



The Effect of Infection Prevention and Control Online Training Compared to Face-to-face Training on Knowledge, Attitude and Practice

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ABSTRACT

Research on Infection Prevention and Control (IPC) is often conducted at hospitals rather than Public Health Center (PHC) whereas its role as a first response facility for the community has an inherent contribution to prevention efforts at the family level, becoming the research gap requiring special attention to this issue. The difference to other previous research is that this study was conducted online, while the previous one in Pesantren II PHC, Kediri, used IPC face-to-face training. Predicting the potential for a more practical and efficient IPC method, this study aimed to determine the effect of IPC online compared to IPC face-to-face training on knowledge, attitudes, and practice. This study was a quasi-experiment with two group pretest-posttest designs. The sample was 102 people, using Total Sampling Techniques divided into IPC online training and IPC face-to-face training groups. Knowledge and attitude were assessed using questionnaires developed by reviewing relevant literature and adapting the content from related studies, while practice was assessed using observation sheets. The data were analyzed with the McNemar test that showed the effects of knowledge, attitude, and practices not only in IPC face-to-face training ($P=0,000$; $0,002$; and $0,000$) but also in online training ($P=0,008$; $0,016$; and $0,000$), and affect COVID-19 knowledge ($P=0,000$), but it does not affect the COVID-19 attitude ($P=1,000$). The results showed an increase in knowledge, attitudes and practice respondents after IPC online training and has the same effectiveness as IPC face-to-face training.

Keywords: IPC online training, IPC face-to-face training, knowledge, attitude, practice

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INTRODUCTION

Healthcare-associated infections (HAIs) occur in patients during treatment in a health facility, during hospitalization, and among health workers due to their occupations (Aghdassi et al., 2019; Castro-Sánchez and Holmes, 2015). HAIs are the main health problem worldwide (Brusaferro et al., 2015; Bedoya et al., 2017). HAIs prevalence in developed countries ranged from 4.8% to 15.5% (CDC, 2016), reaching 15.74% in Indonesia (Ling, Apisarnthanarak and Madriaga, 2015). HAIs are associated with longer hospitalization, increased mortality, healthcare costs, and psychosocial and economic burdens (Guspiel, 2016; Donati et al., 2019).

Infection Prevention and Control (IPC) must be implemented in health facilities to protect patients, staff, and visitors from the risk of infections (Ara et al., 2016; Rodrigues Moura da Costa Valle et al., 2016). Effective and consistent IPC implementation can significantly decrease 30% the incidence rate of HAIs and reduce costs by up to \$25 billion (Geberemariam, Donka and Wordofa, 2018). IPC training can increase knowledge by 62.9% and increase compliance twice (Kolola and Gezahegn, 2017; Engdaw, Gebrehiwot and Andualem, 2019). The implementation of IPC includes 11 standard vigilance, such as hand hygiene, personal protection equipment (PPE), decontamination of patient care equipment, environmental health, waste management, linen stewardship, health workers protection, patient placement, hygiene respiration, and sneezing ethics, the practice of safe injection and safety lumbar puncture (Kemenkes RI, 2017).

Research on IPC is often conducted at hospitals rather than PHC. As primary health care, PHC should have been more compliant towards applying IPC, considering their role as the leading guard in handling patients (Manning and Pogorzelska-Maziarz, 2016; Bedoya et al., 2017). Previous studies determined that IPC compliance factors include sociodemography, individual, and institutional factors (Piai-Morais, Orlandi and de Figueiredo, 2015). Sociodemographic factors include age, gender, marital status, profession, length of work, and working units (Piai-Morais, Orlandi and de Figueiredo, 2015; Engdaw, Gebrehiwot and Andualem, 2019). The individual factors that improve IPC compliance are good knowledge and attitude, skin irritation after hand hygiene, previous IPC training history, and stress (Piai-Morais, Orlandi and de Figueiredo, 2015; Aghdassi et al., 2019). Institutional factors include water availability, soaps, hand rubs, posters, IPC teams, management support, and the standard operating procedure of IPC (Pittet, 2017; Engdaw, Gebrehiwot and Andualem, 2019).

