

From Education to Practice: The Impact of Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, and Training Management on Advancing Healthcare in Saudi Arabia

Hasna Radhi Muharab Al Shammari¹, Jamailh Suleiman Ali Al-Aida¹, Maha Radhi Muharab Al Shamri², Tahani Abdullah Sadun Almayzar³, Ali Mhna'a Alshamari⁴, Aisha Abdullah Hamoud Al-kharin⁵, Fatimah Musaad Owdah Almosi Alhwiti⁶, Hasna Awadh Bulayzana Alharbi⁷

¹Health informatics, Hail Health Collection

²Nursing technician, Hail Health Collection

³Training and scholarship management, Hail Health cluster

⁴Health Administration, Hail Health Collection

⁵Clinical education (support group), Hail health cluster (public health)

⁶Specialist-Laboratory, Qassim Health Cluster

⁷Nursing technician, HIAL PHC

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ABSTRACT

Introduction: Saudi Arabia is going through a transformative phase in health care such as its Vision 2030, where it concentrates its energies on building a sustainable quality health care delivery system. Moving the country from an oil-dependent economy to a diversified one, health has focused itself intensively in investments and innovations. Furthermore and foremost, the advanced education and practice in areas like health informatics, nursing, health administration, laboratory sciences, clinical education, and the management of training programs are where the 21st-century revolution is taking place. These disciplines together forms backbone of modern healthcare delivery by improving efficiency, patient outcomes as well as ensuring that the workforce is ready to face emerging challenges.

Aim of work: To explore the critical contributions of Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, and Training Management on the ongoing transformation of healthcare in Saudi Arabia.

Methods: We conducted a comprehensive search in the MEDLINE database's electronic literature using the following search terms: Impact, Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, Training Management, Advancing, Healthcare, Saudi Arabia. The search was restricted to publications from 2016 to 2024 in order to locate relevant content. We performed a search on Google Scholar to locate and examine academic papers that pertain to my subject matter. The selection of articles was impacted by certain criteria for inclusion.

Results: The publications analyzed in this study encompassed from 2016 to 2024. The study was structured into various sections with specific headings in the discussion section.

Conclusion: Saudi Arabia is spearheading advancement in its healthcare system through well-defined integration of the health informatics sciences, nursing, health administration, laboratory sciences, clinical education, and training management. The above mentions contribute to a complete and functional construct regarding dealing with the needs of a diversely populated society. Hence those areas being quite important for the future success of the health system in Saudi Arabia within the Vision 2030 initiative purposes an icing cooperation among them to affect the lives of individuals in a longer term. In the patient care optimization phase, health informatics contributes; while nursing takes leadership roles in health administration on the one hand by formulating policies that govern precision medicine efficiency in laboratory sciences as clinical education prepares professionals in facing the real-world challenges, while training management upholds a skilled workforce.

Keywords: Impact, Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, Training Management, Advancing, Healthcare, Saudi Arabia

INTRODUCTION

Saudi Arabia is on a new track in transforming healthcare through its Vision 2030 program aimed at building a sustainable high-quality healthcare system (Mani & Goniewicz, 2024). As the country makes an economic transformation from a completely oil-centered economy to a more diversified one, it has endorsed the healthcare sector as one of the main areas for investment and innovation. This transformation involves the introduction of innovative education and practice in key areas such as health informatics, nursing, health administration, laboratory sciences, clinical education, and training management. These disciplines comprise the backbone of modern healthcare delivery in that they are the engines of efficiency, improvement of patient outcomes, and preparation of the workforce for the challenges of the future (Chikware et al., 2024).

