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Human resource adequacy and workload challenges in hospital radiology services

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Abstract

Background: Adequate human resources are essential for safe and continuous radiology services. Indonesian Ministry of Health Regulation No. 24 of 2020 provides staffing requirements for clinical radiology services. This study examined staffing adequacy and workload-related challenges at PKU Muhammadiyah Gamping Hospital, Yogyakarta.
Purpose: To describe human resource adequacy and workload-related challenges in the Radiology Department.
Method: This qualitative descriptive study was conducted from March to July 2026 using observation, document review, and semi-structured interviews with four purposively selected participants: the department head and three radiographers. Data were analysed through reduction, presentation, and conclusion drawing, with staffing conditions compared against the requirements applied in the study.
Results: The department employed 12 radiographers for seven radiological equipment units, had no assigned nursing personnel, and employed one administrative staff member. The comparison indicated staffing gaps in these categories. Interviews and observations also identified overlapping responsibilities and workload challenges. Task rotation, shared responsibilities, and coordination with other hospital units were used to maintain service continuity.
Conclusion: Staffing adequacy requires further assessment based on the applicable radiology service classification and workload. Workload analysis, clearer task allocation, and evidence-based workforce planning may help address staffing gaps and support staff working conditions and service continuity.

Keywords: Human Resources; Radiology Services; Staffing Adequacy; Workload; Working Conditions.

INTRODUCTION

Hospitals are complex healthcare institutions that rely on multidisciplinary healthcare professionals, appropriate resource management, and coordinated service delivery to provide safe and continuous patient care. Hospital performance is influenced by workforce planning, staff competency, administrative support, and the organization of clinical services (Armono, 2022; Harish & Hartanti, 2021; Indriono, 2020). The availability and distribution of health workers are also important considerations in health system planning and the delivery of health services (Ministry of Health of the Republic of Indonesia, 2021, 2025; World Health Organization, 2018). Within hospitals, radiology services play an essential role in clinical diagnosis, treatment planning, disease monitoring, and medical decision-making. Their continuity depends on qualified personnel, functional equipment, standardized procedures, and effective coordination among professional groups (Rahmaddian et al., 2019; Wulandari & Lesmana, 2021). Radiology personnel work in an environment that requires technical accuracy, sustained concentration, compliance with radiation protection procedures, and attention to patient safety. The volume and complexity of imaging procedures may create substantial operational demands, particularly when staffing levels do not correspond to service requirements. Assessing staffing in relation to the time required to perform imaging procedures can help inform workforce planning and service organization (Abdalghani et al., 2025). Previous research has also examined radiology staff performance, the

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implementation of minimum service standards, and workforce requirements in relation to workload (Diyanti et al., 2021; Rahmaddian et al., 2019; Zavihatika et al., 2020). These issues indicate that staffing adequacy should be considered in relation to service demands, professional responsibilities, and the organization of daily work.

Workforce planning also involves staff competency, the distribution of responsibilities, and the availability of personnel who support equipment management and service operations. The relationship between workforce competency and operational efficiency has been discussed in research on human capital planning for X-ray screening systems (Gunawan et al., 2025). Information systems for medical equipment management have also been examined as a means of supporting the work of electromedical personnel (Mulyono et al., 2018). In addition, research on radiology image interpretation in low-resource settings has described operational challenges and the importance of collaboration between imaging departments and other professional groups (Karera et al., 2024). Together, these studies provide a basis for examining staffing composition, task allocation, and interprofessional coordination as components of radiology service organization. Workload is also relevant to the working conditions and psychosocial demands experienced by healthcare personnel. High task demands, time pressure, limited staffing, and overlapping responsibilities may create challenging work environments. Research on healthcare personnel in radiology and nuclear medicine services has examined factors associated with burnout, highlighting the relevance of psychosocial considerations in this occupational setting (Astuti et al., 2022). Workforce shortages and workload challenges have also been discussed in the broader healthcare context, while international research on radiographers has emphasized workforce availability, staffing, education, and training as important elements of workforce planning (Alshadeedi et al., 2025; Zarb & McNulty, 2025). At the broader health-system level, workforce planning requires consideration of the availability and distribution of appropriately skilled personnel to meet service needs (WHO, 2018). However, staffing shortages or demanding work arrangements should not automatically be interpreted as evidence of burnout or psychological distress, as these outcomes require direct assessment using appropriate instruments and research designs.

