

RESEARCH ARTICLES

Comparison of infection control practices in dental radiographic examination during the COVID-19 pandemic among various health facilities in Yogyakarta, Indonesia

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ABSTRACT

Dental radiography services were at high risk of becoming sites for cross-infection during the COVID-19 pandemic. To minimize the spread of COVID-19, infection control adaptations were implemented in dental radiography services across various healthcare facilities, including Type A, B, C, and D hospitals, as well as clinical laboratories. This study aims to determine the differences in infection control practices of dental radiographic examinations during the COVID-19 pandemic at various health facilities. This cross-sectional study involved 42 dental radiographers who worked in Yogyakarta. Control infections were measured using the electronic questionnaire with 27 closed-ended questions. The data were analyzed statistically using the Kruskal-Wallis test, and descriptive analysis was continued by categorizing the control infection into high, medium, and low levels. The validity and reliability test showed that 18 questionnaire items were valid and reliable. The statistical test showed a p-value of 0.672 ($p > 0.05$) for the staff infection control and 0.147 ($p > 0.05$) for the room infection control. This study found no significant differences in infection control practices during dental radiographic examinations across various healthcare facilities during the COVID-19 pandemic. All facilities implemented high levels of infection control, with clinical laboratories showing the highest compliance. The study suggests increasing the number of questionnaire items related to room infection control and expanding the study's scope in future research to improve accuracy and represent a broader population.

Keywords: Covid-19; dental radiographer; health facilities; infection control; pandemic

INTRODUCTION

COVID-19 is a disease caused by a new coronavirus called SARS-CoV-2.¹ The transmission of the COVID-19 in Indonesia has continued to expand substantially since the first case was revealed on March 2, 2020.² As of June 2022, 535 million cases of COVID-19 were confirmed worldwide, with 6 million cases in Indonesia. The SARS-CoV-2 virus spreads mainly through direct transmission, such as sneezing, coughing, and inhaling respiratory droplets, as well as indirect transmission through contact with the nasal mucosa, eyes, or mouth.³

During the COVID-19 pandemic, various health organizations have issued recommendations for providing safe procedures for dental practice.⁴ This is necessary as dental procedures enhance the risk of transmitting the COVID-19 virus,

specifically by requiring the patient and dentist to interact face to face, and the patient has to open his mouth during the treatment.⁵ Dental practices and dental radiology service have also altered their routines by improving healthcare procedures to protect patients and service providers.⁶ This phenomenon was triggered by the community's continued high demand for dental care and dental radiographic examinations during the pandemic.^{7,8,9}

Radiology and other health services are at risk of becoming sites of COVID-19 cross-infection, which can be transmitted through blood and saliva from patients to other patients and through staff as carriers of infectious agents.^{7,10,11} Cross-infection can occur in radiology service because patients are required to take off their face masks during the radiographic procedures.¹²

Healthcare facilities face challenges adapting to the pandemic, particularly in altering patient treatment to prevent COVID-19 viral contamination.¹³ According to the regulations set forth by the Ministry of Health, healthcare facilities are required to implement Infection Prevention and Control (IPC).¹⁴ Referring to national regulation, based on the level of service provided, healthcare facilities in Indonesia are classified as type A, B, C, and D hospitals and clinical laboratories.¹⁵

Infection control at dental radiographic examinations during the COVID-19 pandemic was divided into staff infection control, radiographic room infection control, and equipment infection control for each dental radiographic technique.⁹ Staff infection control can be achieved by maintaining hand hygiene, utilizing Personal Protective Equipment (PPE), organizing staff work shifts, and other preventive measures.^{9,16,17} Meanwhile, room infection control includes disinfecting furniture and other items, regulating air circulation, dividing staff work areas, sorting and standardizing medical waste, and other preventive measures.^{4,9,18,19}

Based on the recent reports, there is a possibility that the radiology staff has not implemented effective infection control due to a lack of knowledge and training.¹⁰ The previous study even stated that 78.2% of radiographers had never been trained in infection control and 74.4% of radiographers had moderate levels of knowledge regarding infection control.²⁰ In addition, the various types of health facilities may result in different regulations and facilities, which could influence the practices of infection control by the work staff.^{14,21} Concerning the importance of infection control in various health facilities during the pandemic, this study aims to determine the different infection control practices in dental radiographic examinations.