Health informatics streamlines healthcare processes through technology and data analytics. It ranges from electronic health records (EHRs) to telemedicine and improves the interpretation of results, collaboration between providers, and access to care delivery in rural areas. In its digital transformation, Saudi Arabia has made the growing demand for creatives skilled in health informatics clear, thus highlighting the need for comprehensive education and professional training in this area (habbash saleh Almansour & Almansour, 2024). Another pillar of health care is nursing in which trained professionals deliver direct care alongside other functions such as leadership and research. Substantive efforts have been made by the Kingdom to elevate the nursing profession from education through capacity building to roles that are advanced such as nurse practitioners. Such initiatives will help reduce the shortage of workforce and subsequently lead to the improved quality of care in various healthcare settings (Al-Dossary, 2018).

All these, health administration, underpin the efficient functioning of healthcare facilities by managing resources, policies, and organizational dynamics. Administrators are indispensable for navigation through the changing face of health reform, financial sustainability, and alignment of institutional goals toward national health objectives. Educational programs regarding health administration into Saudi Arabia provide necessary leadership training for health administrators, which is aimed at future-ready professionals with the skills to oversee an evolving healthcare landscape (Alghaylani et al., 2023).

Laboratory sciences would complete another requirement in the health advancement process. The effective treatment of patients is hinged on accurate diagnostic services around which the very existence of the laboratory professional thrives. As Saudi Arabia pursues extending its capacity for diagnostics, especially in genetic testing and personalized medicine, the need for increasingly highly trained laboratory scientists has become more pressing. It becomes increasingly necessary, therefore, to develop academic and practical training activities for creating expertise in this domain (Alsawidan et al., 2023).

These disciplines are finally being woven together because clinical education and training management have an important role in preparing healthcare professionals to turn theoretical knowledge into practice. A well-designed clinical training program with internships and related continuing education initiatives encompassed by practical requirements can be complemented by academia in bridging schools and healthcare delivery. Improvements in clinical education in Saudi Arabia incorporate collaborations with foreign institutions, application of simulation centers, and advanced technology such as virtual reality (Alsabban & Kitto, 2018).

AIM OF WORK

This integrated body—health informatics, nursing, health administration, laboratory sciences, clinical education, and training management—forms the whole that synergistically impacts the Saudi sector of healthcare. Thus, it will help the Kingdom bolster an interdisciplinary collaboration that is even more comprehensible on education and practice, ushering its way to achieving a modern, effective, and patient-centered health system. This article thus reviews how these fields critically contribute to the ongoing healthcare transformation in Saudi Arabia, presenting both the individual and collective impact of all these health sciences on health outcomes in the nation.

METHODS

A thorough search was carried out on well-known scientific platforms like Google Scholar and Pubmed, utilizing targeted keywords such as Impact, Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, Training Management, Advancing, Healthcare, Saudi Arabia. The goal was to collect all pertinent research papers. Articles were chosen according to certain criteria. Upon conducting a comprehensive analysis of the abstracts and notable titles of each publication, we eliminated case reports, duplicate articles, and publications without full information. The reviews included in this research were published from 2016 to 2024.

RESULTS

The current investigation concentrated on the critical contributions of Health Informatics, Nursing, Health Administration, Laboratory Sciences, Clinical Education, and Training Management on the ongoing transformation of healthcare in Saudi Arabia between 2016 and 2024. As a result, the review was published under many headlines in the discussion area, including: Health Informatics: Bridging Technology and Patient Care, Nursing: Expanding Roles in a Changing Landscape, Health Administration: Shaping Policies and Systems, Laboratory Sciences: The Backbone of Diagnostics and Research, Clinical Education: Bridging Theory and Practice, Training Management: Building a Competent Workforce

DISCUSSION

Healthcare is an ever-evolving, multi-dimensional system that needs the education-practice synergy as well as interdisciplinary interactions. Vision 2030 is a transformative framework that has renewed the healthcare system in Iran, bringing about economic diversification and public service improvement-including health (Alasiri and Mohammed, 2022)-among its targets. Such courses are essential for collective education integration and practice in health informatics, nursing, health administration, laboratory sciences, clinical education, and even training management. Such will lead to modernization in healthcare delivery, improved outcomes, and a stronger system that meets the needs of the population. The review will highlight the impact of these fields on advancing healthcare prospects in Saudi Arabia, focusing on individual and collective contributions to education, practice, and system reform.

