

AI and Automation in Healthcare on Nurses, Lab Specialists, Pharmacists, and Doctors

Fahad Mohammad Aldhafeeri¹, Turki Habis sh. Alanazi², Menwer Tashan Zayed Alanazi³, Ghudair Tashan Alanazi⁴, Laila hawas A. Alshammari⁵, Abdullatif Mulayhan Aldhafeeri⁶, Sultan Bandar Al-Muraykhi⁷, Rashed Abdullah Nasser Almutairi⁸, Narjes Dawood Ibrahim⁹, Ahmad Awad Almogamsi¹⁰

1. Clinical Pharmacology, Forensic Poison Services Unit in Hafar Al-Batin, MOH
2. Pharmacist, Forensic Poison Services Unit in Hafar Al-Batin, MOH
3. Senior Specialist Clinical Biochemistry, Clinical Toxicology, Forensic Poison Services Unit in Hafar Al-Batin, MOH
4. Senior Clinical Pharmacist, Hafr AlBatin Health Cluster, MOH
5. Senior Specialist Laboratory Clinical Biochemistry, Forensic Poison Services Unit in Hafar Al-Batin, MOH
6. Medical Laboratory Technician, Forensic Poison Services Unit in Hafar Al-Batin, MOH
7. Pharmacy Technician, Forensic Poison Services Unit in Hafar Al-Batin, MOH
8. Specialist Laboratory, Forensic Poison Services Unit in Hafar Al-Batin, MOH
9. Nursing, KFH
10. Nurse, Alsalam Hospital

Abstract

Automation and AI are transforming the nature of work. They have the potential to usher in a new age of leisure by taking on the burden of rote tasks, from the assembly of consumer goods to the construction of complex systems. However, between now and then, everyone must manage the impact of this transformation. The healthcare sectors around the world are increasingly deploying AI and other technologies in day-to-day operations. What will the transformation mean for health workers—nurses, lab specialists, pharmacists, and physicians—who constitute the backbone of these two vital global sectors?

Since the days when the first radiotelegraph and teleprinter operators unionized, there have been predictions that technical innovations would destroy jobs. Instead, after short transitory periods, employment has expanded. With the growing deployment of AI and robotic and other automation technologies, the predictions are again being made. Given their increasing scarcity, health workers might welcome a few extra minutes for rest and a cup of coffee. However, the projections are troubling. A recent study found that the deployment of a telemedical platform which helps triage, diagnose, and treat patients with flu-like or other systemic symptoms and uses AI to mine patient text consultations to determine if patients have COVID-19 symptoms saw the work carried out by certified general practitioners rise by nearly 40%. These AI technologies did not replace the physicians. Instead, they enabled them to provide better and cost-effective services to a larger patient base.

keywords: AI and automation, healthcare, unsupervised learning, robot literacy, pharmacists, doctors, cognitive nurses

1. Introduction to AI and Automation in Healthcare

Healthcare jobs require humans to make thousands of decisions each day in a fast-paced setting, and any error can significantly affect the outcomes for the patient. Research on the use of artificial intelligence and automation in healthcare is rapidly developing. AI and automation are potentially transformational for patient care, potentially reducing medical errors and even helping to solve some of the large problems around burnout and job satisfaction. AI, for example, will be the doctor's copilot in a digital cockpit. Lab processing through robotics and automation will speed up diagnostics and even allow new testing to be done. Pharmacists could receive medication orders, already clinically vetted and coded, saving time in choosing and ensuring that the system supplies the right medication in a safe form for the patient. Nurses have a labor shortage looming, and making the most of each day to improve patient care is crucial. The purpose of this volume is to synthesize the current related literature and academic work. (Alzamily et al., 2024)

We will highlight and reflect on key issues and work that should inform or needs to be shared to inform discussions around AI, cognitive and non-cognitive automation, and other similar applications, such as bots that are being used for day-to-day interactions. Other AI, automation, and mechanical devices and systems, such as exoskeletons and cyber robotics in elder care, are advancing rapidly but are not addressed at this time. Awareness is only the first step in defining parameters and weighing benefits and risks, such as implementation, alternative comparison, workforce support, and other technology transfer issues. Ethical implications, especially from the point of view of a welfare model of ethics and behavior, obviously pertain to all people and their healthcare experiences.