MATERIALS AND METHODS

This study has been approved by the Research Ethics Committee, Faculty of Dentistry, and Prof Soedomo Dental Hospital, Universitas Gadjah Mada, with the certification number 078/KE/FKG-

UGM/EC/2022. The survey method was used in this analytic observational study with a cross-sectional approach. The population in this study were dental radiographers who are members of the Indonesian Radiographers' Association (*Persatuan Radiografer Indonesia* (PARI)) of Sleman Regency and work in radiology service at various health facilities in Yogyakarta city and Sleman Regency, the province of Yogyakarta, Indonesia. The non-probability sampling technique was used to obtain study participants based on predetermined inclusion and exclusion criteria.

The inclusion criteria for study participants were dental radiographers employed in radiology services in the Yogyakarta and Sleman Regencies since at least 2020. Radiographers who expressed unwillingness to participate as research respondents were excluded from the study. The type of healthcare facility was the independent variable in this study, and staff and room infection control was the dependent variable.

The research instrument used in this study was an electronic questionnaire designed based on the new habits adaptation guidelines in dental radiology published by Pengurus Pusat Ikatan Radiologi Kedokteran Gigi Indonesia (IKARGI),²² as well as the other previous studies.^{18,23} The questionnaires consisted of 27 close-ended questions with "Yes" and "No" response options, including 22 items related to staff infection control and five items related to room infection control, as shown in Table 1. The questionnaire includes both favorable and unfavorable statements. Prior to distribution, all questionnaire items were tested using a try-out technique with 30 radiographers who met the inclusion and exclusion criteria outlined above. The Pearson Product-Moment correlation test was utilized for validity testing, while Cronbach's Alpha was employed to assess reliability.

In this study, the Guttman Scale was used to score the questionnaire. According to the statement, the positive statement item has a score of 1 for the answer "Yes," which means that the radiology staff implements infection control at the related installation. Meanwhile, a score of 0

Table 1. Questionnaire statement used as research instrument in this study

Category	Questionnaire statement
Staff infection control	<p>Washing hands before and after radiographic examination</p> <p>Washing hands before wearing and after removing gloves.</p> <p>Applying the proper procedure for donning personal protective equipment</p> <p>Wearing gloves during the radiographic examination procedure.</p> <p>Wearing protective goggles during the radiographic examination procedure.</p> <p>Wearing protective goggles during the radiographic examination procedure</p> <p>Wearing a face shield during the radiographic examination procedure.</p> <p>Wearing a mask during the radiographic examination procedure.</p> <p>Wearing gloves during the film processing procedure.</p> <p>Changing gloves between patients.</p> <p>Applying the proper procedure for doffing personal protective equipment</p> <p>Not wearing nail polish, rings, or other accessories on the hands.</p> <p>Being aware that regular beard shaving is a procedure that must be followed by male staff.</p> <p>Implementing a work shift schedule for staff.</p>
Room infection control	<p>The surfaces of the walls and floor in the work area are routinely disinfected</p> <p>Performing disinfection to clean furniture (tables, chairs, light switches, door handles, sinks).</p> <p>Controlling air movement from the clean airflow direction (staff work area) to the contaminated area (patient care area)</p> <p>Implementing the division and restriction of work areas (imaging area, processing area, front office).</p> <p>Implementing medical waste segregation techniques, where containers for the disposal of infectious waste are distinguished from those for non-infectious waste.</p>

Table 2. Scores categorization formula

Score Range	Category
$X \geq \mu + 1 \sigma$	High
$\mu - 1\sigma \leq X < \mu + 1 \sigma$	Medium
$X < \mu - 1 \sigma$	Low

μ = hypothetical mean (theoretical mean)

σ = standard deviation

was assigned to the answer “No,” which indicates that the radiology staff did not implement infection control according to the statement. In the negative statement item, the score will be reserved in value.

