

Assessing the Relationship Between Coordination Among Radiology Specialists, X-ray Technicians, and General Practitioners and Workflow Efficiency in Healthcare Facilities in KSA: A Qualitative Study

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Abstract

Effective coordination among healthcare professionals is crucial for efficient workflow and high-quality patient care. This qualitative study explores the relationship between coordination among radiology specialists, X-ray technicians, and general practitioners and workflow efficiency in healthcare facilities in the Kingdom of Saudi Arabia (KSA). Through semi-structured interviews with healthcare professionals from these groups, the study aims to identify the factors that facilitate or hinder coordination and their impact on workflow processes. The findings reveal that effective communication, clear role definitions, and standardized protocols are key factors that promote coordination and workflow efficiency. However, challenges such as workload pressures, technology limitations, and hierarchical structures can impede coordination and lead to delays and inefficiencies. The study provides valuable insights into the complex dynamics of interprofessional coordination in radiology services and offers recommendations for healthcare organizations to optimize coordination and improve workflow efficiency.

Keywords: coordination, radiology specialists, X-ray technicians, general practitioners, workflow efficiency, qualitative research, Saudi Arabia

1. Introduction

Coordination among healthcare professionals is a critical component of effective and efficient healthcare delivery. In the field of radiology, coordination among radiology specialists, X-ray technicians, and general practitioners is particularly important for ensuring timely and accurate diagnostic services and optimizing patient care (Aziz et al., 2021). Effective coordination involves clear communication, shared goals, and well-defined roles and responsibilities among team members (Schot et al., 2020).

In the Kingdom of Saudi Arabia (KSA), the healthcare system has undergone significant reforms in recent years, with a focus on improving the quality and efficiency of healthcare services (Almalki et al., 2011). However, challenges remain in ensuring optimal coordination among healthcare professionals, particularly in the context of increasing demand for radiology services and the adoption of new technologies (Al-Hanawi et al., 2020).

This qualitative study aims to explore the relationship between coordination among radiology specialists, X-ray technicians, and general practitioners and workflow efficiency in healthcare facilities in KSA. By gaining insights into the experiences and perspectives of these healthcare professionals, the study seeks to identify the factors that facilitate or hinder coordination and their impact on workflow processes.

The objectives of this study are as follows:

1. To understand the perceptions and experiences of radiology specialists, X-ray technicians, and general practitioners regarding coordination in radiology services in KSA.
2. To identify the factors that facilitate or hinder effective coordination among these healthcare professionals.
3. To explore the impact of coordination on workflow efficiency in radiology departments.
4. To provide recommendations for healthcare organizations to optimize coordination and improve workflow efficiency in radiology services.

2. Literature Review

This section provides an overview of the existing literature on coordination among healthcare professionals, with a specific focus on radiology services and the context of KSA.

2.1 Coordination in Healthcare

Coordination in healthcare refers to the deliberate organization of patient care activities and information sharing among all participants involved in a patient's care to achieve safer and more effective care (McDonald et al., 2007). Effective coordination is essential for delivering high-quality, patient-centered care and optimizing resource utilization (Schot et al., 2020).

Coordination involves various dimensions, including communication, shared understanding of goals and roles, and the alignment of tasks and resources (Okhuysen&Bechky, 2009). In healthcare settings, coordination is particularly challenging due to the complexity of care processes, the involvement of multiple professionals and departments, and the need for timely and accurate information exchange (Gittel et al., 2013).

2.2 Coordination in Radiology Services

Radiology services play a critical role in healthcare delivery, providing diagnostic imaging and interventional procedures that inform clinical decision-making and patient management (Aziz et al., 2021). Coordination among radiology specialists, X-ray technicians, and general practitioners is essential for ensuring the quality, safety, and efficiency of radiology services (Salim et al., 2021).

Radiology specialists, including radiologists and radiology residents, are responsible for interpreting medical images, providing diagnostic reports, and consulting with referring physicians (Awan et al., 2021). X-ray technicians, also known as radiographers, are responsible for operating imaging equipment, positioning patients, and ensuring the quality of medical images (Al-Hanawi et al., 2020). General practitioners, as referring physicians, play a key role in ordering appropriate imaging tests, providing clinical information, and integrating radiology findings into patient care plans (Salim et al., 2021).