1.1. Definition and Scope of AI and Automation

Both AI and automation are focused on computer systems, with the end purpose being the creation of machines that work and react like humans. AI will think, reason, and solve problems, while cognitive computing, a subset of AI, enables them to interact as humans. Automation focuses on the substitution of repetitive manual tasks. It is not only robots that are performing automation tasks; there are chatbots and voice assistants with natural language processing and recognition, as well as process robotic automation that uses software to automate repetitive tasks and interpret different and unusual prescriptions from physicians and other healthcare providers. (Lee and Yoon2021)

In some healthcare tasks, AI and automation are better than humans, but as always, there are limitations because customers are human and demand human interaction when called upon. Continuous and integrated human trust and knowledge through education about the technology are needed to manage the implications of AI and automation. Data collection from different sensors in healthcare devices in smart hospitals enables new data points and valuable diagnoses and predictions of symptoms of mysterious diseases earlier than current processes. AI also integrates and relieves massive data, accelerating the continuous learning and knowledge of all disciplines. This will enable physicians to benefit from the collective experience of every patient being shared with them. With the consequence of the reduction of mortality, AI and automation are a real and growing trend in healthcare. In the context of the aging population, cost control, and delivery capacity, a lot more is expected in the coming years.

2. AI and Automation in Nursing

AI and automation are solutions that promise to enable dependable, safer healthcare from both a human and technological standpoint. Much of the attention to date has been heavily drawn to automating clinical decision support, designing robots to enable independent living, and deploying ambient intelligence to enable unobtrusive patient monitoring. The healthcare profession itself has more to gain from AI and automation than any other sector, as it is one that has largely absorbed high levels of bureaucracy, with much being dedicated to routine, reactive, data security, and repetitive tasks that distract from addressing complex patient care. AI and automation technologies promise to support healthcare workforces in maintaining the high levels of quality care that can only be delivered by humans. (Tursunbayeva and Renkema2023)

One area in desperate need of AI and automation is the nursing profession. Nursing is considered by many to be the profession that is in the highest demand, as well as the profession with the most employed women spanning across developing countries all around the world. At the same time, nursing is a profession particularly resistant to change and innovation, in which certain attributes are seen as essential to patient care, yet these are often undervalued by both the profession and the public. Nurses reason as they carry out clinical tasks, using attributes such as multi-sensory information, immediate feedback, emotional content, and therapeutic communication to assist in patient care. Nursing is therefore not a purely technical process, but a highly complex client-directed activity that requires observation, identification, treatment, and a clinical workforce aimed at ensuring the successful and timely benefits to all their clients. Health-related AI and automation technologies need to recognize this if they are to avoid subsequent rejective and resistant behavior from the caregiving sector community. (Soto-Rubio et al.2020)

2.1. Role Redefinition and Workflow Optimization

The theory of healthcare professionals' workflow optimization consists of three axioms: 1) fewer routine responsibilities (including data processing, patient form-filling, record copy preparation, or reimbursement or billing procedures) for healthcare professionals, 2) increasing demand for complicated long-cycle or intermittent services, and 3) interpersonal and emotional services, like a real-life chat or personal encouraging support. Such a primary care medical service system substitutes the highly paid healthcare professionals' intellectual class with lower-salaried nonprofessional nurses and logistics staff at a lower cost. Nevertheless, if we deeply analyze the conclusions of healthcare professionals' workflow optimization, disregarding their initial distrust of replacing their work, we may find mainly positive outcomes. The substituted routine work is not autotelic and, with the potential growth of salary expectations due to the rise of technological development and qualifications, the nonprofessional and low-qualified job opportunities for personal services may concentrate a large part of the population, for example, in today's elderly care and child-caring services. (Leng et al.2024)