A previous study on IPC training used face-to-face methods was executed on health workers of Pesantren II PHC with 58 respondents and was proved to have significant outcomes by improving the knowledge, attitude, and practice of health workers. Pesantren II PHC has the fourth-lowest achievement in Kediri, averaging 84.7% after Kota Wilayah Selatan PHC. The average IPC achievement of all indicators in Kediri is 88.6% (Dinas Kesehatan Kota Kediri, 2019). Kota Wilayah Selatan PHC had the third-lowest achievement in Kediri, with an average achievement of 81.7%. The health care compliance indicator was not achieved using the PPE, which was 85.7%, and the hand hygiene indicator was 65.3% (Puskesmas Kota Wilayah Selatan, 2019). The low achievement indicators of the IPC in Kota Wilayah Selatan PHC are important to holding training for health workers. IPC training conducted in Kota Wilayah Selatan PHC is online because of the COVID-19 outbreak. Based on all the data above, this research was conducted online on IPC training using online methods executed in Kota Wilayah Selatan PHC staff, adding IPC material related to COVID-19, and performed with a shorter duration. It can be essential in increasing knowledge and monitoring of IPC, especially in the COVID-19 outbreak that requires social and physical distancing (Manning and Pogorzelska-Maziarz, 2016; Al-Surimi et al., 2017; ECDC, 2020).

Several previous literature studies stated that there was no significant difference between the outcomes of providing online training interventions compared to face-to-face. The comparison of these two methods raises its own challenges such as physical assessment limitations, delayed feedback, and potential distractions. However, the potential for more practical, flexible methods makes this challenge worth testing (Gallegos et al., 2021; Rad et al., 2022; Wang et al., 2021). These results show that online training is an effective method in increasing knowledge about the concept of health efforts from prevention to curative (Wei et al., 2019). Recording the implementation of Cognitive Load Theory, the demand for creating training methods that are more easily accepted is expected to normalize the ease with which people are exposed to education as a habit of life, which in the future, from the form of repetitive instructional education, even with gradual information, will give rise to sequential activities to improve the quality of life in society (Sweller, J., 2024). However, to our knowledge, no research has specifically compared the significance of differences in online versus face-to-face IPC efforts at the PHC level.

Based on the explanation above, significant research gap has emerged regarding the implementation of IPC at the PHC level compared to the implementation that is more often found in hospitals. PHC as a first response facility for the community has an inherent contribution to prevention efforts at the family level, so special attention is needed regarding this issue. There will also be several gaps obtained from the results of this study due to differences in the research methods carried out between previous studies on IPC training used face-to-face methods executed in the staff of Pesantren II PHC will provide different results with IPC training used online methods that executed in the staff of Kota Wilayah Selatan PHC. Is expected to be able to answer these problems, this study aims to analyze the effect of IPC online training compared to face-to-face on knowledge, attitudes, and practices.

RESEARCH METHOD

This study was a quasi-experiment with two group pretest-posttest models conducted in Kota Wilayah Selatan PHC, Kediri. This study compared with a study in Pesantren II PHC that used IPC training with a face-to-face method. The sample was 102 people, using Total Sampling Techniques. It is divided into two groups: the IPC online training group and the IPC face-to-face training group. The inclusion criteria included all Kota Wilayah Selatan PHC staff and Pesantren II PHC Kediri staff. The exclusion criteria were the staff unwilling to be respondents, reluctant to attend training, and unable to access online training. The ethical clearance number in this study was 005/26/V/EC/KEPK/Lemb. Candle/2020.