Health Informatics: Bridging Technology and Patient Care

Health informatics is part in the core construction of modern health care itself. It is an amalgam of modern technology with medical science in the delivery of health care, which leads to improved patient care and more efficient systems. It is changing the methodologies of the health care system, the ways that it is analyzed, and the aspects in which it is managed to really bring about transformation in Saudi Arabia. Many different types of electronic health record systems (EHRs), telemedicine tools, and data analytics tools are becoming widely used to improve existing workflows, patient outcomes, and evidence-based decisions (Al Muhri et al., 2022).

One of the most evident impacts of health informatics is in promoting integrated care. Integrated care results from linking hospitals, primary care centers, and laboratories together through health informatics; thus, making patient information available and consistent across all levels of care delivery. This eliminates duplication, reduces errors, and promotes coordination among health care providers (Mufleh et al., 2022).

Telemedicine is an essential aspect of health informatics, which has gained significance with Saudi Arabia. Variable remote portions of the nation are practically cut off from health services. Those are made possible through platforms allowing virtual consultation, monitoring from a distance, and prescribing drugs online. The latest event that actually provided momentum to telemedicine was the COVID-19 pandemic, which showcased its ability to deliver care in a timely and less costly manner (Sheerah et al., 2024).

The educational portion of health informatics is also critical. Universities and training institutions in Saudi Arabia are developing specialized programs to educate healthcare professionals on knowledge and skills to work in this ever-evolving field. Graduates trained in health informatics improve operational effectiveness while actively contributing to research and innovation by analyzing large datasets of trends, predicting outcomes, and optimizing resource allocation (Al-Dossary, 2018).

Nursing: Expanding Roles in a Changing Landscape

At the core of healthcare emerges nursing, a discipline that has fully embraced its significant role in the Kingdom of Saudi Arabia in the wake of developments within the healthcare system. While it does not mean that bedside patients have now become history, nurses are now directly involved in leadership, research, and policy-making activities. This transformation complements the wider acceptance of the importance of nursing within an overall holistic approach to health care (Alshammari et al., 2024).

Advanced practice roles, such as nurse practitioners and clinical nurse specialists, have been especially prominent in nursing education in Saudi Arabia. These roles are set to be the future in which nurses will take on diagnostic, treatment, and patient education responsibilities as part of their expanded role, particularly in primary care and community health settings. This is not only a very good option for offloading physicians but also ensures more timely and complete care received by patients (Hibbert et al., 2017).

Nursing education also addresses cultural competence and prepares nurses for patient-centered care in a multicultural society. The curricula develop skills in communication, ethical decision-making, and culturally informed respect for diversity in care. Nursing research is generally on the move, with nurses carrying out research along chronic disease management, mental health, and quality improvement (Albougami et al., 2019). In practice, nurses are the custodians of preventive care and patient education. Nurses in outreach have increased awareness levels around lifestyle diseases such as diabetes and hypertension, both common in Saudi

Arabia. Through informed health decisions, nurses join the ultimate goal of reducing disease burden and improving health outcomes (Alotaibi et al., 2024).

Health Administration: Shaping Policies and Systems

Health administration is vital for managing healthcare systems effectively. It encompasses strategic planning, resource allocation, and policy development. In Saudi Arabia, health administrators play a critical role in implementing reforms consistent with Vision 2030 in which efficiency, quality, and access come into play (Alasiri & Mohammed, 2022).

Another responsibility of health administrators is the management of resources. Such resources include human resources, infrastructures, and finance. Administrators will ensure that hospitals and clinics have adequate staff and all the necessary equipment and funds to help meet the growing demand among patients. And that is a pretty daunting task in a country where the population is rapidly growing, but very much worth it in terms of quality of care (Al Saffer et al., 2019).

