Original Article

Infection prevention and control practices in the radiology department: An Asia-Oceania survey

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Abstract

Objective: To evaluate the current infection prevention and control (IPC) practices in radiology departments (RDs) across the Asia-Oceania region (AOR) and identify strengths and areas for improvement to promote the development of standardized IPC guidelines tailored to diverse local contexts.

Materials and Methods: In November 2023, the Asian Oceanian Society of Radiology (AOSR) Quality, Safety, and Standards Committee distributed a structured survey to radiology professionals across 22 countries, special administrative regions (SAR), and territories. The survey assessed five key areas: demographics, policy implementation, room assessment, departmental IPC practices, and recent measures. Descriptive statistics were used to analyze the responses. Ethical approval was obtained, and participation was voluntary.

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Results: We received 122 survey responses from 22 countries, regions, and territories. While 74.6% (88/118) of the countries had national IPC programs, only 68.9% (84/122) of RDs had department-specific IPC policies, with 50.8% (62/122) adhering to WHO guidelines. 96.7% (118/122) of RDs reported adequate hand hygiene facilities, and 82.0% (100/122) had sufficient personal protective equipment. However, practices such as patient screening and disinfection after use were inconsistent. The COVID-19 pandemic prompted 85.2% (104/122) of RDs to enhance infection prevention and control (IPC) measures, including audits and the implementation of new isolation protocols. Staff training and IPC adherence varied widely, with only 62.3% (76/122) of RDs reporting consistent adherence to IPC.

Conclusion: The survey highlights that, despite significant progress in IPC practices across RDs in the AOR, gaps in policy standardization, staff training, and resource allocation persist. Enhancing education, promoting a no-blame culture, and aligning departmental policies with international guidelines are essential for improving patient safety and reducing healthcare-associated infections. Tailored AOSR guidelines could address regional disparities and foster consistent IPC implementation.

Keywords: Asia-Oceania, Infection Prevention and Control (IPC), Radiology safety, Radiology departments, Healthcare-Associated Infections (HAIs), Survey, Quality Improvement, COVID-19 Impact.

Introduction

Radiology safety includes radiation protection, magnetic resonance hazards, contrast agent-related risks, and infection prevention and control (IPC). While radiation protection, magnetic resonance safety, and contrast agent management have received significant attention, IPC in radiology is often overlooked despite its critical importance in patient safety. [1]. Over the past three decades, the risk of healthcare-associated infections (HAIs) has risen in radiology departments (RDs), partly due to increased patient volume and the widespread use of imaging modalities [2].

Recently, the World Health Organization (WHO) has recommended the use of chest X-rays for screening for pulmonary tuberculosis [3] and for initial imaging during the COVID-19 pandemic [4]. This highlights the growing need for radiology professionals to be knowledgeable about IPC practices, particularly in high-risk environments such as radiology departments (RDs).

HAIs lead to substantial economic burdens and pose significant challenges to clinical outcomes and healthcare costs [5]. Effective IPC prevents avoidable HAIs and ensures safe, high-quality healthcare [6]. The WHO guidelines for IPC, issued in 2016, provide a framework for implementing effective IPC practices at national and facility levels [7]. However, the feasibility of applying these guidelines universally varies according to local context, and adaptation is often necessary due to specific regional and institutional challenges.

In low-resource settings, hospitals face challenges such as inadequate IPC governance, insufficient funding, understaffing, and a lack of essential resources, including sanitation facilities [8, 9]. Many hospitals also struggle with poor infrastructure, including inadequate water, sanitation, and hygiene systems [10], and often lack comprehensive infection surveillance mechanisms [11]. Additionally, overcrowding and insufficient staff training compromise the effectiveness of IPC measures [12].

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While intensive care units receive much of the focus regarding HAIs, RDs also play a critical role in patient management, and both patients and healthcare workers in these departments can be at risk for acquiring HAIs [13]. Furthermore, recent outbreaks have shown that HAIs can occur not only in inpatient settings but also in outpatient settings, underlining the importance of addressing IPC in all healthcare environments [14].

A worldwide WHO IPC survey was conducted in 2019, examining health facilities in general, but not RD specifically [15]. Recognizing the growing need for standardized IPC practices in radiology, the Asian Oceanian Society of Radiology (AOSR) Quality, Safety, and Standards (QSS) Committee initiated a survey to evaluate current IPC policies and practices across RDs in the AOR. This study aims to identify strengths and areas for improvement in IPC practices within the region, with the intention of promoting the development of an AOSR IPC policy tailored to diverse local contexts. This study aims to contribute to ongoing efforts to enhance IPC measures in radiology, ultimately improving patient outcomes and healthcare quality throughout the region by analyzing the findings.

Materials and methods

Survey Design and Distribution

The AOSR QSS Committee developed a structured survey to assess IPC practices in RDs across the AOR. The survey was designed with radiology and infection control experts to ensure comprehensive coverage of relevant topics. At the same time, to ensure maximum participation, the survey was intended to be brief enough to be completed within 5 minutes. The survey focused on five key areas:

1. **Demographics:** Information about the respondents, including their role, institution, and country/region, was collected,
2. **Policy:** The existence and scope of IPC policies at national, institutional, and departmental levels were evaluated,
3. **Room Assessment:** The physical infrastructure and resources available for IPC in RDs were assessed,

4. **IPC Policy in the RD:** Data on the implementation and adherence to IPC policies within the departments were gathered,
5. **Ongoing Measures:** Recent actions or changes to enhance IPC practices, particularly in response to the COVID-19 pandemic [4] were documented.