Another angle of healthcare's robotics and AI development is strategically important—encouraging employees to rethink their professional role. With the increasing flexibility of medical operating tasks, employees will be

freed from routine and repetitive tasks, and this will promote employees' role redefinition and enhance the vitality of organizations. Such a proposition is based on the fact that most administrative tasks are considered non-core. While medical and nursing staff spend 75% of their time on direct patient care, up to 50% of professionals' work might be automated. Since the trickiest components of automatability often require mundane, repetitive tasks, employees can refocus on the most important aspects of healthcare. What is particularly interesting is that letting technology handle mundane clinical workloads actually allows doctors and nurses to practice the art of medicine at a higher level. (Gómez-Ochoa et al.2021)

For example, nurses often spend most of their time documenting patient signs and symptoms, coordinating tests, and counseling patients. By entrusting some of these jobs to machines, nurses can focus on their core competencies, such as caring for patients—providing support to the patient, solving problems, and paying attention to patient observation—and thus make use of the skill and judgment that they have acquired through their training, reduce work stress, and thus also some fatigue, thereby improving patient outcomes. (Kavanagh, 2021)

3. AI and Automation in Lab Specialties

AI has been influencing decision-making in radiology for a lengthy period. Furthermore, its role in assisting pathologists and other specific laboratory examinations has been increasing. It systematically reconciles diverse illustrated investigations of diagnostic tasks and makes disease forecasts. It concerns linked coursework, progresses analytic precision, and has substantial effects on many human occupations. However, as these technologies emerge today, they have an intense influence on pathologists as well as on laboratories, and the cooperation is stepping away from concepts based on the pure results written in the report. AI not only intensifies and enhances analytics to the maximum theoretically convinced truth, offering the basis for investigations in addition to the single and simple description of the effect but also brings clinics closer to the substantial applications of integrative and complementary precision therapy. (Hardy and Harvey, 2020)

In recent years, pathology laboratories have become overwhelmed with AI applications. Significant tasks of pan-cancer histology informative stacks and quantitative round paintings can now be automated. Advanced algorithms are not only excellent analytical tools but also help in developing strong predictive models informed by significant qualitative and insightful characteristics. AI adopts a broad methodology and an excellent interpretation ability for complete considerations, which factually gives rise to a more comprehensive, as well as personalized, form of concordant care for precision. The information obtained from AI's capacity is also clinically beneficial for various clinical research objectives. AI can assist in tracking cancer progression, identifying weak oncogenesis in premalignant situations, and validating medications on pathological specimens. With complete and comprehensive monitoring of cancer surrogates using data combined with clinical outcomes, third-party observational methods substantiate the teamwork between AI and other laboratory experts and are also clinically beneficial to the betterment of patient survival. (Acs et al., 2020)

AI-assisted accounting can be noted for aggressively targeting individual addiction vulnerability and the action of inherited signatures. The capacity of AI to forecast chemosensitivity or naturally detect drug resistance based on individual characteristics leads to transformed and more rational medication choices. In summary, AI-generated discriminations have enhanced not only the adoption of more precise preventive care but also the progress of such knowledge bases that sustain advancements in clinical research. Overall, AI holds important promise, alleviating human pressure on the desire for technical significance and offering a clear, rational, and constant evaluation of illustration characteristics for generating critical medical conclusions. Such collaborations extend the abilities of pathologists and clinical laboratory technicians, especially in providing exceptional therapeutic assistance and establishing important clinics that are not restricted by long-term personal expertise. The second part reflects on more substantial objectives and suggestions and encourages discussions on these important realization strategies. (Du and Xie, 2021)