The instruments used in this study are questionnaires and observation sheets obtained from the Indonesian Ministry of Health Regulation number 27 in 2017 about IPC Guidelines. The questionnaire was developed by reviewing relevant literature and adapting the content of related studies. This study used a yes-no-questionnaire and five Likert scale questionnaire that consisted of 10 questions to assess IPC knowledge, 12 questions to assess the knowledge of COVID-19, 31 questions to assess attitudes towards IPC, and 12 questions to assess attitudes towards COVID-19 (Ogoina et al., 2015; Koo et al., 2016; Zhong et al., 2020). The observation sheet was used to assess respondents' practice against the application of IPC. The variables assessed with the questionnaire include the knowledge variables divided into good knowledge (if the score is \geq mean) and poor knowledge (if the score is $<$ mean). The IPC variable attitude is divided into positive attitudes (if the score is 80 – 124) and negative attitudes (if the score is 31 – 79). The COVID-19 attitude is divided into positive attitudes (if the score is \geq mean) and negative attitudes (if the score is $<$ mean). Variables assessed with the observation sheet include good practice (if \geq 60%) and less practice (if $<$ 60%) (Geberemariam, Donka and Wordofa, 2018; Zhong et al., 2020). The instrument was tested for validity and reliability with a Cronbach's alpha of 0.856.

The study began with observing respondent's practice in each PHC for one day. Observations were conducted when the respondent was doing service without prior notice. Then, respondents filled in a questionnaire about pretest knowledge and attitudes about IPC. After filling in a questionnaire, respondents followed the IPC training according to each group. The online training group gets a 45-minute video that can be accessed through a shared YouTube site. A face-to-face training group got 6-hour training divided into two days of training. The material provided to both groups truly equivalent includes basic knowledge of IPC and HAIs, hand hygiene, ethics of cough and sneezing, health workers protection, environmental control, waste management, use of PPE, safe infiltration practice, patient placement, and decontamination of patient care equipment (Kemenkes RI, 2017). Then, the respondents filled out the questionnaire for post-test knowledge and attitude about IPC, and last observed respondents' practice after training for one day with the same method they used before training.

The IPC online training group was asked to complete a knowledge and attitude questionnaire about the COVID-19 pretest. Then, the respondent attended the online COVID-19 training by viewing an 18-minute video accessible through a shared YouTube site. The contents of the submitted materials include definitions, etiology, pathophysiology, the way of transmission, incubation period, category of patient in COVID-19, differences in symptoms in common cold, influenza, and COVID-19, PPE level, how to use and release of the PPE according to level, and how to prevent COVID-19 (WHO, 2020). Then respondents filled in a questionnaire for post-test knowledge and attitudes about COVID-19.

Data were analyzed univariately to determine the characteristics of data. Bivariate data analysis used the Chi-Square test to determine the difference between the pretest online training against the pretest of face-to-face training and the post-test online training on post-test face-to-face training. McNemar test is used to determine the difference in the knowledge, attitude, and practice seen from the pretest and post-test after IPC online training and face-to-face training and pretest and post-test on the knowledge and attitudes towards COVID-19.

RESULTS OF STUDY

Respondent characteristics (Sociodemographic factor)

Table 1 shows the characteristics of the respondents (sociodemographic factors), with the frequency and percentage for each variable. The characteristics of respondents were used to determine diversity based on age, gender, education level, profession, work unit, and year of service. Based on the results, most respondents were 31-40 years old (50 or 49%), female (78 or 76.5%), diploma (59 or 44%), a profession dominated by nurses (30 or 28,1%), work unit dominated by other work units such as driver ambulance and cleaning service (15 or 34,1%), and year of service dominated by more than ten years (49 or 48%). Sociodemographic factors (age, gender, last education, profession) of previous IPC training have no significant differences between this research. It can be concluded that the characteristics of both respondents are the same.

Individual and institutional characteristic (Individual factor and institutional factor)

Table 2 discusses individual factors and institutional factors. It shows that respondents have no history of skin irritation (72.7%), has yet to receive infection prevention training (89.2%), have availability of PPE, posters, water, soap, and hand rub (100%), stated the presence of an infection prevention committee in the PHC (90.9%).