The survey questionnaire is provided in the Supplement. To ensure broad accessibility, the survey was translated from English into several languages, including Russian and Japanese. It was distributed to RDs via email and professional networks in November 2023, with responses collected in December 2023.

To maximise accessibility and response, an introduction to the survey included a statement assuring participants that "no particular person, institution or country/region/territory will be named in the survey report" and that "your answers will remain private and confidential." Completion of the survey was taken as implied consent. While respondents had the option to provide their name and email address (e.g., for follow-up communication or clarification), these details were not linked to the survey responses during analysis or reporting, and all data were treated as anonymous.

The AOSR QSS Committee ensured that the results would be used solely to improve IPC practices in RDs. The online survey was approved for Exemption Determination (according to SOP version 3, Chapter 5) by the Human Research Committee of the Faculty of Medicine, Prince of Songkla University (REC.68-078-7-1).

Respondents

The survey targeted radiologists, department managers, IPC officers, and other relevant personnel working in RDs across the Asia-Oceania region (AOR). Participation was voluntary and at their convenience.

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Data Collection and Analysis

The responses were compiled into a central database for analysis. The responses were then anonymized by removing the names and analyzed using descriptive statistics to summarize the key findings. The study focused on identifying standard practices, gaps in policy implementation, and variations across different countries and institutions. The descriptive statistical methods included frequency distributions and percentages.

Results

Response Rate and Demographics

The survey received 122 individual responses from 108 RDs across 22 countries, special administrative regions (SAR), and territories in the AOR. Most respondents were heads or directors of RDs 47.5% (58/122), followed by radiologists 43.4% (53/122). The respondents were primarily from hospitals, 70.5% (86/122), and centers 28.6% (35/122), with a smaller proportion from standalone radiology clinics 0.9% (1/122). The geographic distribution of responses was diverse, with notable representation from countries such as Japan, Thailand, and Malaysia, each offering a variety of healthcare settings (Figure 1).

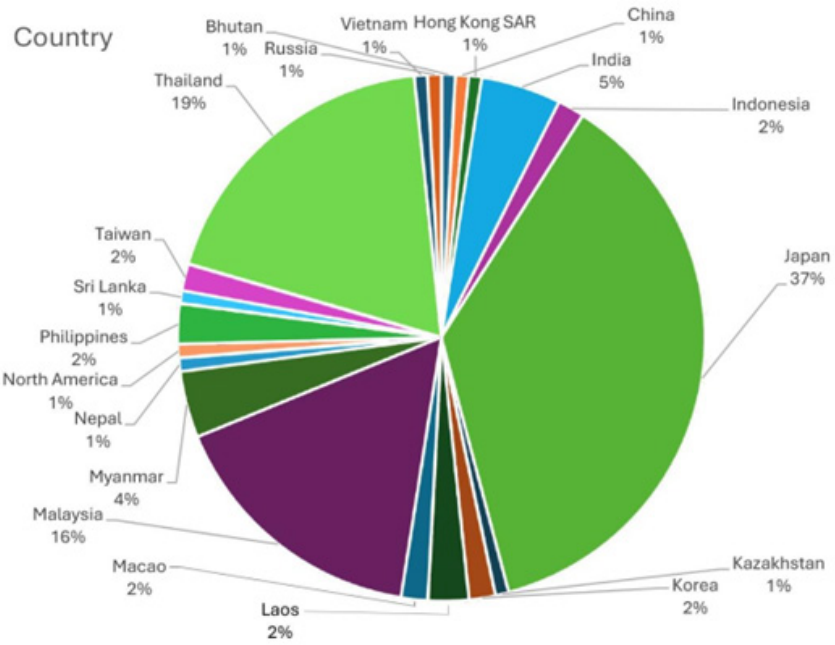


Figure 1. *Percentage distribution of respondents (i.e., RDs) for the IPC survey, categorized by country, SAR, and territory; data are presented as percentages of the total of 122.*

IPC Policy Implementation

The survey revealed that 74.6% (91/122) of the respondents reported being aware of having an IPC committee or program at the national level in their respective countries. These respondents cover all 22 AOR. The countries with 4.9% (6/122) respondents, who were not aware of having a national IPC came from Malaysia, Thailand, and Japan. Therefore, across countries, awareness may vary. At the hospital or center level, the awareness of IPC policy was high, with 92.6 % (113/122) of the respondents indicating knowledge of IPC procedures. However, only 68.9% (84/122) of the respondents reported having a formal IPC policy for their RDs (Figure 2). Among those with an IPC policy, 51.2% (43/84) adhered to the WHO's Guidelines on Core Components of IPC Programmes. In contrast, others either followed local guidelines or did not have a specific IPC policy in place.