Enhanced diagnostics and data analysis can be accomplished based on AI systems. Healthcare professionals collect large amounts of health data and use this data to make treatment suggestions. Currently, this process is performed by health professionals. Emerging technologies, such as artificial intelligence and machine learning, can be used to assist them in achieving their goals more accurately. On the one hand, AI technologies allow physicians to use algorithms to classify health data into disease categories, which speeds up the diagnosis of treatment suggestions. This enhances the efficiency of health services, saving time for both healthcare professionals and patients. On the other hand, AI technologies also transform health data into intelligence. For example, deep learning, a type of AI technology, allows doctors to analyze laboratory test and X-ray image data. Such technologies can dramatically increase the number of cases that they can handle and directly impact and improve the level of healthcare efficiency. (Alowais et al.2023)

4. AI and Automation in Pharmacy

Automation and artificial intelligence technologies are quickly evolving, impacting several employment sectors. Such technologies are beginning to replace certain tasks carried out by radiologists, lab professionals, and nurses. This is seen as a way through which the medical industry may reduce operational costs in certain parts of

healthcare delivery. Contrarily, the advances in AI seem to be improving patient care, efficiency, and outcomes, while supporting medical staff. (Basu et al., 2020)

One challenge of the progress and demands in contemporary healthcare services is the pressure that health workers experience due to a lack of time to attend to the patients' needs and deliver high-quality care. Despite further research, which could develop innovative tools to support therapeutic and surgical methods, few studies have been conducted regarding the impact AI and automation can have on the pharmacy workload, particularly at the distribution and inventory control level. The impact of AI in pharmacy is explored in this study. (Khan et al., 2023)

Medication safety is of critical importance in improving patient outcomes during hospitalization. Errors in medication management are one of the leading causes of harm to hospitalized patients. To err is human – all humans are imperfect and are bound to make mistakes. It is of prime importance to double or triple-check every stage to detect errors early and prevent them from occurring. Automation can significantly reduce the risk of medication errors in the complex and error-prone medication use system. Automated drug dispensing systems have existed for several decades; some dispense the drug to the unit dose level. Fully automated dispensing cabinets have been placed in patient care areas to store the medications that nurses need to administer. These systems afford 'just in time' inventory management. Although there is significantly reduced access time and many benefits, the medication error is often at the administration stage and will not be affected by time saved at the nursing station. (Ahtiainen et al.2020)

For dispensing the right medication, pharmacy robot technology can be applied. The pharmacy robot connects to the inventory system, allowing efficient and accurate storage and retrieval of medication in a pharmacy. Patient medications are indexed using a unique barcode, allowing the robot to cross-check the unit-dosed medication with the order before placing it in the machine. This helps prevent missed doses and medication errors. Due to the high concordance between the photograph acquired from the database and the physical objects, recent work on pharmacy robot use has employed convoluted neural networks to achieve a high accuracy rate. In addition, it checks for drug-drug as well as drug-allergy contraindications. It also tracks when the medication was dispensed, when it was removed, and who removed it. Consequently, it adds a high level of integrity. Perhaps more importantly, it can reduce labor by improving accuracy. Staff can then spend their time on activities that add value. Prior research also showed that the annual savings on pharmacy labor costs can range significantly if pharmacy robots are utilized. (Takase et al.2022)

5. AI and Automation in Medicine

The impact of AI in medicine will be a change and improvement in healthcare research, increasing the search rate. AI, in medical research, will be a powerful, complementary tool and an essential resource in the search. In the future, the number of medical research studies could increase exponentially, with the collaboration of artificial intelligence. On the other hand, the case of healthcare infrastructure and the extra costs could rise, which is another feature of the future healthcare system. Millions of dollars in new laboratory equipment and next-generation medical devices can lead to advancements. The medical costs or healthcare infrastructure budget, direct consequences of new developments, such as the need for investment, are linked to the speed of implementation of AI at the base of healthcare systems. (Shen et al.2022)