Table 1
Frequency Distribution of Respondent Variables

Variables	Category	N	%
Age (Year)	21-30	15	14,7
	31-40	50	49
	41-50	23	22,5
	51-60	14	13,7
Gender	Male	24	23,5
	Female	78	76,5
Education Level	Elementary School	0	0
	Junior High School	1	1
	Senior High School	13	12,7
	Diploma	59	57,8
	Bachelor	29	28,4
	Master	0	0
Profession	Physician	11	10,8
	Nurse	30	28,4
	Midwife	24	23,5
	Laboratory Analysts	3	2,9
	Pharmacist	5	4,9
	Others	29	28,4
Work Unit	Laboratory	1	2,3
	General Polyclinic	5	11,4
	Maternal and Child Health/Contraceptives	7	15,9
	Bride/Groom Polyclinic	1	2,3
	Nutrition Room	2	4,5
	Dental Room	3	6,8
	Village Health Post	2	4,5
	Auxiliary Health Center	8	18,2
Others	15	34,1	
Year of Service	<5 years	13	12,7
	5-10 years	40	39,2
	>10 years	49	48

Source: Primary data, 2020

Table 2
Individual and institutional characteristics

Variables	Category	N	%
Skin Irritation	Yes	12	27,3
	No	32	72,7
Ever taken training on infection prevention before	Yes	11	10,8
	No	91	89,2
Availability of PPE	Yes	44	100
	No	0	0
Availability of posters	Yes	44	100
	No	0	0
Availability of waters	Yes	44	100
	No	0	0
Availability of Soap	Yes	44	100
	No	0	0
Availability of hand rub	Yes	44	100
	No	0	0
Presence of infection prevention committee	Yes	40	90,9
	No	4	9,1

Source: Primary data, 2020

Pretest comparison test results between IPC online training and face-to-face training

Based on Table 3, the pretest results on knowledge, attitude, and practice at the IPC online and face-to-face training were equally insignificant that the Chi-Square test showed a p-value of more than 0.05 ($p=0.302$; $p=0.680$; $p=0.057$). The comparison of the pretest on knowledge, attitude, and practice before IPC online training and face-to-face training has no significant results; it shows that the knowledge, attitude, and practice of respondents before both online and face-to-face training are almost the same.

Table 3
Pretest comparison test results between IPC online training and face-to-face training

		Online training	Face-to-face training	P-value (Chi-Square)
Knowledge	Good	33	38	0,302
	Poor	11	20	
Attitude	Positive	35	48	0,680
	Negative	9	10	
Practice	Good	21	17	0,057
	Poor	23	41	

Source: Primary data, 2020

Posttest comparison test results between IPC online training and face-to-face training

Based on Table 4, the post-test results on knowledge, attitude, and practice at the IPC online and face-to-face training were equally insignificant that the Chi-Square test showed a p-value of more than 0.05 (p=0,988; p=0,101; p=0.071). The comparison of the post-test on knowledge, attitude, and practice after IPC online training and face-to-face training has no significant results; it shows that the knowledge, attitude, and practice of respondents after both online and face-to-face training are almost the same.

Table 4
Posttest comparison test results between IPC online training and face-to-face training

		Online training	Face-to-face training	P-value (Chi-Square)
Knowledge	Good	41	54	0,988
	Poor	3	4	
Attitude	Positive	42	58	0,101
	Negative	2	0	
Practice	Good	37	55	0,071
	Poor	7	3	

Source: Primary data, 2020

Comparative test results of the knowledge, attitude, and practice of pretests and posttest IPC online training and face-to-face training

Based on Table 5, the knowledge assessment results on IPC online training showed that eight respondents initially had poor knowledge and became good knowledge, with the McNemar test results of 0.008 (p<0.05); there is an increase in knowledge after being given an IPC online training. In the IPC face-to-face training, 16 respondents initially had poor knowledge and gained good knowledge with the McNemar test results of 0.000 (p< 0.05); there was an increase in knowledge after the IPC face-to-face training. This study found that IPC online training effectively improved respondent knowledge. It aligns with some studies that say training IPC significantly improved respondents' knowledge (Larson et al., 2006; Jain, Jain and Garg, 2017; Beyamo, Dodicho and Facha, 2019). A Study in Switzerland found that IPC online training can improve respondents' knowledge better than respondents who have read their IPC procedure or have not intervened (Wolfensberger et al., 2019). The value of knowledge is 85.4% in respondents who receive online training, 81.3% in respondents who read their own IPC procedure, and 79.6% in uninvolved respondents. It also follows the other research that said that IPC online training improved respondents' knowledge significantly, from 54% to 64%. The knowledge of respondents increased after giving online training because the training was more flexible, more interesting, and easier to understand (Atack and Luke, 2008).