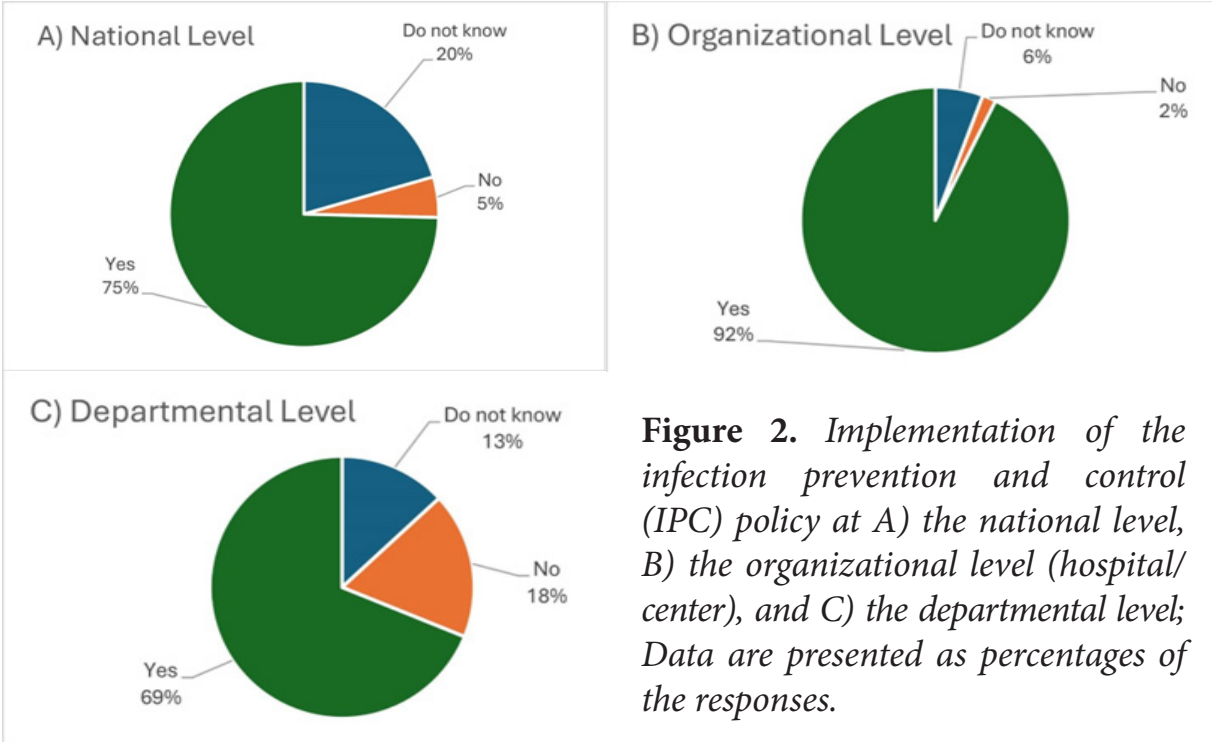
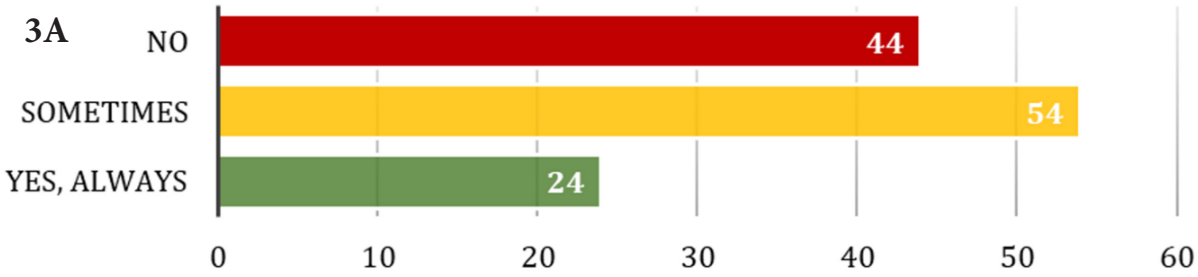


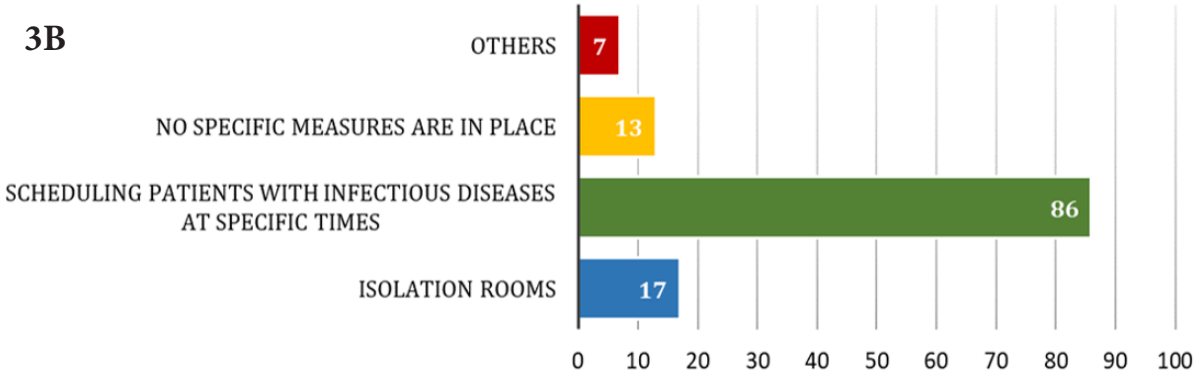
Figure 2. *Implementation of the infection prevention and control (IPC) policy at A) the national level, B) the organizational level (hospital/center), and C) the departmental level; Data are presented as percentages of the responses.*

