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Review Article

**ARTIFICIAL INTELLIGENCE AND HEALTH TECHNICIANS
IN THE HEALTHCARE REVOLUTION: A COMPREHENSIVE
REVIEW**¹Nouf Abdulaziz Alnosair, ²Sanaa mohammed alkhalidi, ³Wejdan Mahmood Alsindi¹Ministry of National Guard Health Affairs, Alnosairno@mnggha.med.sa²Ministry of National Guard Health Affairs, Alkhalidisa4@mnggha.med.sa³Ministry of National Guard Health Affairs, Alsindiw@mnggha.med.sa**Abstract:**

Artificial Intelligence (AI) is revolutionizing the healthcare industry, significantly impacting the roles of health technicians. This review explores how AI-driven technologies are transforming diagnostics, patient care, and operational efficiency, particularly from the perspective of health technicians. AI tools such as machine learning, predictive analytics, and automation are enhancing the accuracy, speed, and effectiveness of tasks traditionally performed by health technicians, including medical imaging, laboratory testing, and pharmacy operations. The integration of AI enables health technicians to focus on higher-value tasks, improve decision-making, and reduce errors. However, the adoption of AI presents challenges, including the need for upskilling, technological gaps, and ethical considerations. This review also addresses concerns about job displacement, emphasizing that AI is augmenting rather than replacing health technicians. Real-world case studies are discussed, highlighting AI's successful application in various health technician roles. The article concludes with a forward-looking view on the evolving responsibilities of health technicians in the AI-driven healthcare ecosystem and the potential innovations on the horizon.

Keywords: Artificial Intelligence, Health Technicians, Healthcare Revolution, Medical Imaging, Laboratory Testing, Pharmacy Automation, AI in Healthcare, Patient Care, Healthcare Innovation, Diagnostic Technologies, Upskilling, Ethical Concerns.

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INTRODUCTION:

The rapid advancement of **Artificial Intelligence (AI)** in healthcare has revolutionized various aspects of medical practice, leading to enhanced efficiency, accuracy, and patient outcomes. From diagnostics and treatment planning to operational management, AI-driven tools are reshaping how healthcare professionals, including health technicians, perform their daily tasks. AI technologies like machine learning, predictive analytics, natural language processing, and robotic automation have shown potential in improving clinical decision-making and patient care while also reducing human error (Jiang et al., 2017; Hamet & Tremblay, 2017).

Health technicians, a crucial workforce in the healthcare system, are directly impacted by these technological advancements. Traditionally, health technicians have performed tasks like medical imaging, laboratory testing, pharmacy operations, and patient monitoring manually. However, with the integration of AI, their role is undergoing significant transformation. AI is streamlining many of their repetitive and time-consuming tasks, allowing technicians to focus on more complex duties that require human judgment, creativity, and empathy (Topol, 2019). This shift not only enhances the efficiency of healthcare services but also raises concerns about the need for upskilling and the potential risks of job displacement.

While AI's potential in healthcare is widely acknowledged, its implementation comes with challenges. Technological gaps, ethical concerns, and the need for health technicians to acquire new skills are pressing issues that must be addressed to ensure the successful integration of AI in healthcare (Mittelstadt et al., 2016). Furthermore, AI in healthcare requires careful regulatory oversight to mitigate risks related to data privacy, algorithmic bias, and accountability in decision-making processes (Challen et al., 2019). This review aims to explore how AI is transforming the role of health technicians within the broader context of the healthcare revolution, providing insights into current challenges and opportunities while highlighting real-world applications and future trends.

AI Technologies in Healthcare

The integration of Artificial Intelligence (AI) into healthcare has significantly transformed the delivery of medical services, from diagnosis to patient management and operational efficiency. AI technologies like machine learning, natural language processing (NLP), and robotic systems are driving advancements across multiple healthcare sectors, offering substantial improvements in accuracy, speed, and personalization of care.