On the other hand, access to quality healthcare is crucial, as technology determines the democratization of health outcomes. Automating some activities in hospitals with robotics technology can reduce the potential for human error and provide support to employees by giving them time to deal with more urgent tasks. Robotic automation supports people in complex tasks and frees them from tasks that are too simple, repetitive, and expose them to risk. For better surgical results, as well as surgeries performed with the highest precision, robotic assistance is a consistent practice in large operations. Robotic assistance already plays an essential role in medical processes such as diagnosis, treatment, and follow-up care. In many hospitals, robots already perform administrative duties. In low-contact areas of a hospital, robots can disinfect all types of surfaces. In light of the ongoing pandemic, integrating robots into repetitive tasks is a crucial aspect within health facilities. Maintaining a sterile environment is a crucial focus, such as emptying medical waste bins, preparing hospital meals, or performing administrative tasks. (Haleem et al., 2021)

5.1. Precision Medicine and Treatment Personalization

AI has and will have growing impacts on the practices of treating illness for doctors, lab specialists, pharmacists, and nurses. One of the fields of greatest impact and first and foremost application is in the area of genomics. New applications of AI methods are opening the door for "Precision Medicine" for treatment, which tailors the most effective medicines for patients' individual cases, so that drugs do not 'miss' and provide inappropriate benefits to patients. The current criteria many doctors base prescribing drugs on is a naive matching to patient age, gender, and weight, as well as relative body versus total body mass. AI will increasingly complement these factor matches. A very important difference in genomics and its relation to drug development is that genomics seeks the cause of diseases and designs treatments or preventive medicine, including the manipulation of genes. When gene therapy and gene regulation were first developed, it became

apparent that one of the major medical applications of therapeutics will be in the area of gene manipulation treatments. (Bohr and Memarzadeh, 2020)

The relationship between genomics and AI research began from the beginning, when AI helped validate early gene targeting studies. Today, AI is used throughout the full range of genomics studies, from understanding gene function providing the rationale for designing knockout mutants, through to genomics, genetic regulatory effects, and gene disease associations, sequence alignment and gene location, protein shape-docking, sequence binding, design folding of the protein, and protein interactions at all scales. The more traditional fields of pharmaceutical companies have been changed in light of the role of genomics. Drug generation and development are dramatically improved by AI analysis of DNA gene sequence data. AI's major role is in the identification of drug targets for DNA-encoded proteins or their coat to RNA or DNA species, or other cofactors required for target expression within a cell. AI can automatically sort target classes such as specific enzymes, structural composite centers important for bioactivity, and subtypes that can be investigated for genomic material related targeting in techniques that can detect targets relevant to disease. Drug lead identification from natural product sources has been a major interest of AI. The functional characterization of genetic polymorphism data. (Bhinder et al., 2021)

conclusion

It is impossible to predict with precision the effects of AI and automation in healthcare with any certainty, but it can be said with confidence that the changes will be profound. Even more profound will be the changes that these technologies enable in coordination and cooperation; not until humans can communicate complex, meaningful ideas rapidly and efficiently can we truly maximize our full knowledge, skill, and problem-solving capabilities. Clearly, AI and automation can take us much farther and faster than we can go alone. Continued concern for the well-being of affected workers and compassion for the people they care for are essential historical lessons of the power and peril of technology and are matters of pragmatic self-interest for everyone in organizations and nations, even for those fortunate ones whose job descriptions will one day describe them as "AI Specialist" or "AI Developer". The bottom line is that health professionals must know more about these technologies than how to avoid falling behind. They must strongly influence policy and direction rather than being led into the future blindly. They also need to learn to serve as team leaders and integrators when humans and computers work together—that is what teamwork is for, to leverage complementary skills, to do things that neither can do alone. AI and automation should increase job satisfaction and the delivery of high-quality care and decrease burnout. They are not predestined to replace workers; in fact, they are predestined to require new work. In sum, then, "computers for what can be computed, humans for the rest."