Room Assessment and Resources

Regarding infection screening practices, only 19.7% (24/122) of the respondents reported that visitors were screened for infectious diseases before entering, 44.3% (54/122) indicated that this screening occurred only occasionally, and 36.0 % (44/122) reported no screening (Figure 3A). For managing patients with infectious diseases, 70.5% (86/123) of the respondents scheduled these patients at specific times, 13.9% (17/123) used isolation rooms, and 10.7% (13/123) had no specific measures in place. Approximately 5.7% (7/123) employed additional measures, such as wrapping the probe with cling film and performing room clean-up afterwards, while one respondent chose both isolation and scheduling (Figure 3 B).



	YES, ALWAYS	SOMETIMES	NO
Q1	19.7%	44.3%	36.0%



	ISOLATION ROOMS	SCHEDULING PATIENTS WITH INFECTIOUS DISEASES AT SPECIFIC TIMES	NO SPECIFIC MEASURES ARE IN PLACE	OTHERS
Q2	13.9%	70.5%	10.7%	5.7%

NOTES:
OTHERS:

1. Basic measures like masking, hygiene & premise cleaning
2. Have work instruction/ guideline for infectious patient
3. If infection means fever, they are identified by measuring body temp and questions.
4. Practice 5 moments of hand hygiene, wrapping up the US probe with cling wrap, discard the linen after infectious cases.
5. It was screen from the entrance of the hospital
6. Perform room cleanup after infectious disease patient scan
7. The entire hospital is doing this.

Figure 3. *A) Infection screening practices before entering RDs and B) Management of infectious patients in RDs.*

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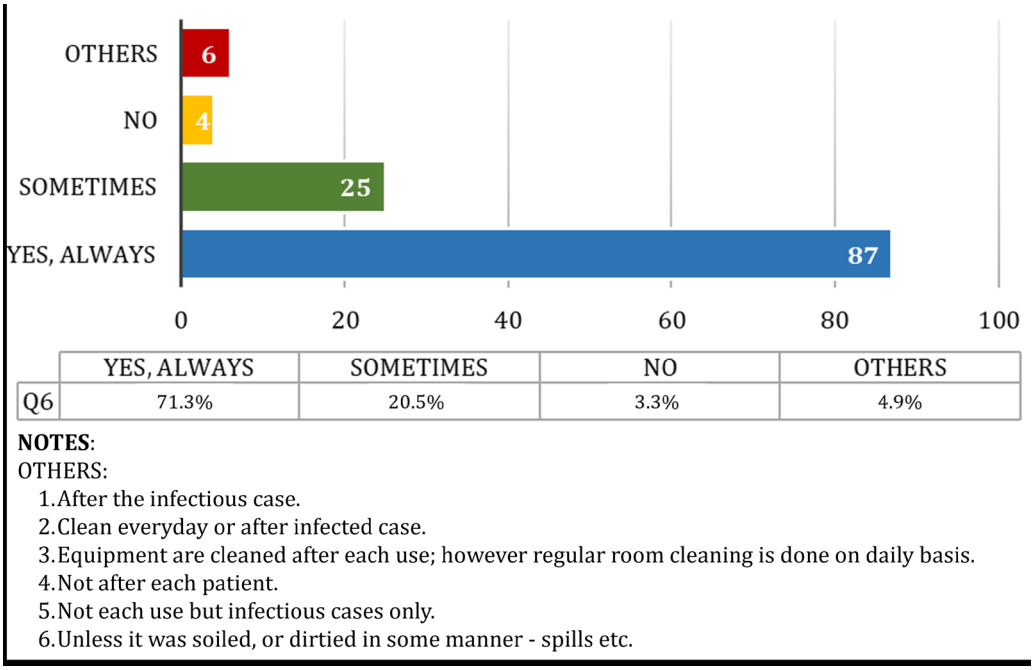
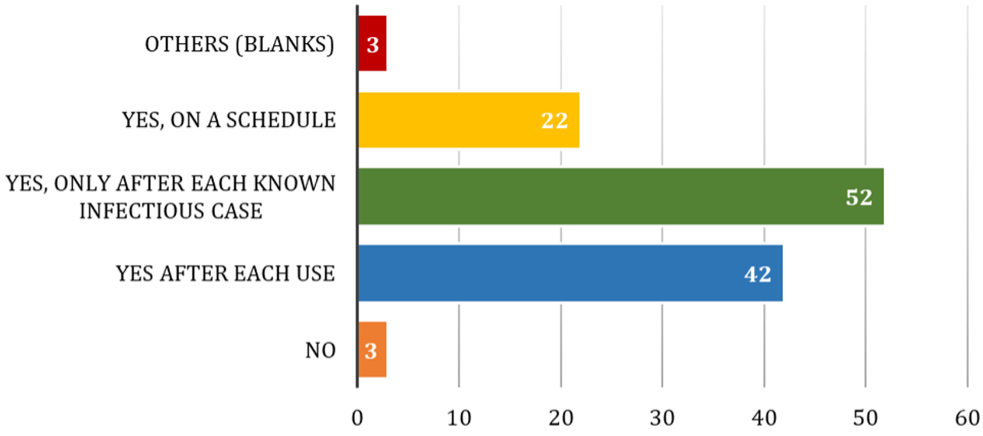
When assessing IPC infrastructure, 87.7% (107/122) of the respondents reported that hand hygiene guidelines were displayed in the room, while 12.3% (15/122) observed the absence of such guidelines. 96.7% (118/122) of the respondents confirmed the availability of adequate sinks, soap, and hand-rub dispensers in their RDs. Personal protective equipment was reported as sufficiently available by 82.0% (100/122) of the respondents. Additionally, 71.3% (87/122) reported cleaning rooms or equipment after each use. In comparison, 20.5% (25/122) did so only sometimes (Fig. 4A). Regarding disinfection practices, 42.6% (52/122) indicated that rooms or equipment were disinfected only after known infectious cases, 34.4% (42/122) reported disinfection after each use, and 18% (22/122) conducted disinfection on a scheduled basis (Fig. 4B). Furthermore, 83.6% (102/122) confirmed that sharps disposal bins were available throughout the RDs. However, 13.9% (17/122) indicated these were available only in certain procedures or imaging rooms.