1. AI in Diagnostics: AI is revolutionizing diagnostics by improving the accuracy and efficiency of medical imaging, pathology, and clinical tests. Machine learning algorithms can analyze vast amounts of data, such as radiological images, to detect patterns and identify abnormalities that might be missed by the human eye (Litjens et al., 2017). AI-powered diagnostic tools assist in early detection of diseases, including cancer, cardiovascular disorders, and neurological conditions. For instance, deep learning models have been applied to interpret mammograms, leading to higher accuracy in breast cancer detection (McKinney et al., 2020).

2. AI in Treatment and Patient Management: AI technologies are being widely adopted in treatment planning and personalized medicine. AI-driven clinical decision support systems analyze patient data and provide recommendations for personalized treatment plans. This approach enables healthcare professionals to offer individualized care based on genetic information, lifestyle, and medical history (Esteva et al., 2019). Moreover, AI tools can predict patient outcomes and suggest optimal interventions, leading to more efficient resource allocation in hospitals.

3. AI in Medical Imaging: One of the most impactful areas of AI application is medical imaging. AI systems can analyze radiological scans such as X-rays, MRIs, and CT scans with high accuracy, identifying patterns and irregularities that help diagnose complex conditions (Lakhani & Sundaram, 2017). AI has also been integrated into automated image analysis, reducing the workload of radiologists and minimizing human error. This technology is particularly valuable in radiology, where AI helps in reading images faster and more consistently, aiding in early and more accurate diagnoses.

4. AI in Robotics and Surgery: AI-driven robotics is gaining traction in surgery, where precision and control are critical. Robotic-assisted surgeries, such as those enabled by the da Vinci Surgical System, allow for minimally invasive procedures with enhanced precision, reduced recovery times, and fewer complications (Shademan et al., 2016). AI algorithms assist in guiding robotic instruments and provide real-time data to surgeons, helping them make more informed decisions during procedures.

5. AI in Predictive Analytics: Predictive analytics is another area where AI has shown significant potential. AI algorithms can analyze historical patient data to predict disease onset, readmission risks, and potential complications. This application allows healthcare providers to take proactive measures in managing chronic conditions and avoiding preventable complications (Rajkomar, Dean, & Kohane, 2019).

For example, AI models have been used to predict which patients are at higher risk of sepsis, enabling timely interventions that save lives.

6. AI in Natural Language Processing (NLP): Natural language processing (NLP) plays a crucial role in automating healthcare documentation, improving clinical workflows, and extracting valuable insights from unstructured medical records. NLP algorithms are used to convert physician notes, discharge summaries, and other free-text documents into structured data that can be used for research and clinical decision-making (Wang et al., 2018). NLP technologies also facilitate the development of virtual health assistants that assist patients in managing chronic diseases, medication adherence, and follow-up care.

7. AI in Drug Discovery and Development: AI has accelerated the drug discovery process by analyzing large datasets to identify potential drug candidates and predict their efficacy. Machine learning algorithms are used to sift through genomic, chemical, and clinical data to identify patterns and predict how new drugs will interact with the human body (Ekins et al., 2019). AI's ability to predict drug efficacy and toxicity can significantly reduce the time and cost associated with bringing new treatments to market.

AI technologies in healthcare are poised to further revolutionize how medical services are delivered. From improving diagnostics to personalizing

treatment plans and enhancing surgical precision, AI offers numerous benefits to patients, healthcare providers, and medical technicians alike. However, with these advancements come challenges related to ethical considerations, regulatory frameworks, and the need for continuous upskilling in the healthcare workforce.

The Role of Health Technicians in the AI Revolution

Artificial Intelligence (AI) is revolutionizing healthcare, and health technicians are at the forefront of this transformation. As AI technologies become increasingly integrated into healthcare systems, the role of health technicians is evolving. From performing manual tasks to leveraging AI-driven tools, health technicians now play a critical role in ensuring the successful adoption and implementation of AI across various healthcare settings.