Policy Development is also another key aspect of health administration. Through it, health administrators develop working relationships with government policy-makers, academic institutions, and international agencies to forge policies that will address current significant health problems. For example, increasing access to primary care services, improving maternal and child health, and creating awareness of mental health have been fronted by health administrators through policies driven by data and research to ensure that they are evidence-based and targeted (Al-Hanawi et al., 2019).

Health administration has vital contributions to innovation and collaboration. Administrators connect the public and private sectors. They encourage investments in healthcare technologies, infrastructure, and education. This partnership led to the establishment of state-of-the-art facilities and the introduction of advanced medical technologies, making Saudi Arabia a regional leader in healthcare (Uraif, 2024).

Laboratory Sciences: The Backbone of Diagnostics and Research

Laboratory sciences, which are the hallmarks of diagnostics, disease surveillance, and biomedical research, are vital to healthcare development in Saudi Arabia. Such laboratories provide necessary data that ultimately helps direct clinical decisions, from pathogen identification to treatment efficacy assessment. In an increasingly precision medicine-driven world, laboratory sciences help in personalizing care. (Alharbi et al., 2023).

It is certainly an important progress in laboratory sciences for Saudi Arabia. Molecular diagnostics include all techniques such as polymerase chain reaction (PCR) and next-generation sequencing, which have changed the detection of genetic disorders and infectious diseases as well as cancer. These techniques can be applied for early and accurate diagnoses, which would help improve patient outcome and reduce the cost of healthcare generally (Almznslawi et al., 2024).

Laboratory scientists participate in public health by conducting epidemiological studies and surveillance of disease outbreaks. Specifically, Saudi Arabian laboratories played a major role in the testing, contact tracing, and efficacy studies for vaccines during the COVID-19 pandemic. Most of what hospitals do in Saudi Arabia is to lessen the effect of this pandemic and even have raised awareness for further investments into laboratory infrastructure and training (Alzibarah et al., 2023).

Education and training in laboratory technologies are, without a doubt, essential components for a sufficient balance of the skilled labor force in laboratory sciences. Clinical laboratory science, biochemistry, and microbiology are specialized courses taught in universities and vocational institutes in Saudi Arabia. These courses are focused not only on hands-on training and research but also in adherence to international quality standards, transforming graduates fit for the future of healthcare (Aldhafeeri et al., 2022).

Clinical Education: Bridging Theory and Practice

Clinical education serves as a stepping stone between theory and practice and becomes a comprehensive source through which health professionals can offer required care. Clinical education in Saudi Arabia is currently characterized by new teaching learning modes, interdisciplinary operations, and lifelong learning (Alsawwid et al., 2023).

Simulation-based learning is among the most important developments in clinical education. Using a high-fidelity simulator, medical schools and training centers replicate real-life scenarios that allow students to practice the skills with risk reduction for both the patient and the health professional. For instance, nursing students practice the infusion of intravenous medications, while simulated surgeries are performed by medical students (Alshahrani et al., 2020).

Interdisciplinary training is yet another critical aspect of clinical education. Training programs have brought together students of medicine, nursing, pharmacy, and the laboratory sciences in the effort to develop teamwork and communication skills, which are critical for effective patient care. Interprofessional education not only prepares students for effective collaboration in different settings but also reduces errors in practice and improves

outcome (Al Tous et al., 2022-held). Continuing education and professional development imply integration into and graduating from clinical education-all health workers need to keep pace with the advancing world within their respective professional fields.

Workshops, conferences, and online coursework were evidence of the many opportunities available for skill enhancement and knowledge acquisition. The Saudi government and private organizations play a great role in supporting continuing education through funding and accreditation (Alanazi et al., 2022).

Training Management: Building a Competent Workforce

Training management is essential in developing a resourceful and flexible workforce for healthcare. Planning, implementing, and evaluating training programs are meant to serve the needs of the professionals in healthcare practice as well as that of the general population that advocates towards it. As such, in Saudi Arabia, training management is prioritized in the demand for skilled workers that directly results from the escalating demand for health services in a developing healthcare sector(Al-Hanawi et al., 2019).