Data analysis was continued using the Shapiro-Wilk test to determine the normality of the data distribution.²⁴ This test was chosen due to the small number of sample data obtained, which included fewer than 50 respondents.²⁵ The results

of this test revealed a significance level of less than 0.05, indicating that the data distribution was non-normal. Subsequently, a comparative analysis was conducted using the Kruskal-Wallis test.

Descriptive analysis was then performed on the questionnaire responses. The responses were categorized into several levels to represent the distribution of total scores for each type of healthcare facility, as outlined in the formula in Table 2.²⁶ Scores in the high category indicated that the implementation of infection control measures was considered excellent.

RESULTS

Respondents in this study were 42 dental radiographers from 13 health facilities, which were classified into five types of health facilities based on Indonesia's Minister of Health Number 56 of

Table 3. Characteristics of respondents based on age, gender, education level, and work location

Variabel	Distribution	n	%
Age	22 – 33 year	23	54.8
	34 – 45 year	16	38.1
	46 – 56 year	3	7.1
Gender	Male	19	45.2
	Female	23	54.8
Education	High School	1	2.4
	Diploma III	30	71.4
	Diploma IV	10	23.8
	Bachelor	1	2.4
Work Location	Type A Hospitals	7	16.7
	Type B Hospitals	15	35.7
	Type C Hospitals	3	7.1
	Type D Hospital	8	19
	Clinical laboratory	9	21.4

2014 and Number 411 of 2010. The distribution of respondent characteristics in Table 3 below shows that the majority of respondents (54.8%) in this study were between the ages of 22 and 33. Respondents were predominantly female (54.8%), and 71.4% of respondents had a Diploma III education. Respondents work in five different health facilities, including types A, B, C, and D hospitals, as well as clinical laboratories.

Table 4. Shapiro-Wilk test results

Health facilities	Shapiro-Wilk test results	Description
Type A Hospitals	0.132	Normal
Type B Hospitals	0.022	Not normal
Type C Hospitals	0.424	Normal
Type D Hospital	0.044	Not normal
Clinical laboratory	0.031	Not normal

Table 5. Kruskal-Wallis test results

Aspect	n	Kruskal-Wallis test results	p value
Staff Infection Control	42	0.672	> 0.05
Room Infection Control	42	0.147	> 0.05

The validity test showed that 18 of 27 questionnaire items were declared valid with $r\text{-count} > r\text{-table}$ (0.361), and the Pearson Product Moment significance value was less than 0.05 ($p < 0.05$). The valid items include 13 items for staff infection control aspects and five items for room infection control. The reliability test showed that Cronbach's Alpha value was 0.929, indicating that 18 items were reliable.

The Shapiro-Wilk test results in Table 4 show that two of five health facilities, including type A

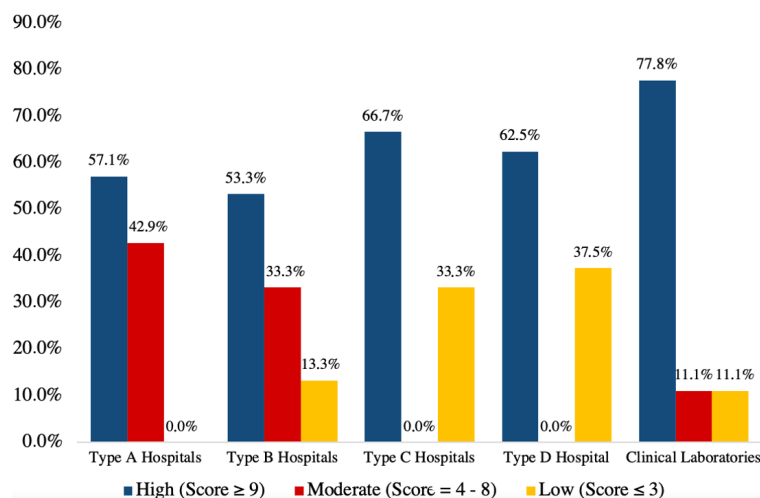


Figure 1. Category score distribution of staff infection control based on the type of health facilities