Health technicians, traditionally responsible for tasks like medical imaging, laboratory testing, and patient monitoring, are now required to adapt to AI tools that enhance their work. AI is automating many routine processes, such as image analysis and laboratory result interpretation, allowing technicians to focus on more complex and value-added activities (Topol, 2019). For instance, AI systems can analyze vast amounts of data in seconds, providing technicians with insights that can improve the accuracy and speed of their work.

Table 1: AI-Enhanced Workflow for Health Technicians

Traditional Role	AI-Augmented Role	Key Benefits
Manual image analysis	AI-assisted image interpretation	Improved accuracy and faster diagnosis
Conducting routine lab tests	AI-enabled test automation	Reduced manual work and faster results
Manually documenting patient data	AI-driven electronic health records (EHR)	Better data management and retrieval
Monitoring patient vitals	AI-based real-time monitoring	Early detection of complications

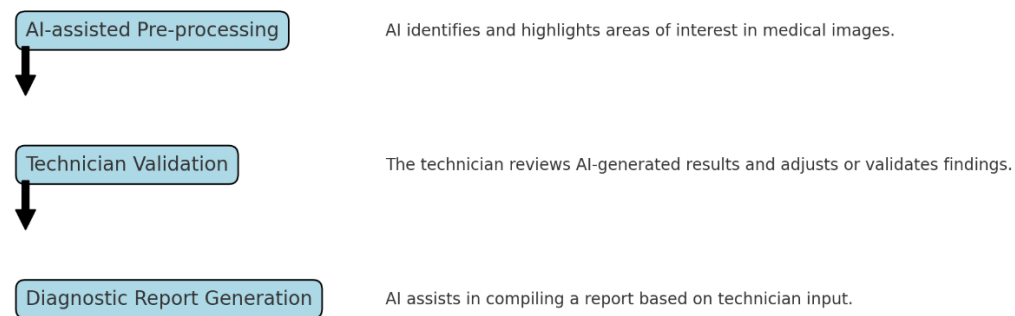
One of the most significant impacts of AI on health technicians is the need for new skills and continuous training. Health technicians must learn how to operate AI-driven tools, interpret AI-generated data, and troubleshoot AI systems (Hamet & Tremblay, 2017). This transition from manual to technology-assisted roles necessitates ongoing professional development. For example, radiology technicians need to understand how to use AI software for image interpretation, while laboratory technicians must learn how to manage AI-powered diagnostic equipment.

Table 2: New Skills Required for Health Technicians in the AI Era

Technician Role	New AI-Related Skills
Radiology Technicians	AI-based image analysis, troubleshooting AI software
Laboratory Technicians	Managing AI-powered diagnostic tools
Pharmacy Technicians	Using AI systems for medication management
Nursing Technicians	Monitoring AI-driven patient monitoring systems

AI is not a replacement for health technicians but a collaborative tool that augments their work. In medical imaging, for example, AI algorithms help health technicians by pre-processing images, identifying potential areas of concern, and prioritizing cases that need immediate attention (Litjens et al., 2017). This collaboration between AI and health technicians ensures faster and more accurate diagnoses, leading to better patient outcomes.

Figure 2: AI and Health Technician Collaboration in Medical Imaging



1. **AI-assisted pre-processing:** AI identifies and highlights areas of interest in medical images.
2. **Technician validation:** The health technician reviews AI-generated results and validates or adjusts findings.
3. **Diagnostic report generation:** AI assists in compiling a diagnostic report based on technician input.

This workflow allows health technicians to manage a higher volume of cases with greater accuracy and efficiency, reducing diagnostic errors and improving patient care.

While AI offers many benefits, there are also challenges that health technicians must navigate. One concern is the potential for job displacement, as AI automates routine tasks. However, research suggests that AI is more likely to augment existing roles rather than replace them (Jiang et al., 2017). By automating repetitive tasks, AI allows technicians to focus on higher-value activities that require human intuition and expertise. Another challenge is the ethical considerations surrounding AI, including data privacy and algorithmic bias. Health technicians must be trained to understand these issues and work within the frameworks established to ensure ethical AI use in healthcare.