Aligning education with the needs of healthcare is one of the primary objectives of training management. So it develops on the basis of the workforce analyses that any gap in skill and knowledge may be filled. Some training programs in Saudi Arabia include emergency medicine, geriatric care, and health informatics, all of which reflect an interest in the fulfillment of a country's changing demographics and health challenges (Almalki et al., 2021).

Notably, mentorship and leadership development play an important role in training management. Senior professionals assist juniors with mentoring, giving guidance and feedback as well as support. Meanwhile, leadership training programs are designed to identify and develop future leaders, thus preparing them for effective management of teams, projects, and organizations (Kazim et al., 2024).

Evaluation and quality assurance are two critical components of training program effectiveness. This includes the Saudi Commission for Health Specialties (SCFHS), which is a regulatory body in Saudi Arabia to assure and ascertain that programs are compliant with applicable national and international standards. Among the mechanisms for quality maintenance and relevance of training initiatives are regular assessments, feedback mechanisms, and accreditation processes (McMahon et al., 2024).

CONCLUSION

Integration of health informatics with nursing, health administration, laboratory sciences, clinical education, and training management shows the bright future that lies ahead of healthcare in Saudi Arabia. These aspects perform their different tasks to shape a growing, all-encompassing yet efficient healthcare system from the most urbanized to dispersed rural areas in the country. This certainly leads to further importance as the Saudi Arabia puts ahead its Vision 2030 initiative, promoting healthcare services enhanced by its multidisciplinary collaboration in the long-term improvement of healthcare delivery and outcomes.

Health informatics thus plays a crucial role in patient care, facilitating communication while enabling a more evidence-based approach for decision-making. Nursing has progressed into a more leadership and advanced practice component to ensure that nurses are also involved with patients as well as the systems they operate in. Health administration is policy-making as well as resource management to ensure the sustainability of the healthcare system. Laboratory sciences include the methodology for diagnosis and research that facilitates the advent of precision medicine, makes public health efforts more widespread, and brings them about. Clinical education brings practice and theory together. It prepares health professionals to face the realities of practice. Finally, training management plays an important role in presenting a competent and flexible workforce.

These all contribute to the better quality and accessibility of care, but at the same time they build a health system that is resilient, patient-centered, and at the same time institutes change in the face of an evolving horizon in health care. Education and training are essential for this transformation as they equip the workforce with much-needed skill sets for survival in a modern health environment.

REFERENCES

1. Al Muhri, H. S. M., Almahri, F. S. M., Al Mansour, M. H. A., Al Najrani, A. S. M., Alsulaiman, H. H. H., Alsulaiman, S. H. H., ... & Al Muhri, R. A. M. (2022). Digital transformation in the area of health in Saudi Arabia. *Advances in Clinical and Experimental Medicine*, 9(4).
2. Al Saffer, Q., Al-Ghaith, T., Alshehri, A., Al-Mohammed, R., Al Homidi, S., Hamza, M. M., ... & Alazemi, N. (2021). The capacity of primary health care facilities in Saudi Arabia: infrastructure, services, drug availability, and human resources. *BMC health services research*, 21, 1-15.
3. Al Tous, M., Alkhaibary, A., Alabssi, H., Haimour, A., Alqarni, A., & Saleh, M. (2022). Interdisciplinary educational approaches in healthcare organizations. *Cardiometry*, (22), 154-159.
4. Alanazi, A. N., Alanazi, H. N., Aldhaferi, B. A., Albnaqi, F. F., Alsalem, N. N., & Alshridi, N. H. (2022). Investigating The Mediating Role Of Self-Efficacy In The Relationship Between Continuing Education And Job Performance Among Saudi Arabian Nurses. *Chelonian Research Foundation*, 17(2), 4140-4149.

