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The role of AI in transforming healthcare in South Africa

W Janneker, Diploma in Computer Science
Afritech AI

Corresponding author: ***W Janneker*** *(Wayne.Janneker@afritech.africa)*

South Africa's healthcare system struggles with resource constraints, workforce gaps, and rising disease burdens. Artificial intelligence (AI) offers a scalable solution – enhancing diagnostics, drug discovery, and clinical decision-making while optimising hospital efficiency. Success depends on interoperable data, bias-aware AI models trained on local datasets, and robust ethical frameworks. Learning from China's AI health strategy and leveraging BRICS collaboration, South Africa must prioritise a unified digital health infrastructure to ensure equitable, secure AI adoption. Responsible implementation can augment clinical expertise and improve care standards across public and private sectors.

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As South Africa (SA) navigates the complexities of its healthcare system, artificial intelligence (AI) emerges as a transformative force poised to address longstanding challenges and unlock new opportunities. With an overburdened public health sector, a growing disease burden, and disparities in access to quality care, AI-driven solutions offer the potential to enhance diagnostic accuracy, streamline operations and improve patient outcomes. From predictive analytics that anticipate disease outbreaks to AI-powered telemedicine platforms bridging the urban-rural healthcare divide, the integration of AI in healthcare is no longer a futuristic vision – it is an urgent necessity. As SA embraces digital transformation, fostering AI innovation will be key to ensuring a more efficient, accessible, and patient-centric healthcare system.

The role of connectivity and data integration

Connectivity is a critical factor in closing the digital divide and enhancing electronic health records (EHRs). AI thrives on robust data ecosystems, and SA must prioritise the integration of interoperable healthcare data to support AI-driven innovations. The adoption of AI in healthcare depends on the availability of localised datasets, which can improve algorithmic accuracy and lead to more effective decision-making models tailored to the region's unique healthcare challenges.

The COVID-19 pandemic demonstrated the power of global data collaboration in healthcare. Data-sharing initiatives enabled clinicians to collaborate on clinical notes, imaging, and pathology, expediting decision support and advancing genomic analysis for early strain detection.[1] These lessons underscore the importance of strengthening SA's data-sharing infrastructure to optimise AI applications in healthcare.

AI market growth and SA's position

According to Markets and Markets, the global AI in healthcare market, valued at US$10.31 billion in 2023, is projected to grow at a 49.1% compound annual growth rate (CAGR), having reached US$14.92 billion by 2024 and US$164.16 billion by 2030.[2] While the USA and China currently lead this market, Africa's potential for AI-driven healthcare innovation remains largely untapped. SA has an opportunity to establish itself as a key player by investing in AI research, development and infrastructure.

Addressing healthcare inequality through AI

SA's healthcare system remains deeply unequal, divided into a two-tiered structure. The country spends 8.5% of its gross domestic product (GDP) on healthcare, approximately R332 billion, with half of these resources allocated to the private sector, which serves a small socioeconomic elite. Meanwhile, 84% of the population, who bear a disproportionate burden of disease, rely on the under-resourced public sector.[3]

The public healthcare system faces significant workforce shortages, leading to an overwhelming patient load per healthcare worker. AI presents a unique opportunity to alleviate this burden by enhancing interoperability between medical data systems, improving decision support tools, and enabling more efficient resource allocation.

AI-powered tools, such as clinical decision support systems (CDSSs), assist healthcare providers in making more accurate diagnoses and treatment plans, ultimately improving population health outcomes. AI-driven automation can also enhance administrative efficiency, reducing paperwork and freeing up medical professionals to focus on patient care.[3]

The need for centralised healthcare records

To ensure equitable access to AI-enhanced healthcare, SA must focus on centralising its healthcare records. A unified EHR system will not only improve patient data accessibility but also contribute to the development of AI models that reflect Africa's diverse healthcare landscape. Studies indicate that hospitals with well-adopted EHR systems experience higher patient satisfaction and improved healthcare service quality.[4]

Addressing AI bias and ethical challenges in SA healthcare

AI is rapidly transforming healthcare, offering promising advancements in diagnostics, treatment planning and patient management. However, one of the key challenges SA faces is AI bias, largely stemming from insufficient data that reflect the country's diverse population. Bias in AI models often originates from the datasets used during training, which may inadvertently encode societal inequalities, historical disparities or systemic injustices present in the data collection process.[5]

In healthcare, diagnostic algorithms trained on historical patient data from EHRs may disproportionately represent certain demographic groups while underrepresenting others. This can lead to disparities in clinical decision-making, ultimately affecting patient outcomes. Without diverse and representative data, AI-driven healthcare solutions may fail to provide accurate and equitable recommendations across SA's multiethnic and socioeconomically varied population.