Table 3: Challenges and Opportunities for Health Technicians with AI

Challenges	Opportunities
Job displacement concerns	AI augments technician roles
Need for continuous upskilling	Enhanced job responsibilities and expertise
Ethical concerns with AI algorithms	Improved patient care through AI tools
Technological adaptation	Higher efficiency and reduced human error

Several real-world applications demonstrate how health technicians are already working with AI technologies:

- **Radiology:** AI-driven imaging tools assist radiology technicians in detecting cancers, fractures, and other abnormalities more accurately (McKinney et al., 2020).
- **Laboratory Diagnostics:** AI systems in laboratories can analyze blood samples and other tests faster than human technicians, providing immediate insights and freeing

technicians for more advanced analysis (Wang et al., 2018).

- **Pharmacy Automation:** Pharmacy technicians use AI to manage medication dispensing systems, ensuring precise drug administration and reducing the likelihood of errors (Ekins et al., 2019).

These applications highlight the collaborative role of AI and health technicians in improving patient care and operational efficiency.

The integration of AI into healthcare is reshaping the role of health technicians, empowering them to deliver faster, more accurate services. While AI automates many routine tasks, it also provides health technicians with the tools to perform more complex and critical duties. The need for continuous education and upskilling is paramount as AI technologies evolve. Ultimately, AI is not replacing health technicians but enabling them to become more effective and integral to the healthcare ecosystem.

Benefits of AI for Health Technicians

The integration of Artificial Intelligence (AI) in healthcare offers numerous advantages for health technicians, transforming their roles and improving their efficiency in delivering patient care. By automating routine tasks, assisting in complex procedures, and providing real-time insights, AI enables technicians to work more effectively and focus on more critical duties. Below are the key benefits AI offers to health technicians.

1. **Improved Accuracy and Speed:** AI's ability to process vast amounts of data quickly and accurately is one of its primary benefits. Health technicians, especially in radiology and medical imaging, benefit from AI's ability to analyze images and detect abnormalities with greater precision. AI-powered diagnostic tools assist in identifying diseases like cancer, cardiovascular issues, and neurological disorders earlier and more accurately, reducing human error (McKinney et al., 2020). The speed at which AI can analyze images or test results allows technicians to process more cases in less time, improving overall healthcare efficiency.
2. **Enhanced Decision-Making Support:** AI provides technicians with advanced decision-support tools, helping them interpret data and make more informed decisions. For example, in medical imaging, AI can highlight potential areas of concern, allowing technicians to focus their attention on specific areas and review AI-generated suggestions

(Jiang et al., 2017). This leads to more accurate diagnoses and better patient outcomes, as health technicians can cross-reference AI's findings with their own expertise.

AI also helps laboratory technicians by automating data analysis and pattern recognition, which allows for faster detection of anomalies in blood tests, microbiology results, and other diagnostics (Topol, 2019). With AI, technicians are able to validate AI's findings, thereby enhancing diagnostic accuracy and offering more reliable results to healthcare providers.

3. Workload Reduction and Efficiency Gains:

One of AI's major benefits is its ability to reduce the workload of health technicians by automating repetitive and labor-intensive tasks. In laboratories, for instance, AI-powered systems can run routine tests, analyze results, and even flag abnormal findings without the need for constant human supervision (Esteva et al., 2019). Similarly, AI-based tools in pharmacy automation can help manage medication dispensing and stock control, enabling pharmacy technicians to oversee operations more efficiently (Ekins et al., 2019).

AI also aids in managing electronic health records (EHRs), automating the documentation process, and ensuring better data accuracy. This frees up technicians from administrative tasks, allowing them to spend more time on patient-centered care or other high-value tasks (Mittelstadt et al., 2016).

4. Real-Time Monitoring and Early Detection:

AI's capacity for continuous, real-time monitoring enhances the ability of health technicians to manage patients effectively. AI systems, such as those used in intensive care units or for chronic disease management, monitor patient vitals around the clock and alert health technicians to any potential issues, such as irregular heart rhythms or declining oxygen levels (Challen et al., 2019). This early detection capability enables technicians to intervene before conditions worsen, improving patient safety and reducing hospital readmissions.