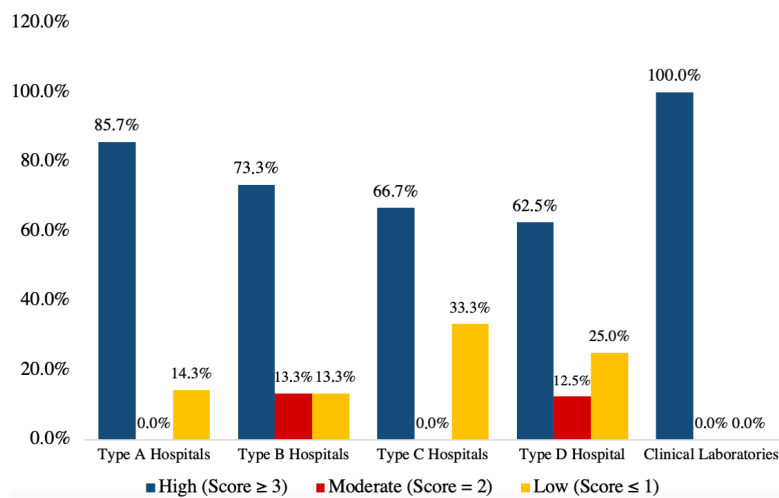


Figure 2. Category score distribution of room infection control score categories based on the type of health facilities

and type C hospitals, have a significance value of $p > 0.05$. According to this value, the distribution of the data is considered to be normal. However, the other three types of health facilities, including type B and type D hospitals and clinical laboratories, had a significance value of $p < 0.05$, indicating no normal distribution for these variables.

The Kruskal-Wallis test results in Table 5 revealed a p -value of 0.672 ($p > 0.05$) for staff infection control and 0.147 ($p > 0.05$) for room infection control. This demonstrates no significant differences in the practices of staff and room infection control for the five types of health facilities.

The descriptive analysis results show that all types of health facilities are dominated by high-category scores for staff infection control (Figure 1). Clinical laboratories have a high-category score with the highest percentage at 77.8% for staff infection control. It is known that the five types of health facilities are dominated by high-category scores as opposed to moderate or low-category scores.

According to the distribution of questionnaire scores for room infection control, all types of health facilities mostly have high-category response scores (Figure 2). Clinical laboratories have a high-category score, with the maximum percentage of room infection control at 100%. The data indicates that high-category scores

predominate in the score distribution for room infection control in all health facilities.

DISCUSSION

This study was conducted to ascertain the differences in infection control practices of dental radiographic examinations during the COVID-19 pandemic at various health facilities. This study was carried out among five types of health facilities, including type A, B, C, and D hospitals and clinical laboratories. Two categories were established in this study for infection control at dental radiography examinations during the COVID-19 pandemic, which comprises staff and radiographic room infection control.⁹ Staff infection control includes implementation of hand hygiene, the division of staff work schedules, the use of Personal Protective Equipment (PPE), and further along.^{9,16,17} In the interim, radiographic room infection control encompasses the regulation of air circulation, the division of staff work areas, the sorting and standardization of medical waste, and the disinfection of furniture and other items.^{4,9,18,19} This study discusses the differences in infection control practices in dental radiographic examinations.

Refer to Table 5, the statistical test results, specifically the Kruskal-Wallis test of staff infection control, showed a p -value of 0.672 ($p > 0.05$).

These results indicate no significant difference in staff infection control practices among five types of health facilities. These results also align with the category score distribution in Figure 1, in which all five types of health facilities demonstrate the high category scores. All these high category scores represent that the majority of respondents provided nearly identical responses with comparable percentages. This indicates that during the COVID-19 pandemic, most respondents excellently implemented staff infection control in dental radiographic examinations. This is supported by the Regulation of Indonesia's Minister of Health Number 27 of 2017, which requires all healthcare facilities to have and implement IPC policies. In addition to having IPC policies, each health facility must modify its policies to comply with the IPC Guidelines created by the Ministry of Health.¹⁴

Although the statistical tests revealed no significant differences in staff infection control practices for each type of health facility, the staff infection control practices among the five types of health facilities could be distinguished descriptively. The differences are revealed by comparing the percentages of high category scores from each health facility. Figure 1 shows that the clinical laboratory has the highest percentage scores (77,8%) for staff infection control. Type C, D, and A hospitals were followed, with type B for the lowest percentage (53,3%). The disparity in percentage score represents the difference in staff infection control practices at each type of health facility.