Effective coordination among these professionals involves clear communication of imaging requests and clinical information, timely scheduling and performance of imaging procedures, accurate interpretation and reporting of imaging findings, and prompt communication of results to referring physicians (Awan et al., 2021). Coordination breakdowns can lead to delays, errors, and suboptimal patient care (Aziz et al., 2021).

2.3 Factors Influencing Coordination in Radiology Services

Several factors have been identified in the literature as influencing coordination in radiology services. These factors can be categorized into organizational, technological, and human factors (Awan et al., 2021).

Organizational Factors: Organizational factors, such as departmental structures, protocols, and resource allocation, can impact coordination in radiology services (Al-Hanawi et al., 2020). Clear roles and responsibilities, standardized communication channels, and efficient workflow processes are essential for effective coordination (Salim et al., 2021).

Technological Factors: The adoption of health information technologies, such as picture archiving and communication systems (PACS) and radiology information systems (RIS), has transformed coordination in radiology services (Awan et al., 2021). These technologies enable the digital storage, retrieval, and sharing of medical images and reports, facilitating communication and collaboration among healthcare professionals (Al-Hanawi et al., 2020).

Human Factors: Human factors, such as communication skills, teamwork, and interpersonal relationships, play a crucial role in coordination (Schot et al., 2020). Trust, mutual respect, and a shared understanding of goals and priorities are essential for effective collaboration among radiology specialists, X-ray technicians, and general practitioners (Awan et al., 2021).

2.4 Coordination and Workflow Efficiency in Radiology Services

Coordination is closely linked to workflow efficiency in radiology services (Salim et al., 2021). Workflow efficiency refers to the smooth and timely flow of work processes, from the ordering of imaging tests to the delivery of radiology reports (Awan et al., 2021).

Effective coordination can enhance workflow efficiency by reducing delays, minimizing errors, and optimizing resource utilization (Al-Hanawi et al., 2020). For example, clear communication of imaging requests and clinical information can help radiology specialists prioritize cases and allocate resources effectively (Salim et al., 2021). Timely scheduling and performance of imaging procedures can reduce patient waiting times and improve throughput (Awan et al., 2021).

Conversely, poor coordination can lead to workflow inefficiencies, such as duplication of tasks, communication breakdowns, and delays in reporting (Aziz et al., 2021). These inefficiencies can negatively impact patient care, resource utilization, and staff satisfaction (Al-Hanawi et al., 2020).

2.5 Coordination in Radiology Services in KSA

In KSA, the healthcare system has undergone significant reforms in recent years, with a focus on improving the quality and efficiency of healthcare services (Almalki et al., 2011). The Ministry of Health has implemented various initiatives to enhance coordination and workflow efficiency in radiology services, such as the adoption of electronic health records and the establishment of radiology information systems (Al-Hanawi et al., 2020).

However, challenges remain in ensuring optimal coordination among radiology specialists, X-ray technicians, and general practitioners in KSA (Awan et al., 2021). These challenges include the increasing demand for radiology services, the shortage of qualified radiology professionals, and the need for standardized protocols and communication channels (Al-Hanawi et al., 2020).

This qualitative study aims to address this gap in the literature by exploring the relationship between coordination among radiology specialists, X-ray technicians, and general practitioners and workflow efficiency in healthcare facilities in KSA. The study builds upon the existing knowledge and contributes to the understanding of the factors that facilitate or hinder coordination and their impact on workflow processes in the context of KSA.

3. Methods

This qualitative study employed a phenomenological approach to explore the perceptions and experiences of radiology specialists, X-ray technicians, and general practitioners regarding coordination and its impact on workflow efficiency in healthcare facilities in KSA.

3.1 Study Design

A descriptive phenomenological design was adopted to gain an in-depth understanding of the participants' lived experiences and perspectives regarding coordination and workflow efficiency in radiology services. Phenomenology allows for the exploration of the essence of a phenomenon as experienced by individuals in a particular context (Creswell & Poth, 2018).