	YES, ALWAYS	SOMETIMES	NO	OTHERS
Q6	71.3%	20.5%	3.3%	4.9%

NOTES:
OTHERS:
1. After the infectious case.
2. Clean everyday or after infected case.
3. Equipment are cleaned after each use; however regular room cleaning is done on daily basis.
4. Not after each patient.
5. Not each use but infectious cases only.
6. Unless it was soiled, or dirtied in some manner - spills etc.



	NO	YES AFTER EACH USE	YES, ONLY AFTER EACH KNOWN INFECTIOUS CASE	YES, ON A SCHEDULE	OTHERS (BLANKS)
Q7	2.5%	34.4%	42.6%	18.0%	2.5%

Figure 4. *RDs room or equipment practices on A) cleaning and B) disinfection.*

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IPC Policy in the Radiology Department

The majority of respondents, 62.3% (76/122), indicated that their RDs consistently followed IPC policies, while 36.9% (45/122) reported receiving limited or no IPC training for staff. Incident reporting was encouraged in 52.5% (64/122) of RDs, and a no-blame culture was in place. 59.0% (72/122) of respondents noted that staff were encouraged to report IPC breaches. Management support for IPC implementation and enforcement was reported as "very supportive" by 41.0% (50/122) of the respondents, "somewhat supportive" by 21.3% (26/122), and "not supportive at all" by 0.8% (1/122). IPC audits were conducted monthly in 14.8% of RDs, quarterly in 19.7%, and annually in 15.6% of RDs. Only 32.8% (40/122) of the respondents had received feedback on their adherence to IPC policies in their RDs.

Recent Measures and Improvements

In response to the COVID-19 pandemic, 85.2% (104/122) of RDs implemented new measures to enhance IPC practices. Of the total respondents, 24.6% (30/122) reported recent infectious disease events in their RDs, while 63.9% (78/122) reported no such cases. To improve IPC, many RDs introduced audits, multidisciplinary team meetings, and the installation of negative pressure suites for interventional procedures. Key improvements indicated by the respondents were increased staff education, enhanced hand hygiene protocols, more stringent isolation measures, and improved use of protective equipment. Several departments adhered to existing hospital IPC policies and adopted additional practices, such as environmental disinfection and air purification. Some RDs sought external guidance and maintained patient communication through various channels.

RDs implemented waste segregation to enhance infection control, conducted regular screenings, and updated IPC policies according to hospital guidelines. Specific measures for interventional procedures included infection screening, mandatory mask-wearing, thorough hand hygiene, and dedicated examination rooms for infectious patients. Monthly guidance from the IPC Committee and hospital rounds were conducted, and the IPC manual was revised biannually. Regular audits, standards of operations, and rapid response protocols were established, particularly in response to the COVID-19 pandemic, which included hand hygiene campaigns and workflow reviews.

Furthermore, 62.3% (76/122) of the respondents agreed that AOSR policy or guidelines, based on fundamental principles tailored to local contexts, would benefit both institutions and the wider society. These standard, evidence-based international and national guidelines are crucial for effective IPC in RDs, as clinical environments are high-risk areas. Continuous education and dissemination of knowledge to all staff members were seen as essential. While a nurse in the department was responsible for IPC and participated in the hospital's IPC committee, the specific guidelines were not always clear, and variations in practices were noted across different hospital chains. Concerns about doctors' inconsistent use of infection control measures and some vague responses to survey questions also emerged.