References:

- Alzamily, Jawad YI, et al. "Artificial Intelligence in Healthcare: Transforming Patient Care and Medical Practices." (2024). philpapers.org
- Lee, DonHee, and Seong No Yoon. "Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges." *International journal of environmental research and public health* 18.1 (2021): 271. mdpi.com
- Tursunbayeva, Aizhan, and Maarten Renkema. "Artificial intelligence in health-care: implications for the job design of healthcare professionals." *Asia Pacific Journal of Human Resources* 61.4 (2023): 845-887. wiley.com
- Soto-Rubio, Ana, María Del Carmen Giménez-Espert, and Vicente Prado-Gascó. "Effect of emotional intelligence and psychosocial risks on burnout, job satisfaction, and nurses' health during the covid-19 pandemic." *International journal of environmental research and public health* 17.21 (2020): 7998. mdpi.com
- Leng, Jiewu, et al. "Review of manufacturing system design in the interplay of Industry 4.0 and Industry 5.0 (Part I): Design thinking and modeling methods." *Journal of Manufacturing Systems* 76 (2024): 158-187. [\[HTML\]](#)
- Gómez-Ochoa, Sergio Alejandro, et al. "COVID-19 in health-care workers: a living systematic review and meta-analysis of prevalence, risk factors, clinical characteristics, and outcomes." *American journal of epidemiology* 190.1 (2021): 161-175. ssrn.com
- Kavanagh, J. M. "Crisis in Competency: A Defining Moment in Nursing Education.." *Online Journal of Issues in Nursing*, 2021. [\[HTML\]](#)
- Hardy, M. and Harvey, H. "Artificial intelligence in diagnostic imaging: impact on the radiography profession." *The British journal of radiology*, 2020. nih.gov
- Acs, B., Rantalainen, M., and Hartman, J. "Artificial intelligence as the next step towards precision pathology." *Journal of internal medicine*, 2020. wiley.com
- Du, S. and Xie, C. "Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities." *Journal of Business Research*, 2021. [\[HTML\]](#)
- Alowais, Shuroug A., et al. "Revolutionizing healthcare: the role of artificial intelligence in clinical practice." *BMC medical education* 23.1 (2023): 689. springer.com
- Basu, K., Sinha, R., Ong, A., and Basu, T. "Artificial intelligence: How is it changing medical sciences and its future?." *Indian journal of dermatology*, 2020. lww.com

Khan, O., Parvez, M., Kumari, P., Parvez, S., and Ahmad, S. "The future of pharmacy: how AI is revolutionizing the industry." *Intelligent Pharmacy*, 2023. [sciencedirect.com](https://www.sciencedirect.com)

Ahtiainen, Hanne Katriina, et al. "Safety, time and cost evaluation of automated and semi-automated drug distribution systems in hospitals: a systematic review." *European Journal of Hospital Pharmacy* 27.5 (2020): 253-262. [bmj.com](https://www.bmj.com)

Takase, Tomoki, et al. "Evaluating the safety and efficiency of robotic dispensing systems." *Journal of Pharmaceutical Health Care and Sciences* 8.1 (2022): 24. [springer.com](https://www.springer.com)

Shen, Zefeng, et al. "The global research of artificial intelligence on prostate cancer: a 22-year bibliometric analysis." *Frontiers in Oncology* 12 (2022): 843735. [frontiersin.org](https://www.frontiersin.org)

Haleem, A., Javaid, M., Singh, R. P., Rab, S., and Suman, R. "Hyperautomation for the enhancement of automation in industries." *Sensors International*, 2021. [sciencedirect.com](https://www.sciencedirect.com)

Bohr, A. and Memarzadeh, K. "The rise of artificial intelligence in healthcare applications." *Artificial Intelligence in healthcare*, 2020. [nih.gov](https://www.nih.gov)

Bhinder, B., Gilvary, C., Madhukar, N. S., and Elemento, O. "Artificial intelligence in cancer research and precision medicine." *Cancer discovery*, 2021. [nih.gov](https://www.nih.gov)