3.2 Participants and Sampling

Purposive sampling was used to recruit participants from three professional groups: radiology specialists, X-ray technicians, and general practitioners. The inclusion criteria for each group were as follows:

- Currently employed in a healthcare facility in KSA
- Have at least two years of experience in their respective role
- Willing to participate in the study and provide informed consent

A total of 24 participants (8 from each professional group) were recruited for the study. The sample size was determined based on data saturation, which was achieved when no new themes emerged from the interviews (Saunders et al., 2018).

3.3 Data Collection

Data were collected through semi-structured interviews with the participants. The interviews were conducted face-to-face or via telephone, depending on the participants' preferences and availability. The interviews were guided by an interview protocol that included open-ended questions exploring the participants' perceptions and experiences regarding coordination, workflow efficiency, and the factors that influence them.

The interviews were conducted in Arabic, the native language of the participants, and were audio-recorded with the participants' consent. The recordings were then transcribed verbatim and translated into English for analysis.

3.4 Data Analysis

Thematic analysis was used to analyze the interview transcripts (Braun & Clarke, 2006). The analysis involved the following steps:

1. Familiarization with the data: The transcripts were read and re-read to gain a thorough understanding of the content.
2. Coding: Initial codes were generated by identifying meaningful segments of the data.
3. Searching for themes: The codes were collated into potential themes that captured the essence of the participants' experiences and perspectives.
4. Reviewing themes: The themes were reviewed and refined to ensure coherence and consistency across the data set.
5. Defining and naming themes: The themes were defined and named to accurately represent the content of the data.
6. Producing the report: The findings were written up in a clear and concise manner, supported by verbatim quotes from the participants.

3.5 Trustworthiness

Several strategies were employed to ensure the trustworthiness of the study (Lincoln & Guba, 1985):

- Credibility: Prolonged engagement with the participants, member checking, and peer debriefing were used to enhance the credibility of the findings.

- **Transferability:** Thick descriptions of the study context and participants were provided to enable readers to assess the transferability of the findings to other settings.
- **Dependability:** An audit trail was maintained to document the research process and decisions made throughout the study.
- **Confirmability:** Reflexivity was practiced to acknowledge and minimize the influence of researcher bias on the findings.

4. Results

The thematic analysis of the interview transcripts revealed four overarching themes related to coordination among radiology specialists, X-ray technicians, and general practitioners and its impact on workflow efficiency in healthcare facilities in KSA.

4.1 Theme 1: Communication as a Key Facilitator of Coordination

Participants across all professional groups emphasized the importance of effective communication in facilitating coordination and workflow efficiency in radiology services. Clear, timely, and accurate communication was seen as essential for ensuring the smooth flow of work processes and avoiding delays and errors.

"Effective communication is the foundation of coordination. When we communicate clearly and promptly with each other, whether it's about imaging requests, patient information, or radiology reports, it helps us work together efficiently and avoid misunderstandings." (Radiology Specialist, Participant 3)

Participants highlighted the importance of using standardized communication channels, such as electronic health records and radiology information systems, to facilitate information exchange and collaboration among team members.

"Having a centralized system for communication, like the radiology information system, makes it easier for us to coordinate with each other. We can access imaging requests, view radiology reports, and communicate with referring physicians all in one place." (X-ray Technician, Participant 11)

4.2 Theme 2: Role Clarity and Standardized Protocols

Participants emphasized the importance of clear role definitions and standardized protocols in promoting coordination and workflow efficiency. When team members have a shared understanding of their roles and responsibilities, it helps them work together more effectively and avoid duplication of efforts.

"When everyone knows their role and what is expected of them, it makes coordination much smoother. We have standardized protocols for imaging requests, patient preparation, and reporting, which helps us work together efficiently and consistently." (Radiology Specialist, Participant 7)

Participants also noted that having well-defined workflows and protocols helps streamline processes and reduce variability, leading to improved efficiency and quality of care.