A further ethical concern is the lack of governance and oversight in mitigating AI bias. SA's current AI policy framework[6] emphasises the importance of human-centred AI, ensuring that AI augments – rather than replaces – human decision-making. However, the framework does not yet provide specific guidelines for AI-driven CDSSs, raising crucial questions about accountability and regulatory oversight. Despite AI's role in augmenting clinical decisions, ultimate responsibility still rests with healthcare professionals, necessitating clear ethical and legal frameworks to govern AI applications in medicine.

Given these challenges, a pivotal discussion is required on the role of the National Department of Health in establishing ethical guidelines and governance structures for AI in healthcare. Addressing AI bias through improved data representation, stringent validation processes and ethical AI governance will be critical in ensuring that AI-driven healthcare solutions serve all South Africans equitably.

AI as a solution to medicolegal liability and budget constraints

Despite these challenges, AI presents a significant opportunity to reduce medicolegal liability claims, which currently burden the SA healthcare system and divert critical funding away from essential therapeutic areas. AI-driven decision support systems have the potential to enhance diagnostic accuracy, reduce medical errors, and provide clinicians with evidence-based recommendations, ultimately improving patient safety and mitigating legal risks.[7]

By leveraging AI to analyse prior medical events, detect potential risks, and suggest interventions tailored to individual patient histories, healthcare providers can make more informed decisions that improve outcomes while reducing the likelihood of adverse events. Furthermore, AI can enhance patient experience by ensuring continuity of care, identifying early warning signs of complications, and optimising treatment pathways.

Given these benefits, it is imperative that AI governance frameworks evolve to balance the risks of bias with the immense potential AI offers in strengthening SA's healthcare system. A collaborative effort between policymakers, clinicians, and technologists is required to establish ethical, transparent, and patient-centric AI applications that support equitable healthcare delivery.

Cloud computing and health data exchange: A unified approach for SA

The financial investment in AI must be carefully considered as SA advances its digital healthcare strategy. AI-driven diagnostics in radiology, pathology, and telemedicine require significant computational resources and infrastructure investment. As the burden of diagnosing and managing non-communicable diseases (NCDs) increases – exacerbated by the widening disparity between healthcare workers and patients – there is an urgent need for scalable, efficient solutions that enhance diagnostic speed and accuracy.

Cloud computing presents a strategic opportunity to modernise SA's healthcare information technology (IT) infrastructure. Rather than provincial departments independently localising their environments and increasing expenditure on fragmented infrastructure, a unified, centralised approach through a national health data exchange and government public cloud offers a more efficient and cost-effective alternative.

The Centre for Science, Innovation, and Research (CSIR) currently hosts a government high-performance computing (HPC) facility,[7] which can be enhanced to support a national healthcare AI and data exchange. By leveraging local cloud infrastructure, SA can ensure in-country compute and storage capacity that aligns with national policies mandating that medical data remain within national borders. A locally hosted cloud exchange would not only facilitate secure health data interoperability but also enable AI-driven analytics and predictive modelling to improve patient care.

By adopting a centralised cloud-based health exchange, SA can drive innovation, enhance data security, and optimise resource allocation, ultimately improving the efficiency and accessibility of healthcare services nationwide. Establishing a government-led cloud strategy for healthcare will be key to overcoming infrastructure limitations and ensuring equitable access to AI-driven healthcare advancements.

China's AI and healthcare strategy: A blueprint for global leadership

China has set ambitious goals to transform healthcare through AI, aiming to become a global leader in the field by 2030. Central to this strategy are five key pillars: infrastructure, data, technology, energy, and talent development. By integrating these elements, China is positioning itself at the forefront of AI-driven medical innovation.[8]

Infrastructure: Building a centralised AI ecosystem

A core component of China's AI strategy is the centralisation of infrastructure, data centres and computing power. By focusing on large-scale, high-performance computing infrastructure, China is ensuring seamless, robust, and secure operations that will support AI-driven healthcare advancements.

Data: The foundation of AI in healthcare

Data are critical for AI model training and optimisation. China recognises the importance of collecting, analysing, and managing vast medical datasets to enhance AI performance while promoting the fair and ethical use of localised data for improved patient outcomes. This approach ensures that AI models are tailored to local populations, reducing biases and enhancing clinical effectiveness.

Technology: Advancing AI in medical innovation

China is prioritising AI-driven breakthroughs in medical imaging, drug discovery, and personalised medicine. Investments in AI-powered medical devices, robotics, and digital healthcare applications are rapidly expanding, with a strong focus on improving diagnostics, treatment planning, and operational efficiencies in healthcare institutions.