5. Alasiri, A. A., & Mohammed, V. (2022). Healthcare transformation in Saudi Arabia: an overview since the launch of vision 2030. *Health services insights*, 15, 11786329221121214.
6. Albougami, A. S., Alotaibi, J. S., Alsharari, A. F., Albagawi, B. S., Almazan, J. U., Maniago, J. D., & EiRazkey, J. Y. (2019). Cultural competence and perception of patient-centered care among non-Muslim expatriate nurses in Saudi Arabia: A cross sectional study. *Pak J Med Health Sci*, 13(2), 933-939.
7. Aldhafeeri, A. T., Aldhafeeri, F. T., Aldhafeeri, M. F., Alanazi, F. A., Aldhafeeri, B. Z., & Alanazi, M. F. (2022). Evaluating The Impact Of Continuing Education On Job Satisfaction And Performance Among Laboratory Technicians In Saudi Arabia: A Mixed-Methods Study. *Chelonian Research Foundation*, 17(2), 4097-4111.
8. Al-Dossary, R. N. (2018). The Saudi Arabian 2030 vision and the nursing profession: The way forward. *International nursing review*, 65(4), 484-490.
9. Alghaylani, A. S., Alsulaimani, M. A., ALgethamim, F. M., Al Zahrani, M. A., Al Thumali, A. A., Altowairqi, M. A., ... & Alotaibi, W. S. D. (2023). Charting The Course; A Systematic Review On Healthcare Leadership Styles And Their Symphony With Employee Satisfaction In Saudi Arabian Health Administration. *Journal of Namibian Studies: History Politics Culture*, 38, 1511-1531.
10. Al-Hanawi, M. K., Khan, S. A., & Al-Borie, H. M. (2019). Healthcare human resource development in Saudi Arabia: emerging challenges and opportunities—a critical review. *Public health reviews*, 40, 1-16.
11. Alharbi, M. S. S., Alharbi, A. A. F., Alotaibi, R. J., Alyami, M. S. A., Kindasa, T. M. A., Maglia, A. I. A., ... & Al-Masabi, M. A. A. (2023). Exploring The Role Of Medical Laboratories In Modern Healthcare: A Comprehensive Overview. *Journal of Namibian Studies: History Politics Culture*, 36, 1893-1904.
12. Almalki, M., Jamal, A., Househ, M., & Alhefzi, M. (2021). A multi-perspective approach to developing the Saudi Health Informatics Competency Framework. *International Journal of Medical Informatics*, 146, 104362.
13. Almnzlawi, A. M., ALaeq, R. A., Alotaibi, Y. M., Mohammed, K., Ahmed, S. A. A., & Alharbi, A. O. (2024). Advances in Laboratory and Imaging Techniques for Detecting Minimal Residual Disease in Leukemia.
14. Alotaibi, M. M., Alalyani, A. M. A., Aljuaid, M. A., Alkhalf, A. I. I., Alatawi, K. S. A., Alotaibi, S. E., ... & Alenizy, J. Z. (2024). The Impact of Nursing Professionals on Public Health Awareness and Patient Education in Saudi Arabia. *Journal of International Crisis and Risk Communication Research*, 1240-1253.
15. Alsabban, W., & Kitto, S. (2018). Bridging continuing medical education and quality improvement efforts: a qualitative study on a health care system in the Kingdom of Saudi Arabia. *Journal of Continuing Education in the Health Professions*, 38(4), 255-261.
16. Alsawidan, A. H., Al-Suwaidan, H. M. M., Alsawidan, A. M. M., Alyami, H. M. A., Alswidan, A. M., Alswidan, A. M., ... & Al Hokash, A. H. M. (2023). Enhancing Efficiency And Accuracy In Medical Laboratories: The Role Of Lab Technicians. *Journal of Namibian Studies: History Politics Culture*, 36, 1920-1930.
17. Alsaywid, B. S., Alajlan, S. A., & Lytras, M. D. (2023). Transformative learning as a bold strategy for the vision 2030 in Saudi Arabia: Moving higher healthcare education forward. In *Technology-enhanced healthcare education: Transformative learning for patient-centric health* (pp. 187-207). Emerald Publishing Limited.
18. Alshahrani, S. M., Khan, N. A., Easwaran, V., Iqbal, M. J., & Alavudeen, S. S. (2020). Effects of Virtual Education on Clinical Pharmacy Practice in Saudi Arabia: Implementation of Simulation-Based Education. *Lat. Am. J. Pharm*, 39(12), 2520-6.
19. Alshammari, A. R. N., Alshammari, K. H. H., Alshammari, F. R. N., Alshammari, A. H. D., Alshammari, H. M., Alshammari, M. B., ... & Alshammari, O. B. T. (2024). Critical Analysis of Nursing Roles in An Evolving Healthcare Landscape. *Journal of Ecohumanism*, 3(8), 2500-2511.
20. Alzibarah, M. H., Sagoor, M. I. A., Al Mansour, M. H., Almnsoore, H. M., Al-Sleem, A. M., & Al Sulaiman, M. S. A. (2023). Critical Analysis: The Impact Of Laboratories On Pandemic Management. *Chelonian Research Foundation*, 18(2), 2344-2357.
21. Chikware, A. B., Roman, N. V., & Davids, E. L. (2024). Improving Health Informatics Competencies: A Scoping Review of the Components of Health Informatics Academic Programs. *SAGE Open*, 14(4), 21582440241293259.
22. habbash saleh Almansour, S., & Almansour, M. H. H. (2024). The Role of Health Technology in Improving Healthcare Services in Saudi Arabia. *Journal of International Crisis and Risk Communication Research*, 812-831.
23. Hibbert, D., Aboshaiqah, A. E., Sienko, K. A., Forestell, D., Harb, A. W., Yousuf, S. A., ... & Leary, A. (2017). Advancing nursing practice: the emergence of the role of advanced practice nurse in Saudi Arabia. *Annals of Saudi Medicine*, 37(1), 72-78.
24. Kazim, S. M., AlGhamdi, S. A., Lytras, M. D., & Alsaywid, B. S. (2024). Nurturing Future Leaders: Cultivating Research and Innovation Skills in Saudi Scientific Community. In *Transformative Leadership*