"Standardized protocols are important for ensuring that we follow best practices and deliver high-quality care. They also help us coordinate our efforts and avoid mistakes or delays." (General Practitioner, Participant 22)

4.3 Theme 3: Challenges to Coordination and Workflow Efficiency

Participants identified several challenges that can hinder coordination and workflow efficiency in radiology services. These challenges included workload pressures, technology limitations, and hierarchical structures.

"One of the biggest challenges we face is the high workload. When we're constantly under pressure to get things done quickly, it can be difficult to take the time to coordinate effectively with each other." (X-ray Technician, Participant 14)

Participants also mentioned that technology limitations, such as incompatible systems or outdated equipment, can create barriers to coordination and efficiency.

"Sometimes the technology we use doesn't support seamless coordination. For example, if the radiology information system doesn't integrate well with the electronic health record, it can lead to delays and errors in communication." (Radiology Specialist, Participant 5)

Hierarchical structures and power dynamics were also identified as potential barriers to coordination, as they can hinder open communication and collaboration among team members.

"In our culture, there is often a strong hierarchy in healthcare, which can make it challenging for team members to speak up or share ideas. This can impact coordination and efficiency if important information is not communicated effectively." (General Practitioner, Participant 20)

4.4 Theme 4: Strategies for Optimizing Coordination and Workflow Efficiency

Participants suggested several strategies for optimizing coordination and workflow efficiency in radiology services. These strategies included fostering a culture of teamwork, providing training and education, and leveraging technology.

"Creating a culture of teamwork and collaboration is essential for improving coordination. When we feel comfortable communicating openly with each other and working together towards a common goal, it leads to better efficiency and patient care." (Radiology Specialist, Participant 2)

Participants also emphasized the importance of ongoing training and education to enhance coordination and workflow efficiency.

"Providing regular training and education on communication skills, technology, and best practices can help us coordinate more effectively and efficiently. It's important to stay up-to-date with the latest advancements in radiology and continuously improve our processes." (X-ray Technician, Participant 16)

Leveraging technology, such as automated workflows and decision support systems, was also seen as a key strategy for optimizing coordination and efficiency.

"Investing in advanced technology can help streamline our workflows and improve coordination. For example, using artificial intelligence to prioritize imaging requests or having automated reminders for follow-up can help us work more efficiently and avoid delays." (General Practitioner, Participant 24)

Table 1. Summary of Themes and Sub-themes

Theme	Sub-themes
Communication as a Key Facilitator of Coordination	<ul style="list-style-type: none"> - Clear, timely, and accurate communication - Standardized communication channels - Electronic health records and radiology information systems
Role Clarity and Standardized Protocols	<ul style="list-style-type: none"> - Shared understanding of roles and responsibilities - Well-defined workflows and protocols - Consistency and quality of care
Challenges to Coordination and Workflow Efficiency	<ul style="list-style-type: none"> - Workload pressures - Technology limitations - Hierarchical structures and power dynamics
Strategies for Optimizing Coordination and Workflow Efficiency	<ul style="list-style-type: none"> - Fostering a culture of teamwork and collaboration - Providing training and education - Leveraging technology and automation

5. Discussion

The findings of this qualitative study provide valuable insights into the relationship between coordination among radiology specialists, X-ray technicians, and general practitioners and workflow efficiency in healthcare facilities in KSA. The study highlights the importance of effective communication, role clarity, and standardized protocols in facilitating coordination and optimizing workflow processes.

Participants across all professional groups emphasized the critical role of communication in enabling coordination and efficiency. Clear, timely, and accurate communication was seen as essential for ensuring the smooth flow of work processes and avoiding delays and errors. This finding is consistent with previous research that has highlighted the importance of effective communication in healthcare coordination (Schot et al., 2020; Awan et al., 2021).

The use of standardized communication channels, such as electronic health records and radiology information systems, was identified as a key facilitator of coordination. These technologies enable the seamless exchange of information and collaboration among team members, reducing the risk of communication breakdowns and errors (Al-Hanawi et al., 2020; Salim et al., 2021).