In areas such as nursing and clinical support, AI's real-time monitoring tools help technicians track patient progress, adjust care plans, and respond to complications quickly. This improves patient outcomes and reduces the burden on healthcare professionals by

providing real-time alerts and actionable insights.

5. **Skill Enhancement and Professional Development:** AI empowers health technicians by enabling them to acquire new skills and competencies. Technicians are now required to understand how to use AI-driven tools and interpret their outputs effectively. This technological shift pushes technicians to engage in continuous professional development, enhancing their job profiles and career growth opportunities (Hamet & Tremblay, 2017). In turn, these newly acquired skills allow health technicians to remain relevant in the evolving healthcare environment and contribute more significantly to patient care.
6. **Reduced Human Error:** AI reduces human error, particularly in high-pressure environments like emergency rooms, operating theaters, and diagnostic labs. Health technicians benefit from AI systems' ability to flag anomalies, detect inconsistencies, and verify complex data (Litjens et al., 2017). By working alongside AI, technicians are able to catch potential errors earlier in the process, leading to better patient safety and treatment accuracy.

The integration of AI into healthcare brings significant benefits for health technicians by improving diagnostic accuracy, reducing workloads, enhancing decision-making, and facilitating real-time patient monitoring. AI tools allow technicians to work more efficiently and focus on higher-value tasks, ultimately improving patient care and healthcare outcomes. As AI continues to evolve, its role in supporting and augmenting health technicians will become increasingly indispensable.

AI in Specific Health Technician Roles

Artificial Intelligence (AI) is transforming the specific roles of health technicians across various fields, from radiology and laboratory diagnostics to pharmacy and nursing. By automating repetitive tasks and augmenting decision-making, AI empowers technicians to work more efficiently while improving the accuracy and quality of patient care. Below is an overview of how AI impacts different health technician roles.

Radiology technicians are responsible for capturing and analyzing medical images such as X-rays, MRIs, and CT scans. AI's role in this area is particularly profound, as AI-powered image analysis tools can detect patterns and abnormalities more quickly and

accurately than human eyes alone. AI systems can assist radiology technicians by:

- **Automating Image Analysis:** AI algorithms pre-process images, identifying potential areas of concern, such as tumors, fractures, or organ anomalies (Litjens et al., 2017).
- **Improving Diagnostic Accuracy:** AI assists technicians in interpreting complex images, reducing the likelihood of human error and enabling earlier detection of conditions like cancer (McKinney et al., 2020).
- **Streamlining Workflow:** AI can prioritize cases based on urgency, allowing technicians to focus on critical patients and manage their workload more effectively.

Example: An AI system might highlight a suspicious lesion in a mammogram, allowing the radiology technician to flag the image for immediate review by a radiologist. This reduces the time required for a diagnosis and improves patient outcomes.

Laboratory technicians conduct various tests on patient samples, such as blood, urine, and tissue, to detect diseases and monitor health conditions. AI is increasingly being used to automate and enhance these processes, providing several benefits:

- **AI-Powered Diagnostics:** AI systems can quickly analyze laboratory results, recognizing patterns that might indicate diseases or abnormalities. For example, AI can analyze blood smears to detect leukemia cells or screen for genetic mutations (Esteve et al., 2019).
- **Increased Efficiency:** By automating routine tests, AI allows laboratory technicians to process more samples in less time, reducing the burden of manual labor and improving turnaround times for test results (Ekins et al., 2019).
- **Error Reduction:** AI minimizes human error by standardizing processes such as reagent preparation, sample tracking, and result interpretation.