Discussion

IPC has long played a critical role in reducing the burden of HAIs and combating antimicrobial resistance, with its foundational principles dating back to 1998 in the USA. Since then, IPC strategies have been widely implemented at acute healthcare facility levels across the globe, supported by the WHO through core IPC program guidelines in 2009. These guidelines aim to provide evidence-based support for IPC at both national and healthcare facility levels, and they are tailored to meet the needs of both high- and low-resource settings [16, 17]. Implementing IPC is generally shared by all healthcare workers, not solely by IPC teams or policymakers, as the success of IPC programs depends on the awareness and adherence of all hospital staff to IPC practices.

According to a 2015 WHO survey, national IPC programs were implemented in only 41% of the member countries, with some regional variations. For instance, Europe and Southeast Asia had slightly higher coverage, and only 29% of the tertiary hospitals had formal IPC policies. [18]. However, a subsequent survey in 2024 displayed a higher level of implementation of the IPC program, reaching 72.9% having trained IPC focal points and 83.3% promoting a multimodal

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improvement strategy [19]. The subsequent high implementation of the IPC program is attributed to the outbreak of COVID-19 in 2020, which likely prompted various hospitals to implement IPC more actively. Both papers cover the healthcare settings in general, rather than RD in particular.

Therefore, our study provides valuable insights into the state of IPC practices within RDs in the AOR following COVID-19, highlighting strengths and areas for improvement. Our survey results revealed that a significant proportion (74.6%) of the respondents reported being aware of having a national IPC committee or program in place. However, only 68.9% of the institutional respondents were aware that they had a specific IPC policy tailored for the RDs. Among those with an IPC policy, more than half (50.8%) followed the WHO guidelines, while others adhered to local guidelines or had no formal policy in place. This variability highlights the need for standardized IPC practices in RDs to ensure consistency and safety across the region. One possible explanation for the high number of respondents with awareness of the IPC national program in our survey is that our study was conducted after the COVID-19 pandemic, when awareness of IPC was significantly heightened. Our findings are consistent with the WHO IPC 2024 global survey report, which examined active national IPC programmes (i.e., functioning programmes with an annual work plan and budget) and found that they existed in 71.3% (107 of 150) of the surveyed countries [19]. The pandemic prompted numerous improvements in IPC practices, according to our survey, with 85.2% (104/122) of RDs reporting the adoption of new infection control measures, including audits, multidisciplinary meetings, and the installation of negative pressure rooms.

Western guidelines from organizations such as the Radiological Society of North America (RSNA), the European Society of Radiology (ESR), and the American College of Radiology (ACR) provide a valuable context for assessing the findings from our study. The RSNA has long emphasized the importance of infection control in RDs, focusing on equipment disinfection, hand hygiene, and staff training [20]. These guidelines align with our findings, underscoring the importance of regular education and adherence to standardized infection control measures.

Similarly, the ESR's guidelines on IPC in RDs focus on areas such as patient screening, disinfection of imaging equipment, and the use of personal protective equipment. While the ESR's recommendations are broadly similar to those of the WHO, they are more detailed in addressing the specific IPC needs of RDs, particularly during invasive radiological procedures. Our study concurs with these findings, noting that procedures involving contrast injections, catheters, and power injectors pose unique infection risks specific to the radiology department [21].

The ACR also recommends implementing comprehensive infection prevention programs in imaging centers, advocating for staff training, equipment cleaning, and stringent protocols for high-risk procedures [22]. These practices, emphasized in the ACR guidelines, align with the proactive approach observed in some RDs following the COVID-19 pandemic. However, our survey also identified areas for improvement, particularly in screening practices and disinfection protocols, which remain highly variable across departments.

Our findings highlight the unique IPC challenges faced by RDs, which are often overlooked in comparison to other clinical areas. The high patient turnover, combined with the frequent use of invasive procedures (such as contrast injections and catheterizations), increases the risk of HAIs in radiology settings. Equipment such as needleless connectors and contrast injectors, commonly used in radiological procedures, has been identified as a high-risk point for infection transmission. [1, 23]. This highlights the need for specialized IPC standards for RDs beyond those in general healthcare settings.

Furthermore, the survey revealed that many respondents were radiologists, who typically do not have direct patient contact. However, IPC is the responsibility of all healthcare workers, and radiographers who interact with patients directly must be included in IPC programs and training. Radiographers often receive limited IPC training in their formal education, and extending IPC education to this group could enhance patient safety in RDs [24].

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Ongoing education and promoting a no-blame culture within RDs ensure that IPC protocols are consistently followed. Training programs should address the technical aspects of infection control (e.g., hand hygiene and equipment disinfection) and emphasize the importance of reporting incidents without fear of blame. A culture encouraging open communication and continuous learning is vital for improving IPC practices and preventing future outbreaks [25].

The epidemiological disparities in HAIs, particularly between developed and developing nations, highlight the impact of various factors such as inadequate infrastructure, understaffing, and a lack of standardized guidelines [26]. These challenges contribute to the variability in IPC practices, underscoring the need for more robust national and institutional policies.