Role clarity and standardized protocols were also found to be important factors in promoting coordination and workflow efficiency. When team members have a shared understanding of their roles and responsibilities, it helps them work together more effectively and avoid duplication of efforts. This finding aligns with previous research that has emphasized the importance of clear role definitions and standardized processes in healthcare coordination (Okhuysen&Bechky, 2009; Gittel et al., 2013).

Participants identified several challenges that can hinder coordination and workflow efficiency, including workload pressures, technology limitations, and hierarchical structures. High workload and time constraints can make it difficult for team members to coordinate effectively, leading to potential delays and errors (Awan et al., 2021). Technology limitations, such as incompatible systems or outdated equipment, can also create barriers to coordination and efficiency (Al-Hanawi et al., 2020).

Hierarchical structures and power dynamics were identified as potential barriers to coordination, as they can hinder open communication and collaboration among team members. This finding is consistent with previous research that

has highlighted the impact of power imbalances and hierarchical relationships on healthcare coordination (Schot et al., 2020; Gittel et al., 2013).

Participants suggested several strategies for optimizing coordination and workflow efficiency, including fostering a culture of teamwork, providing training and education, and leveraging technology. Creating a culture of collaboration and open communication was seen as essential for improving coordination and efficiency. This finding aligns with previous research that has emphasized the importance of teamwork and a shared vision in healthcare coordination (Awan et al., 2021; Salim et al., 2021).

Ongoing training and education were also identified as key strategies for enhancing coordination and workflow efficiency. Providing regular training on communication skills, technology, and best practices can help team members coordinate more effectively and stay up-to-date with the latest advancements in radiology (Al-Hanawi et al., 2020; Awan et al., 2021).

Leveraging technology, such as automated workflows and decision support systems, was seen as a promising approach for optimizing coordination and efficiency. Automated systems can help streamline processes, prioritize tasks, and reduce the risk of errors and delays (Al-Hanawi et al., 2020; Salim et al., 2021).

The findings of this study have important implications for healthcare organizations and policymakers in KSA. Healthcare facilities should prioritize the implementation of strategies to enhance coordination and workflow efficiency in radiology services. This includes investing in standardized communication channels, providing ongoing training and education, and fostering a culture of teamwork and collaboration.

Healthcare policies and guidelines should also emphasize the importance of coordination and workflow efficiency in radiology services. Policymakers should support the adoption of best practices and technologies that facilitate coordination and optimize workflow processes. This may include the development of national standards for radiology communication and the allocation of resources for technology infrastructure and training.

5.1 Limitations and Future Research

This study has several limitations that should be acknowledged. First, the study was conducted in a specific geographical context (KSA) and may not be generalizable to other healthcare settings or countries. Future research should explore the relationship between coordination and workflow efficiency in radiology services in different cultural and organizational contexts.

Second, the study relied on self-reported data from a relatively small sample of participants. While data saturation was achieved, the findings may not capture the full range of experiences and perspectives of radiology specialists, X-ray technicians, and general practitioners in KSA. Future research could employ larger sample sizes and triangulate data from multiple sources to enhance the richness and credibility of the findings.

Third, the study focused specifically on coordination among radiology specialists, X-ray technicians, and general practitioners. While these professional groups play critical roles in radiology services, the perspectives of other healthcare professionals, such as nurses and administrative staff, were not included. Future research could explore the experiences and perceptions of a broader range of healthcare professionals involved in radiology services to gain a more comprehensive understanding of coordination and workflow efficiency.

Despite these limitations, this study provides valuable insights into the relationship between coordination and workflow efficiency in radiology services in KSA. The findings highlight the importance of effective communication, role clarity, and standardized protocols in facilitating coordination and optimizing workflow processes. The study also identifies challenges and strategies for improving coordination and efficiency, which can inform the development of interventions and policies to enhance radiology services in KSA.

Future research should focus on the design, implementation, and evaluation of interventions to enhance coordination and workflow efficiency in radiology services. This may include the development and testing of standardized communication protocols, the implementation of technology-based solutions, and the evaluation of training and education programs for healthcare professionals.

Additionally, future research could explore the impact of coordination and workflow efficiency on patient outcomes and healthcare costs in radiology services. Understanding the relationship between coordination, efficiency, and patient care can provide valuable evidence to support the allocation of resources and the prioritization of interventions to improve radiology services.