Energy: Sustaining AI-intensive healthcare applications

Recognising the high computational demands of AI in healthcare, China is making substantial investments in energy infrastructure to ensure reliable and sustainable operations. By securing energy

resources for AI-driven applications, China aims to maintain the scalability and efficiency of its healthcare AI systems.

Talent development: Fostering a skilled AI workforce

China acknowledges the need for a strong, locally trained AI workforce to sustain its healthcare AI ambitions. Strategic partnerships between universities and industry leaders are fostering innovation, ensuring that AI expertise remains homegrown, and supporting long-term advancements in medical AI applications.

As a country with strong diplomatic and economic ties to China, SA is uniquely positioned to leverage this relationship for AI and healthcare advancements. Through bilateral collaborations, technology transfers, and research partnerships, SA can gain valuable insights from China's AI-driven healthcare strategy.

Furthermore, SA's participation in BRICS (Brazil, Russia, India, China, South Africa) provides an opportunity to engage with a broader network of global stakeholders, fostering knowledge-sharing and joint innovation in AI-powered healthcare solutions. By actively collaborating within BRICS and strengthening intercountry support with China, SA can accelerate its own AI healthcare initiatives, improve patient outcomes, and contribute to the global AI ecosystem.

AI-powered focus areas in SA healthcare

To drive meaningful and immediate improvements in SA's healthcare system, AI adoption should be strategically targeted at therapeutic areas that present significant imbalances and burdens**.** By reimagining healthcare delivery through AI-driven solutions, SA can enhance efficiency, improve patient outcomes, and reduce system-wide strain. Below are six high-impact use cases that can be rapidly deployed:

Medical imaging: Addressing diagnostic bottlenecks

Medical imaging represents one of the most significant burdens in SA healthcare. AI algorithms can analyse medical images – including X-rays, computed tomography scans and magnetic resonance imaging – with exceptional accuracy and speed, surpassing human capabilities in early disease detection. While a radiologist may take up to 3 minutes to interpret an X-ray, AI can do so in 7 - 10 seconds, dramatically improving workflow efficiency and reducing diagnostic delays.

Drug discovery: Accelerating therapeutic innovation

AI can significantly shorten the time and cost required for drug discovery and development by identifying new therapeutic compounds, predicting drug interactions, and optimising clinical trial processes. This is particularly crucial for addressing diseases with a high prevalence in SA, such as tuberculosis (TB), HIV and emerging NCDs**.**

Personalised medicine: Enhancing treatment precision

By leveraging EHR data and AI-driven predictive modelling, healthcare providers can tailor treatment plans to individual patient profiles, ensuring more accurate and proactive interventions. AI-driven personalised medicine enables precision dosing, early risk detection, and targeted therapies based on a patient's genetic, lifestyl, and medical history.

Telemedicine: Expanding access to remote healthcare

AI-powered telemedicine can bridge the gap between clinicians and patients, especially in rural and underserved areas. Currently, many rural clinics in SA receive in-person doctor visits only once a week. AI-driven remote diagnostics, virtual consultations, and connected medical devices enable continuous care, ensuring that patients receive timely medical attention without the constraints of geographical barriers.

Hospital management: Optimising resource efficiency

AI-driven hospital management systems can enhance patient care, reduce operational costs, and improve resource allocation. Key applications include:

- AI-powered patient scheduling to optimise consultation times and reduce wait periods.
- Automated e-prescriptions and robotic pharmacy dispensing, ensuring faster and more accurate medication distribution.
- Predictive analytics for bed and ICU management, helping hospitals better allocate resources in response to patient demand.

Disease prediction and prevention: Proactive healthcare measures

AI can be a powerful tool in predicting and preventing disease outbreaks through real-time epidemiological modelling. By analysing health records, social determinants of health, and environmental factors, AI can:

- Identify early warning signs of infectious disease outbreaks, such as TB and influenza.
- Enable early interventions for chronic diseases, such as diabetes and hypertension, through continuing monitoring and risk assessment.
- Support public health initiatives, improving vaccine distribution strategies and targeted disease-prevention efforts.

The path forward for AI in healthcare

The integration of AI in healthcare presents a transformative opportunity to enhance diagnostics, streamline hospital management, expand patient access, and improve treatment precision. However, as AI adoption accelerates, it is crucial to balance the benefits with ethical considerations, regulatory oversight, and workforce readiness to ensure responsible and effective implementation.

Balancing benefits and risks

AI-driven healthcare solutions offer the potential to reduce diagnostic errors, optimise resource allocation, and improve patient outcomes. However, risks such as data bias, algorithmic opacity, and over-reliance on AI recommendations must be carefully managed. Without diverse and representative datasets, AI models risk perpetuating disparities rather than mitigating them. The challenge lies in developing transparent, unbiased AI systems that enhance – not replace – clinical decision-making.