In Indonesia, Ministry of Health Regulation No. 24 of 2020 concerning Clinical Radiology Services provides a specific regulatory framework for clinical radiology services (Ministry of Health of the Republic of Indonesia, 2020a). Assessing staffing adequacy therefore requires identifying the applicable service classification and the personnel requirements relevant to that classification. Other regulations address different aspects of healthcare, including child anthropometric standards under Ministry of Health Regulation No. 2 of 2020, and should not be treated as interchangeable with regulations governing clinical radiology services (Ministry of Health of the Republic of Indonesia, 2020b). Consequently, conclusions about radiology staffing compliance should be based on verified requirements that apply to the service being assessed. Preliminary observations conducted during the authors' clinical placement at the Radiology Department of PKU Muhammadiyah Gamping Hospital, Yogyakarta, from March to June 2026, identified differences between the available workforce and the staffing requirements used in the initial comparison. The department employed 12 radiographers to support seven radiological equipment units, had one administrative staff member, and had no nurses assigned directly to the department. The available staffing records also listed two personnel under a combined category of radiation protection officers and medical physicists, without separately specifying their professional classifications. Although services continued through task allocation, staff rotation, and coordination with other hospital units, these arrangements raised questions about workforce distribution and the basis for assessing staffing adequacy. The applicable clinical radiology service classification and corresponding staffing requirements had not been independently confirmed, and individual workload and psychological outcomes were not directly assessed.

Further contextual investigation is therefore needed to describe the available human resources, identify differences between staffing levels and the requirements used in the initial comparison, and explore the organizational arrangements used to maintain service continuity. Accordingly, this study aimed to describe human resource adequacy and workload-related challenges in the Radiology Department of PKU Muhammadiyah Gamping

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Hospital, Yogyakarta, with particular attention to staffing composition, task distribution, and work organization. The study focused on organizational working conditions and did not seek to establish regulatory noncompliance or determine psychological outcomes among personnel.

RESEARCH METHOD

This study employed a qualitative descriptive design to explore human resource availability, workload-related challenges, and work organization in the Radiology Department of PKU Muhammadiyah Gamping Hospital, Yogyakarta, Indonesia. Staffing conditions were examined in relation to Indonesian Ministry of Health Regulation No. 24 of 2020 concerning Clinical Radiology Services, particularly the staffing requirements specified for each service capability classification. The study was conducted in the hospital's Radiology Department. Observations were carried out from March to June 2026 during the authors' clinical placement, followed by interviews in early July 2026. Four participants were recruited through purposive sampling: the head of the Radiology Department and three radiographers. The department head was selected because of their managerial responsibilities, while the radiographers had at least two years of work experience and were directly involved in radiological examinations. These participants were considered knowledgeable about staffing arrangements, task distribution, and daily service operations.

Data were collected through direct observation, semi-structured interviews, and document review. Observations focused on personnel availability, service activities, and task allocation. Interviews followed a prepared interview guide and were audio-recorded for transcription. Documents reviewed included available staffing records, the departmental organizational structure, and relevant regulatory provisions. The professional categories and numbers of available personnel were examined against the applicable regulatory requirements. Particular attention was given to distinguishing radiation protection officers from medical physicists because these are separate personnel categories under the regulation.

Data analysis involved transcription, data familiarization, data reduction, categorization, and interpretation. Information was organized into four themes: human resource adequacy, workload-related challenges, task distribution, and work organization. Triangulation was undertaken by comparing interview accounts with observational findings and available documents. Agreements and discrepancies across these sources were considered when interpreting the findings. Where the evidence was insufficient to confirm a staffing classification or professional role, the finding was treated as requiring verification rather than as an established regulatory violation. The findings were interpreted in relation to organizational working conditions and potential psychosocial demands. Occupational stress, psychological distress, and other mental health outcomes were not directly measured and therefore were not reported as established findings. Ethical approval was obtained from the Research Ethics Committee of PKU Muhammadiyah Hospital, Yogyakarta (No. 175/KEP-PKU/I/2026) in June 2026. Interviews were conducted after research authorization had been granted. All participants received an explanation of the study objectives and provided informed consent before participation.