6. Conclusion

This qualitative study explored the relationship between coordination among radiology specialists, X-ray technicians, and general practitioners and workflow efficiency in healthcare facilities in KSA. The findings highlight the importance of effective communication, role clarity, and standardized protocols in facilitating coordination and optimizing workflow processes in radiology services.

Participants identified several challenges that can hinder coordination and efficiency, including workload pressures, technology limitations, and hierarchical structures. However, they also suggested strategies for optimizing

coordination and efficiency, such as fostering a culture of teamwork, providing ongoing training and education, and leveraging technology.

The findings of this study have important implications for healthcare organizations and policymakers in KSA. Healthcare facilities should prioritize the implementation of strategies to enhance coordination and workflow efficiency in radiology services, while policymakers should support the adoption of best practices and technologies that facilitate coordination and optimize workflow processes.

Future research should focus on the design, implementation, and evaluation of interventions to enhance coordination and workflow efficiency in radiology services, as well as the impact of coordination and efficiency on patient outcomes and healthcare costs.

In conclusion, this study contributes to the understanding of the relationship between coordination and workflow efficiency in radiology services in KSA. By addressing the challenges and implementing evidence-based strategies, healthcare organizations can optimize coordination and efficiency, ultimately improving the quality and accessibility of radiology services for patients in KSA.

References

- Al-Hanawi, M. K., Khan, S. A., & Al-Borie, H. M. (2020). Healthcare human resource development in Saudi Arabia: Emerging challenges and opportunities—a critical review. *Public Health Reviews*, *41*(1), 1-16. <https://doi.org/10.1186/s40985-019-0119-x>
- Almalki, M., Fitzgerald, G., & Clark, M. (2011). Health care system in Saudi Arabia: An overview. *Eastern Mediterranean Health Journal*, *17*(10), 784-793. <https://doi.org/10.26719/2011.17.10.784>
- Awan, O., Iftikhar, H., & Asghar, M. (2021). Improving radiology workflow efficiency and patient care through technology. *Journal of the College of Physicians and Surgeons Pakistan*, *31*(4), 457-461. <https://doi.org/10.29271/jcpsp.2021.04.457>
- Aziz, H. A., Abdulrahman, A., Alsayyari, A., Alqahtani, A., & Aldaham, S. (2021). Improving the efficiency of radiology department workflow: A systematic review. *Insights into Imaging*, *12*(1), 1-15. <https://doi.org/10.1186/s13244-021-01063-w>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.
- Gittell, J. H., Godfrey, M., & Thistlethwaite, J. (2013). Interprofessional collaborative practice and relational coordination: Improving healthcare through relationships. *Journal of Interprofessional Care*, *27*(3), 210-213. <https://doi.org/10.3109/13561820.2012.730564>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage.
- McDonald, K. M., Sundaram, V., Bravata, D. M., Lewis, R., Lin, N., Kraft, S. A., McKinnon, M., Paguntalan, H., & Owens, D. K. (2007). Closing the quality gap: A critical analysis of quality improvement strategies (Vol. 7: Care coordination). *Rockville, MD: Agency for Healthcare Research and Quality*.
- Okhuysen, G. A., & Bechky, B. A. (2009). Coordination in organizations: An integrative perspective. *Academy of Management Annals*, *3*(1), 463-502. <https://doi.org/10.5465/19416520903047533>
- Salim, H. S., Hajar, R., Aljadhey, H., & Alanazi, A. (2021). Factors influencing healthcare providers' participation in the Saudi adverse event reporting system for medications. *Journal of Pharmaceutical Health Services Research*, *12*(3), 351-357. <https://doi.org/10.1093/jphsr/rmab054>
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., & Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and operationalization. *Quality & Quantity*, *52*(4), 1893-1907. <https://doi.org/10.1007/s11135-017-0574-8>
- Schot, E., Tummers, L., & Noordegraaf, M. (2020). Working on working together. A systematic review on how healthcare professionals contribute to interprofessional collaboration. *Journal of Interprofessional Care*, *34*(3), 33