- and Sustainable Innovation in Education: Interdisciplinary Perspectives (pp. 231-265). Emerald Publishing Limited.
25. Mani, Z. A., & Goniewicz, K. (2024). Transforming Healthcare in Saudi Arabia: A Comprehensive Evaluation of Vision 2030's Impact. *Sustainability*, 16(8), 3277.
 26. McMahon, G. T., Alnasser, M., Alzouman, H., Aldakhil, L., & Ababtain, A. (2024). Transforming Continuing Professional Development for Healthcare Professionals to Meet National Goals in Saudi Arabia. *Journal of CME*, 13(1), 2378617.
 27. Mufleh, A. S. S., Alshraah, S. M., Nabil, A. A., Alshraah, A. M., Al-shaboul, I. A., Alshatnawi, E. F., ... & Issa, S. H. (2024). Integrating Telemedicine, Health Informatics, and Smart City with Saudi Arabia's Vision 2030: Advancing Sdgs 3 and 11. *Cuadernos de Economía*, 47(133), 91-104.
 28. Sheerah, H. A., AlSalamah, S., Alsalamah, S. A., Lu, C. T., Arafa, A., Zaatari, E., ... & Labrique, A. (2024). The Rise of Virtual Health Care: Transforming the Health Care Landscape in the Kingdom of Saudi Arabia: A Review Article. *Telemedicine and e-Health*, 30(10), 2545-2554.
 29. Uraif, A. (2024). Developing Healthcare infrastructure in Saudi Arabia using smart technologies: Challenges and opportunities. *Communications and Network*, 16(3), 51-73.