The attitude assessment of IPC online training showed that seven respondents initially had a negative attitude and became a positive attitude with the McNemar test results of 0.016 (p< 0.05); there is a positive change in attitudes after being given an IPC online training. In face-to-face training, ten respondents initially had a negative attitude and became a positive attitude with the McNemar test results of 0.002 (p< 0.05); there was a positive attitude change after the IPC face-to-face training. This study shows that IPC online training significantly improved respondents' attitudes. It is aligned that attitude positively influences practice, with a coefficient reusability of 0.872 (Quan et al., 2016; Carrico et al., 2019). The respondent's attitude increased because attitude positively correlates with knowledge. The increased knowledge after the training makes the attitude more positive than before training.

The practice assessment of IPC online training showed that 16 respondents initially had poor practice and then became good practice with the McNemar test results of 0.000 (p< 0.05); there is good practice change after IPC online training. In IPC face-to-face training, 38 respondents initially had poor practice and became good practice with the McNemar test

results 0.000 ($p < 0.05$); there was a good practice change after the face-to-face IPC training. This study showed that IPC online training effectively improved respondents' practice. It aligns with a previous study in China that found IPC online training on health workers can significantly increase compliance with IPC practice (Luo et al., 2010). Poor IPC practice can be influenced by several factors, such as lack of knowledge and training in IPC, lack of facilities, high workload, less support from the workplace, and a slight number of health workers compared to the number of patients (Larson et al., 2006; Hosoglu et al., 2011; Abdelwahab et al., 2019). IPC online training is effective in improving the practice of respondents because the practice has a positive correlation to knowledge and attitude. With IPC online training that improves respondents' knowledge and attitude, respondents' practice has also increased.

This study uses 7 from 11 IPC standards from the Ministry of Health. The 7 standards of IPC assessed in this study show that IPC online training is significant in improving the use of PPE practice, decontaminating medical equipment, and patient placement. However, hand hygiene, waste management, cough ethics, and safety injection practices have no significant results. The significant increase in the 3 indicators occurs because, after training, health workers have good knowledge and can apply it well (Choi and Kim, 2016; Baek et al., 2020). Hand hygiene, waste management, and cough ethics have no significant results because, before this training, health workers' practice towards these 3 indicators was already good. The safety injection procedure is not significantly improved in online training. Due to face-to-face training, respondents can practice the safety injection procedure directly in front of the trainer, which cannot be done in online IPC training (Kuznets, Lerner and Davidson, 2018).

The results of a posttest comparison in this study showed an insignificant difference between IPC Online training and IPC face-to-face training on respondents' knowledge, attitudes, and practice. This showed that both IPC online and IPC face-to-face training improved the respondents' knowledge, attitudes, and practice. It is in line that there is no significant difference between e-learning and traditional learning of knowledge, attitudes, and practice (George et al., 2014; Pei and Wu, 2019; Barteit et al., 2020). In another sentence, some studies show that e-learning and traditional learning of knowledge, attitudes, and practice are the same.

These results also concluded that online training has the potential to produce equivalent effectiveness when compared to face-to-face training. In line with previous literature, this also showed that there were no limitations of time and space, thus giving autonomy for targets to access from anywhere with application according to their practices, as well as more consistent delivery of material to ensure that all information is not missed (Gallegos et al., 2021, Wang et al., 2021). However, it needs to be underlined that the challenges and difficulties of implementing online training require that the target must be ensured to have adequate device facilities and infrastructure and accessibility. Previous literature also noted that this application was still a big problem for education that requires hands-on action, such as CPR, intubation, LMA, and AED shock devices (Rad et al., 2022). There is a need for further study regarding potential opportunities for holding hybrid training that applies both online and face-to-face methods.