Different infection control practices in dental radiological examinations of each type of health facility can occur due to several factors, including staff motivation and work experience, which influence the health workers' compliance in applying standard precautions to prevent nosocomial infections.²⁷ Furthermore, the availability of healthcare facilities and infrastructure and health workers' education may all impact infection control practices.²⁸

The Kruskal-Wallis test in Table 5 showed a significance value of 0.114 ($p > 0.05$) for the room infection control aspect. This indicates no significant difference in room infection control

practices between each type of health facility. According to the category scores distribution shown in Figure 2, all types of health facilities appear to have high category scores. This high category score indicates that the implementation of room infection control during the COVID-19 pandemic was quite excellent. Moreover, it is supported by the Regulation of Indonesia's Minister of Health Number 27 of 2017, which states that all hospitals, health centers, clinics, and independent practices must implement all IPC programs. The precautionary principle is followed when implementing PPI to protect patients and health workers from the risk of infection, especially during the COVID-19 pandemic.²⁹

Statistically, it has been reported that there is no significant difference in room infection control practices between the five types of health facilities; however, descriptively, these could be distinguished by comparing the percentages from each health facility. According to Figure 2, the clinical laboratory has the highest percentage scores (100%) for room infection control, followed by type A, B, C, and D for the lowest percentage (62.5%). The difference in percentage score indicated the variation in room infection control practices among each type of health facility. Based on Figures 1 and 2 above, clinical laboratories demonstrate the most effective implementation of staff infection control compared to other types of health facilities.

The implementation of PPI is also supported by policy, which requires health facility leaders to form the PPI Committees or Teams. Each type of health facility has a different PPI organization according to its needs, workload, and type. The organizational structure is designed as an IPC Committee in type A and B hospitals. Type C and D hospitals may have an organizational structure as an IPC Team, whereas other health facilities may adjust to individual conditions.²⁹

This study shows no difference in staff and room infection control practices in dental radiographic examinations during the COVID-19 pandemic in various health facilities. This is consistent with other studies, including one conducted in four

Saudi Arabian hospitals that discussed infection control in COVID-19 patients during medical imaging procedures and raised infection control awareness in radiology departments. According to the result, most respondents from the four hospitals implemented infection control in the radiology department during the COVID-19 pandemic per WHO and the Centers for Disease Control and Prevention (CDC) guidelines.³⁰ Another study conducted in Yogyakarta with a total subjects of 111 health workers from various health facilities found that as many as 95.5% of health workers used PPE while working during the COVID-19 pandemic. As many as 98.2% of these health workers implemented hand hygiene procedures after touching the COVID-19 patient's environment during the aerosol-generating procedure.³¹

The study concludes that there is no significant difference in staff and room infection control practices during dental radiographic examinations across various health facilities during the COVID-19 pandemic. The descriptive analysis indicates that clinical laboratories demonstrated the highest level of staff and room infection control practices.

This study shows no significant differences in infection control practices in dental radiographic examinations during the COVID-19 pandemic in various health facilities. According to the descriptive analysis based on levels, all health facilities applied high levels of infection control during the pandemic. A clinical laboratory showed the highest results for infection control practices. This study suggests that the number of questionnaire items for the room infection control aspect should be increased to obtain specific results and represent all elements in this aspect. Due to the limitations of the survey respondents, future studies are expected to consider expanding the range of research locations and populations to improve research's accuracy and represent the actual situation.

CONCLUSION

This study found no significant differences in infection control practices during dental

radiographic examinations across various healthcare facilities during the COVID-19 pandemic. All facilities implemented high levels of infection control, with clinical laboratories showing the highest compliance. The study suggests increasing the number of questionnaire items related to room infection control and expanding the study's scope in future research to improve accuracy and represent a broader population.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest with the data contained in the manuscript.

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