Just like ECR, RSNA, and ACR, AOSR, as a leading authority in the AOR, can play a role in uniting the various members by establishing a formal IPC specific to RDs at the institutional and departmental levels, which aligns with the WHO core components but adapts them to local contexts. Continuous engagement through educational initiatives, incorporating IPC training into radiology education curricula, mandating annual training for all staff, and promoting a no-blame culture to encourage reporting of IPC violations and near-miss events will strengthen practices in the RD [27]. AOSR can also play a role via a position statement to advocate for government and institutional support to enhance infrastructure and resource availability. AOSR can leverage regional collaboration to share knowledge, best practices, and resources, thereby enhancing its effectiveness.

This study provides valuable insights into IPC practices in RDs across the AOR; however, a few limitations should be noted. The survey did not encompass all institutions and RDs across the AOR, nor did it aim for proportional representation. It was based on voluntary participation at the convenience of potential respondents. Hence, the majority of responses were from Japan, Thailand, and Malaysia, reflecting their active participation in this survey. Consequently, the results may not fully represent the AOR but rather reflect the status of the participating institutions (see Supplement). These three countries, Japan and Thailand being developed nations, whilst Malaysia is a developing country, represent well-established healthcare systems in the region.

A more detailed, country-level analysis incorporating diverse and representative data from all countries is an essential goal for future studies. This will provide a more nuanced understanding of IPC practices across various healthcare settings. The categorization in one survey question—Private, Government, Academic, and Others—was not mutually exclusive, which could lead to inconsistencies in classification. Additionally, the survey did not include a question on hospital size or level (e.g., primary, secondary, tertiary), which limits understanding of how these factors impact IPC practices. These aspects should be taken into consideration when interpreting the findings. Unfortunately, this gap in the survey design constitutes a limitation that cannot be corrected retrospectively.

We also note that varied responses originated from the same countries. The survey was designed to explore knowledge gaps and variations in infection prevention and control (IPC) practices. Therefore, discrepancies between responses were considered meaningful and reflective of potential differences in awareness or implementation within the same institution. No attempt was made to reconcile such discrepancies, as these insights contribute to identifying internal inconsistencies and areas for improvement.

In conclusion, the survey highlighted the overall commitment to IPC in RDs across the AOR, with significant progress made in response to the COVID-19 pandemic. The findings provide valuable insights that can guide future improvements in compliance with IPC practices and their implementation across the region. Addressing policy implementation, training, and resource allocation gaps is critical for enhancing infection control practices. Standardizing IPC policies across departments and aligning them with national and international guidelines will improve consistency. Furthermore, enhancing staff education, particularly for radiographers, and ensuring adequate resources will strengthen IPC measures, providing safer and more effective radiology services. Continuous vigilance and adaptation to emerging infection risks are essential for maintaining high IPC standards in the radiology department.

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Data availability statement: The datasets generated or analyzed during the study are available from the corresponding author upon reasonable request.

References

1. Alamer A, Alharbi F, Aldhilan A, Almushayti Z, Alghofaily K, Elbehiry A, et al. Healthcare-Associated Infections (HAIs): Challenges and measures taken by the Radiology Department to Control Infection Transmission. Vaccines (Basel) 2022;10 :2060. doi: 10.3390/vaccines10122060.

2. Ustünsöz B. Hospital infections in radiology clinics. Diagn Interv Radiol 2005; 11:5-9.

3. World Health Organization. WHO operational handbook on tuberculosis: module 2: screening: systematic screening for tuberculosis disease [Internet]. Geneva: WHO; 2021[cited 2025 Sep 27]. Available from: https://www.who.int/publications/i/item/9789240022614

4. World Health Organization. Use of chest imaging in COVID-19: a rapid advice guide: web annex A: imaging for COVID-19: a rapid review 2020 [Internet]. Geneva: WHO; 2025 [cited 2025 Sep 27]. Available from: https://www.who.int/publications/i/item/use-of-chest-imaging-in-covid-19

5. World Health Organization. Surveillance of health care-associated infections at national and facility levels: practical handbook [Internet]. Geneva: WHO; 2024 [cited 2025 Sep 27]. Available from: https://www.who.int/publications/i/item/9789240101456

6. Igwe U, Okolie OJ, Ismail SU, Adukwu E. Effectiveness of infection prevention and control interventions in health care facilities in Africa: A systematic review. Am J Infect Control 2024;52:1135-43. doi: 10.1016/j.ajic.2024.06.004.

7. World Health Organization. Improving infection prevention and control at the health facility: Interim practical manual [Internet]. Geneva: WHO; 2018 [cited 2025 Sep 27]. Available from: https://www.who.int/publications/i/item/WHO-HIS-SDS-2018.10

8. Nuvials X, Palomar M, Alvarez-Lerma F, Olaechea P, Otero S, Uriona S, et al. Health-care associated infections. Patient characteristics and influence on the clinical outcome of patients admitted to ICU. Envin-Helics registry data. Intensive Care Med Exp 2015;3(Suppl 1):A82. doi: 10.1186/2197-425X-3-S1-A82.