Table 5
Comparative test results of the knowledge, attitude, and practice of pretests and posttest IPC online training and face-to-face training

	Posttest Pretest	Good Knowledge	Poor Knowledge	P Value (McNemar)
Knowledge (Online Training)	Good	33	0	0,008
	Poor	8	3	
Knowledge (Face-to-face Training)	Good	38	0	0,000
	Poor	16	4	
Attitude (Online Training)	Positive	35	0	0,016
	Negative	7	2	
Attitude (Face-to-face Training)	Positive	48	0	0,002
	Negative	10	0	
Practice (Online Training)	Good	21	0	0,000
	Poor	16	7	
Practice (Face-to-face Training)	Good	17	0	0,000
	Poor	38	3	

Source: Primary data, 2020

Comparative test results of knowledge and attitudes before and after the training COVID-19 online

Table 6 showed that in terms of knowledge, there were significant results with the p-value of the McNemar test of 0.000 ($p < 0,05$); there was increased knowledge after getting COVID-19 online training. Although the result on attitude was insignificant, with a p-value of McNemar test 1.000 ($P > 0.05$), there was no positive attitude change after getting COVID-19 online training.

Table 6
Comparative test results of knowledge and attitudes before and after the training COVID-19 online

	Posttest Pretest	Good Knowledge	Poor Knowledge	P Value (McNemar)
Knowledge	Good	24	0	0,000
	Poor	12	8	
Attitude	Positive	43	0	1,000
	Negative	1	0	

Source: Primary data, 2020

It is in line with a previous study in China that IPC online training has significant results on the respondents' knowledge but does not significantly influence respondents' attitudes (Zhong et al., 2020). It is occurred because the possibility of the respondent's attitude before the training is good; after the training, the respondents attitudes has been increased from 93.1% to 100%. However, it is not in line with the study in Saudi Arabia that said the IPC training significantly affects the attitude of respondents (Manning and Pogorzelska-Maziarz, 2016).

LIMITATION OF THE STUDY

This study's limitation is the respondents' variation because the IPC face-to-face training was conducted in Pesantren II PHC, and the IPC online training was conducted in Kota Wilayah Selatan PHC.

CONCLUSIONS AND SUGGESTIONS

The results showed an increase in knowledge, attitudes and practice respondents after IPC online training and has the same effectiveness as IPC face-to-face training. IPC COVID-19 online training shows increased knowledge but not in attitudes. These results open up opportunities for health service institutions and policy makers to provide intentions and create constructive strategies involving online methods as an efficient alternative for providing training and education. Moreover, there is a need for further study regarding potential opportunities for holding hybrid training that applies both online and face-to-face methods. At another portion, coordination between PHC and the Health Department for periodic monitoring and evaluation of IPC is essential to improve health worker knowledge and compliance. Repeated two-way training from the person in charge of the IPC program to all PHC staff is needed to increase the knowledge and compliance of health workers. Monitoring and evaluation are also carried out every 3 months to improve the quality of PHC. The addition of online posters or links about IPC in communication groups PHC employees also regularly needs to be done to increase the interest of health workers in PHC. Research on the vigilance of other IPC standards that have not yet been studied, such as health worker protection, environmental control, and linen management, needs to be done. Also, it should use the same respondents.

Acknowledgment

The authors are grateful to the University of Muhammadiyah Malang, all respondents in Pesantren II PHC and Kota Wilayah Selatan PHC Kediri, as well as the fast response of ethical approval from the Kediri Single Window for Investment. GSP designed and conceptualized the study, developed the data collection instrument, and fixed the methodology. Other authors assisted in analyzing and interpreting the data, finding the supporting journals, cleaning the data, preparing the questionnaire, visualizing and interpreting the results, and finalizing the manuscripts.

ETHICAL CONSIDERATIONS

Ethics approval was obtained from the Ethical Committee “Lembaga Chakra Brahmanda Lentera” (The ethical clearance number is 005/26/V/EC/KEPK/Lemb. Candle/2020). All respondents could refuse to participate in the study and were given an agreement form before following the study.

Conflict of Interest Statement

The authors declare that there is no conflict of interest.

Funding Statement

The author did not receive any assistance from any organization, despite the fact that they submitted their work to one of the organizations.

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