Example: AI systems that detect early signs of sepsis from lab results can alert laboratory technicians and healthcare providers, allowing for rapid intervention. Pharmacy technicians play a crucial role in preparing and dispensing medications, managing inventory, and ensuring patients receive the correct prescriptions. AI technologies are now helping pharmacy technicians in several ways:

- **Automating Dispensing Systems:** AI-enabled pharmacy robots can automate the dispensing of medications, ensuring that the

correct dosages are prepared for patients, thereby reducing human error (Ekins et al., 2019).

- **Optimizing Inventory Management:** AI systems can predict drug usage patterns and manage inventory levels more efficiently, ensuring that critical medications are always in stock.
- **Personalizing Medication:** AI can assist in tailoring medication regimens based on patient-specific data such as genetic information, lifestyle, and medical history.

Example: AI-powered pharmacy robots in hospitals can dispense medications for hundreds of patients daily with high accuracy, reducing errors in medication administration and improving patient safety.

Health Information technicians and clinical support technicians often assist in monitoring patient vitals, managing electronic health records (EHR), and supporting physicians in patient care. AI systems are being utilized to enhance these roles by:

- **Real-Time Patient Monitoring:** AI-based systems continuously monitor patient vitals and provide real-time alerts for potential complications. For example, AI systems in intensive care units (ICUs) can detect early signs of respiratory failure or cardiac arrest and alert nursing technicians for immediate intervention (Challen et al., 2019).
- **Streamlining EHR Management:** AI automates much of the data entry and retrieval process in EHRs, allowing nursing technicians to quickly access patient information and ensure accurate documentation (Mittelstadt et al., 2016).
- **Predictive Analytics for Patient Care:** AI tools can predict which patients are at risk for complications, such as falls or infections, allowing nursing technicians to take preventive measures.

Example: In an ICU, AI algorithms may analyze patient data from sensors and provide early warnings for deteriorating conditions, allowing nursing technicians to prioritize patients needing immediate attention.

Respiratory therapy technicians work with patients who have respiratory conditions, such as asthma, chronic obstructive pulmonary disease (COPD), or respiratory failure. AI applications are helping these technicians by:

- **Optimizing Ventilator Settings:** AI systems can analyze patient data and suggest optimal

ventilator settings, ensuring patients receive the correct amount of oxygen and minimizing the risk of lung injury.

- **Monitoring Respiratory Patterns:** AI can continuously monitor a patient's breathing and detect irregularities, such as apnea or shallow breathing, allowing technicians to intervene promptly.

Example: An AI-enabled ventilator system adjusts oxygen flow based on the patient's real-time respiratory rate, reducing the risk of human error and ensuring more precise treatment.

AI is transforming the specific roles of health technicians across various fields, enabling them to perform their duties more efficiently and accurately. From automating routine tasks to enhancing decision-making processes, AI empowers technicians to focus on more complex and value-added responsibilities. As AI continues to evolve, its role in supporting health technicians will only grow, contributing to improved healthcare outcomes and patient safety.

CONCLUSION:

Artificial Intelligence (AI) is reshaping the healthcare landscape, and health technicians are at the center of this transformation. Across various roles—including radiology, laboratory diagnostics, pharmacy, nursing, and respiratory therapy—AI technologies are empowering technicians to work more efficiently, accurately, and effectively. By automating routine tasks, enhancing decision-making capabilities, and providing real-time patient monitoring, AI allows technicians to focus on more complex, value-added duties, ultimately improving patient outcomes and healthcare quality.

The adoption of AI provides several key benefits for health technicians, such as improved diagnostic accuracy, enhanced workflow efficiency, and better management of patient data. AI reduces human error and accelerates the decision-making process, allowing technicians to manage higher workloads and ensure safer, more reliable patient care. However, the success of AI integration depends on continuous upskilling and training, as health technicians must adapt to new technologies and learn how to interpret AI-generated results.

While concerns about job displacement and ethical considerations remain, AI is more likely to augment rather than replace the role of health technicians, transforming them into integral players in the healthcare ecosystem. As AI continues to evolve, its collaboration with health technicians will be critical in

driving innovation, improving operational efficiency, and enhancing the overall quality of healthcare services.

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