleaning staff, porters, kitchen staff, and other support staff, when implementing IPC guidelines(11).

Generally, the result of this study revealed that the majority of nurses had good knowledge about infection control measures. However, some attitudes regarding the implementation of IPC did not reveal that the knowledge has an impact. Training programs had significant differences in improving knowledge on how to perform hand washing; discharge PPE; however, implementing IPC requires more than just training. Supervising also plays an essential role in the discipline in the implementation of IPC.

## CONCLUSION

The implementation of IPC in the COVID-19 ward needs to improve since each dimension has not all reached the maximum value. The pandemic conditions require nurses and other health workers to increase the application of IPC, especially to carry out hand hygiene activities, handle injecting equipment, and use and order PPE. This study found that the training can improve knowledge, but there was no significant relationship between nurses' knowledge and IPC application. This study recommends supervision of the implementation of IPC by those trained and certified as observers or as IPCNs.

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## REFERENCES

1. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *The Lancet* [Internet]. 2020;January:497–514. Available from: <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930185-9>
2. World Health Organization (WHO). Rolling updates on coronavirus disease (COVID-19). <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>. 2020.
3. Rezaei F, Marcy MR, Yarmohammadian MH, Sheikhbardsiri H. Hospitals preparedness using WHO guideline: A systematic review and meta-analysis. Vol. 25, *Hong Kong Journal of Emergency Medicine*. SAGE Publications Ltd; 2018. p. 211–22.
4. Chopra V. Sixty-Day Outcomes Among Patients Hospitalized With COVID-19. *American Journal of Physiology - Cell Physiology*. 2020 Nov 1;319(5):945.
5. Ministry of Health. Pedomam Pencegahan Dan Pengendalian Coronavirus Disease 2019 (Covid-19). Jakarta; 2020. Report No.: HK.01.07/MENKES/413/2020.
6. Luangasanatip N, Hongsuwan M, Limmathurotsakul D, Lubell Y, Lee AS, Harbarth S, et al. Comparative efficacy of interventions to promote hand hygiene in hospital: Systematic review and network meta-analysis. *BMJ (Online)*. 2015;351.
7. Zocher U, Dan-Nwafor C, Yahya D, Ita OI, Kloth S, Eckmann's T, et al. Participatory approach to quality development in infection prevention and control (IPC) in Nigerian health facilities. *Infection Prevention in Practice*. 2019 Jun;1(2):100012.
8. Tartari E, Fankhauser C, Masson-Roy S, M6rquez-Villarreal H, Fern6ndez Moreno I, Rodriguez Navas ML, et al. Train-the-Trainers in hand hygiene: A standardized approach to guide education in infection prevention and control. *Antimicrobial Resistance and Infection Control*. 2019 Dec 30;8(1).
9. Askarian M, Khalooee A, Nakhaee N. Personal hygiene and safety of governmental hospital staff in Shiraz, Islamic Republic of Iran. Vol. 12, 2006.
10. Salem OA. Knowledge and Practices of Nurses in Infection Prevention and Control within a Tertiary Care Hospital. 2019.
11. Emy NP, Yanti D, Pradiksa H, Md IA, Susiladewi V. Nurses Knowledge And Perception Regarding Personal Protective Equipment While Caring For Patients With Covid-19. *Jurnal Keperawatan* 2021;13(1):213–26. Available from: <http://journal.stikeskendal.ac.id/index.php/Keperawatan>
12. Houghton C, Meskell P, Delaney H, Smalle M, Glenton C, Booth A, et al. Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: A rapid qualitative evidence synthesis. Vol. 4, *Cochrane Database of Systematic Reviews*. John Wiley and Sons Ltd; 2020. p. 1–55.
13. Adams V, Song J, Shang J, McDonald M, Dowding D, Ojo M, et al. Infection prevention and control practices in the home environment: Examining enablers and barriers to adherence among home health care nurses. *American Journal of Infection Control*. 2021 June 1;49(6):721–6.