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RESEARCH RESULTS

Table 1. Human Resources Available in the Hospital Radiology Department

Type of personnel	Number	Employment status
Radiographers	12	Active
Radiation Protection Officers And Medical Physicists	2	Active, professional categories not separately specified
Nurses	0	No nurses assigned directly to the department
Administrative Staff	1	Active
Electromedical Technician	1	Active
Radiologists	5	Active

The available staffing records indicated that the Radiology Department employed 12 radiographers, five radiologists, one electromedical technician, and one administrative staff member. Two additional personnel were recorded under the combined category of radiation protection officers and medical physicists. The available records did not specify their individual professional classifications. No nurses were assigned directly to the department.

Table 2. Preliminary Comparison of Available Human Resources and Reported Staffing Requirements

Type of personnel	Reported requirement	Available personnel	Reported compliance
Radiologists	4	5	1 more than the reported requirement
Radiographers	14 for 7 units of equipment	12	2 fewer than the reported requiremen
Nurses	2	0	No nurses assigned directly to the department
Medical Physicists	2	2	Availability could not be confirmed
Electromedical Personnel	1	1	Equal to the reported requirement
Administrative Staff	2	1	1 fewer than the reported requirement

The preliminary comparison showed differences between the available personnel and the staffing requirements used in the initial assessment, particularly for radiographers, nursing personnel, and administrative staff. The department had 12 radiographers for seven radiological equipment units, compared with the reported requirement of 14. No nurses were assigned directly to the department, while one administrative staff member was available against the reported requirement of two. The number of medical physicists could not be confirmed because the available staffing records did not distinguish them from radiation protection officers. These findings describe the staffing information available to the researchers and do not establish regulatory compliance or noncompliance, as the applicable service classification and corresponding personnel requirements require further verification.

DISCUSSION

This study identified differences between the available human resources in the Radiology Department of PKU Muhammadiyah Gamping Hospital and the staffing requirements used in the initial comparison. The department had 12 radiographers, five radiologists, one electromedical technician, and one administrative staff member. Two additional personnel were recorded under a combined category of radiation protection officers and medical physicists, while no nurses were assigned directly to the department. These findings illustrate the importance of examining staffing by professional

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category rather than relying solely on the total number of personnel. Previous studies have examined radiology workforce requirements, staff performance, and the implementation of minimum service standards as components of radiology service management (Diyanti et al., 2021; Rahmaddian et al., 2019; Wulandari & Lesmana, 2021; Zavihatika et al., 2020).

The preliminary comparison indicated that the department had two fewer radiographers than the reported requirement of 14 for seven radiological equipment units. It also had one administrative staff member against the reported requirement of two, while no nurses were assigned directly to the department. These differences warrant further review of workload, task distribution, and support arrangements within the service. However, the figures should be interpreted cautiously because the applicable clinical radiology service classification and its corresponding staffing requirements were not independently verified. The findings therefore describe differences in the available staffing information and the initial comparison rather than establish regulatory noncompliance.

The need to assess staffing in relation to service demands is consistent with research examining radiographer staffing frameworks and the duration of imaging procedures (Abdalghani et al., 2025). Previous studies have also examined workforce requirements in radiology departments in relation to workload and minimum service standards (Rahmaddian et al., 2019; Zavihatika et al., 2020). International research has highlighted workforce availability, staffing levels, education, and training as important considerations in radiographer workforce planning (Zarb & McNulty, 2025). More broadly, health workforce planning requires attention to the availability and distribution of appropriately skilled personnel to meet population and service needs (WHO, 2018). Nevertheless, equipment numbers alone are insufficient to establish the exact staffing requirement because service classification, procedure volume, operational hours, professional responsibilities, and local service arrangements may also be relevant.

The staffing records also revealed a limitation in the classification of personnel listed jointly as radiation protection officers and medical physicists. Because the records did not specify the professional category of each person, the number of medical physicists available to the department could not be established. This distinction is important because professional titles and responsibilities should not be assumed to be interchangeable when evaluating staffing requirements. Workforce competency and operational efficiency are relevant considerations in planning personnel for X-ray screening services (Gunawan et al., 2025). Similarly, information systems for medical equipment management may support electromedical personnel in recording and managing equipment-related information (Mulyono et al., 2018). These considerations suggest that workforce assessment should document both personnel numbers and clearly defined professional roles.

The department continued to provide services through task allocation, staff rotation, and coordination with other hospital units. Such arrangements may help maintain operational continuity when staffing resources are constrained, but their presence does not demonstrate that workload is appropriate or staffing is sufficient. Research on radiology image interpretation in low-resource settings has described operational challenges and the importance of collaboration among professional groups (Karera et al., 2024). More generally, hospital performance and resource management literature emphasizes the organization of resources and responsibilities to support service delivery (Armono, 2022; Harish & Hartanti, 2021). However, this study did not quantify individual task duration, procedure volume per staff member, overtime, or workload intensity. It therefore cannot determine whether the existing arrangements resulted in excessive workload or reduced service quality.