9. Klavs I, Bufon Luznik T, Skerl M, Grgic-Vitek M, Lejko Zupanc T, Dolinsek M, et al. Prevalance of and risk factors for hospital-acquired infections in Slovenia-results of the first national survey, 2001. J Hosp Infect 2003;54:149-57. doi: 10.1016/s0195-6701(03)00112-9.

10. Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections in hospitals in Norway, 2002 and 2003. J Hosp Infect 2005;60:40-5. doi: 10.1016/j.jhin.2004.09.038.

11. Di Pietrantonj C, Ferrara L, Lomolino G. Multicenter study of the preva lence of nosocomial infections in Italian hospitals. Infect Control Hosp Epidemiol 2004;25:85-87. doi: 10.1086/502299.

12. Magadze TA, Nkhwashu TE, Moloko SM, Chetty D. The impediments of implementing infection prevention control in public hospitals: Nurses' perspectives. Health SA 2022;27:2033. doi: 10.4102/hsag.v27i0.2033.

13. McLaws ML, Taylor PC. The Hospital Infection Standardised Surveillance (HISS) programme: analysis of a two-year pilot. J Hosp Infect 2003;53:259-67. doi: 10.1053/jhin.2002.1361.

14. Hefzy EM, Wegdan AA, Abdel Wahed WY. Hospital outpatient clinics as a potential hazard for healthcare associated infections. J Infect Public Health 2016;9:88-97. doi: 10.1016/j.jiph.2015.06.015.

15. Tomczyk S, Twyman A, de Kraker MEA, Coutinho Rehse AP, Tartari E, Toledo JP, et al. The first WHO global survey on infection prevention and control in health-care facilities. Lancet Infect Dis 2022;22:845-56. doi: 10.1016/S1473-3099(21)00809-4.

16. World Health Organization. Evidence of hand hygiene as the building block for infection prevention and control: an extract from the systematic literature reviews undertaken as the background for the WHO guidelines on core components of infection prevention and control programmes at the national and acute health care facility level [Internet]. Geneva: WHO; 2017 [cited 2025 Sep 27]. Available from: https://www.who.int/publications/i/item/WHO-HIS-SDS-2017.7

17. Informal Network on Infection Prevention and Control in Health Care; World Health Organization. Core components for infection prevention and control programmes: Report of the second meeting, Informal Network on Infection Prevention and Control in Health Care, Geneva, Switzerland, 26-27 June 2008 [Internet]. Geneva: WHO; 2025 [cited 2025 Sep 28]. Available from: https://iris.who.int/handle/10665/69982

18. World Health Organization. Worldwide country situation analysis: response to antimicrobial resistance [Internet]. Geneva: WHO; 2015 [cited 2025 Sep 28]. Available from: https://iris.who.int/server/api/core/bitstreams/0d3763c7-5559-473a-8403-f6f6774a0a5f/content

19. World Health Organization. Global report on infection prevention and control 2024: executive summary [Internet]. Geneva: WHO; 2024 [cited 2025 Sep 28]. Available from: https://iris.who.int/handle/10665/379863

20. Lynch JB, Davitkov P, Anderson DJ, Bhimraj A, Cheng VC-C, Guzman-Cottrill J, et al. Infectious Diseases Society of America Guidelines on Infection Prevention for Healthcare Personnel Caring for Patients With Suspected or Known COVID-19. Clin Infect Dis 2021:ciab953. doi: 10.1093/cid/ciab953.

21. Revel MP, Parkar AP, Prosch H, Silva M, Sverzellati N, Gleeson F, et al. COVID-19 patients and the Radiology department–advice from the Euro pean Society of Radiology (ESR) and the European Society of Thoracic Imaging (ESTI). Eur Radiol 2020;30:4903-9. doi: 10.1007/s00330-020-06865-y.

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

22. American College of Radiology.ACR manual on MR safety 2020 [Internet]. Reston (VA): ACR; 2020 [cited 2025 Sep 27]. Available from: https://t2star.com/ewExternalFiles/ACR%20MR%20Safety%20Manual%20Vol1%202020.pdf

23. Hynes D, Aghajafari P, Janne d'Othée B. Role of interventional radiology in the management of infection. Semin Ultrasound CT MR 2020;41:20-32. doi: 10.1053/j.sult.2019.10.006.

24. Freihat R, Jimenez Y, Lewis S, Kench P. Radiographers and other radiology workers' education and training in infection prevention and control: A scoping review. Radiography (Lond) 2024;30:1536-45. doi: 10.1016/j.radi.2024.09.047.

25. Devaraj A. Important lessons for infection control in radiology departments during the COVID-19 pandemic. Eur Radiol 2020;30:3599. doi: 10.1007/s00330-020-06873-y.

26. Sengupta S, Barman P, Lo JJ. Opportunities to overcome implementation challenges of infection prevention and control in low-middle income countries. Curr Treat Opt Infec Dis 2019;11:267 - 80. doi: 10.1007/s40506-019-00200-w.

27. Braun BI, Chitavi SO, Suzuki H, Soyemi CA, Puig-Asensio M. Culture of safety: impact on improvement in infection prevention process and outcomes. Curr Infect Dis Rep 2020;22:34. doi: 10.1007/s11908-020-00741-y.