These organizational findings also have potential relevance to working conditions and psychosocial demands. In radiology services, sustained concentration, time pressure, and competing responsibilities may create occupational challenges that warrant attention in workforce planning. Research has examined factors associated with burnout among healthcare personnel in radiology and nuclear medicine services, providing context for considering the psychosocial dimensions of radiology work (Astuti et al., 2022). Workforce shortages and workload challenges have also been discussed in the broader healthcare context (Alshadeedi et al., 2025). At the health-system level, ensuring the availability of an appropriately skilled workforce is an important

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component of maintaining health service capacity (WHO, 2018). Nevertheless, this study did not directly assess burnout, psychological distress, job satisfaction, or well-being. It would therefore be inappropriate to conclude that the staffing differences identified in this study caused psychological problems among radiology personnel. Future research should assess workload and psychosocial outcomes directly using appropriate measures.

The findings should also be interpreted within the broader context of health service planning and regulation. National health reports and health human resource policies provide context for workforce planning and the management of health services in Indonesia (Ministry of Health of the Republic of Indonesia, 2021, 2025). However, general workforce policies and national health reports do not replace verification of the specific requirements applicable to a clinical radiology service. Ministry of Health Regulation No. 24 of 2020 concerning Clinical Radiology Services is more directly relevant to identifying the regulatory framework for this department (Ministry of Health of the Republic of Indonesia, 2020a). In contrast, Ministry of Health Regulation No. 2 of 2020 concerns child anthropometric standards and does not establish radiology staffing requirements (Ministry of Health of the Republic of Indonesia, 2020b). The applicable service classification and corresponding staffing provisions must therefore be confirmed before regulatory conclusions can be made.

Other studies concerning hospital information systems, service quality, patient satisfaction, and general human resource standards provide broader perspectives on healthcare operations but do not directly establish staffing adequacy in this department. Research on radiology information system design has addressed the potential contribution of information systems to patient services (Ardiana, 2019). Research on patient-perceived service quality has examined its relationship with outpatient satisfaction in a nuclear medicine unit (Nopriwan et al., 2022). Research on human resource and minimum healthcare service standards has also considered implementation in a municipal context (Indriono, 2020). These studies provide general organizational context, but the present study did not evaluate information system performance, patient satisfaction, or patient-perceived service quality. Similarly, general discussions of hospital performance and resource management should not be treated as direct evidence that the staffing arrangements observed in this study met specific clinical radiology requirements (Armono, 2022; Harish & Hartanti, 2021).

The study has several limitations. First, it was conducted in a single hospital, so the findings may not be transferable to radiology departments with different service classifications, staffing structures, or workloads. Second, the assessment relied on available staffing records and information from four participants, consisting of the department head and three radiographers. Third, the professional classifications of the two personnel recorded under the combined radiation protection officer and medical physicist category could not be separately verified. Fourth, the staffing requirements used in the initial comparison were not independently confirmed against the applicable clinical radiology service classification. Finally, individual workload intensity and psychological outcomes were not measured directly. These limitations mean that the findings should be interpreted as a contextual description of staffing arrangements and workload-related organizational challenges rather than a definitive assessment of regulatory compliance, staff burnout, or psychological well-being.

Despite these limitations, the study provides a basis for reviewing staffing documentation, clarifying professional categories, and examining how tasks are distributed across the radiology department. Hospital management may consider verifying the applicable service classification and staffing requirements, reviewing workforce allocation in relation to operational demand, and ensuring that professional responsibilities are clearly documented. Further studies involving direct workload measurement, procedure volume, staffing coverage, and validated psychosocial instruments are needed to determine whether the organizational conditions identified here are associated with measurable occupational or psychological outcomes.

CONCLUSION

The study identified differences between available personnel and the staffing requirements used in the initial comparison, particularly regarding radiographers, nursing personnel, and administrative staff. Further verification of the applicable clinical radiology service classification, staffing requirements,

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and professional personnel categories is necessary before determining regulatory compliance. Reviewing task allocation and workforce planning may help support service continuity and appropriate working conditions. Further research is needed to assess workload intensity and its potential psychosocial implications for radiology personnel.

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