Continuing professional development for healthcare workers

For AI to be effectively integrated into the healthcare system, continuing education and training for healthcare professionals are essential. Medical practitioners must be equipped with the skills to interpret AI outputs, recognise potential biases, and make informed decisions that prioritise patient safety. Institutions should implement structured AI literacy programmes as part of medical training and continuing professional development, ensuring that clinicians remain at the forefront of technological advancements.

Ethical AI use and regulatory considerations

The ethical application of AI in healthcare requires a robust regulatory framework that ensures transparency, accountability, and fairness. Key considerations include:

- Bias mitigation: Policies to ensure AI models are trained on diverse, representative datasets to prevent discrimination.
- AI oversight and governance: Establishing an independent regulatory body to evaluate AI systems before deployment in clinical settings.
- Liability and accountability: Clearly defining legal responsibility when AI-driven decisions lead to adverse patient outcomes.
- Security and privacy: Strengthening data protection laws to ensure patient confidentiality and compliance with national healthcare data regulations.

Public Engagement: Building trust and adoption

Successful AI implementation in healthcare requires public confidence and acceptance. AI-driven healthcare solutions must be introduced with clear communication, public engagement, and transparency about how they function, their limitations, and their benefits. Patients must be educated on AI-assisted medical decisions to foster trust and encourage informed collaboration between clinicians and AI systems.

Informed consent and transparency

Ensuring informed consent is a cornerstone of ethical AI use in healthcare. Patients should have a clear understanding of how AI is being used in their diagnosis and treatment, along with the ability to opt in or out of AI-assisted decision-making. Transparency must extend beyond patient interactions – health institutions and AI developers must openly disclose AI methodologies, performance metrics, and potential risks.

Addressing structural conflicts in AI-driven healthcare

The integration of AI in healthcare introduces structural conflicts, including concerns over data ownership, commercial interests, and human oversight. Policymakers must ensure that AI implementation prioritises patient welfare over financial incentives, maintaining the human-centric nature of healthcare. This requires a collaborative effort between government bodies, healthcare institutions, AI developers, and civil society organisations to develop a healthcare AI strategy that aligns with ethical, clinical, and societal values.

Conclusion: A responsible AI-driven future

AI is not a replacement for human expertise but a tool to enhance and support medical decision-making. To fully harness its potential, SA must adopt a multistakeholder approach that includes ethical safeguards, regulatory oversight, continuing professional development, and public engagement. By addressing these challenges proactively, AI can be integrated into healthcare responsibly, equitably and transparently, ultimately advancing patient care while preserving trust and accountability in the medical profession.

1. Arora N, Banerjee AK, Narasu ML. The role of artificial intelligence in tackling COVID-19. Future Virol 2020;15(11):717-724. https://doi.org/10.2217/fvl-2020-0130
2. Markets and Markets. Artificial intelligence (AI) in healthcare market growth, drivers, and opportunities. https://www.marketsandmarkets.com/market-reports/artificial-intelligence-healthcare-market-54679303.html (accessed 30 March 2025).
3. Naidoo S, Bottomley D, Naidoo M, Donnelly D, Thaldar D. Artificial intelligence in healthcare: Proposals for policy development in South Africa. S Afr J Bioethics Law 2022;15(1):11-16. https://doi.org/10.7196/SAJBL.2022.v15i1.797
4. Ayaad O, Alloubani A, ALhajaa EA, et al. The role of electronic medical records in improving the quality of health care services: Comparative study. Int J Med Informatics 2019;127:63-67. https://doi.org/10.1016/j.ijmedinf.2019.04.014
5. Hanna MG, Pantanowitz L, Jackson B, et al. Ethical and bias considerations in artificial intelligence/machine learning. Mod Pathol 2025;38(3):100686. https://doi.org/10.1016/j.modpat.2024.100686.
6. Department of Communications and Digital Technologies. South Africa's artificial intelligence (AI) planning. https://www.dcdt.gov.za/images/phocadownload/AI_Government_Summit/National_AI_Government_Summit_Discussion_Document.pdf (accessed 30 March 2025).
7. Think Global Health. South Africa's medical negligence crisis. 2024. https://www.thinkglobalhealth.org/article/south-africas-medical-negligence-crisis (accessed 30 March 2025).
8. TRENDS Research & Advisory. China's AI strategy: A case study in innovation and global ambition. https://trendsresearch.org/insight/chinas-ai-strategy-a-case-study-in-innovation-and-global-ambition/ (accessed 30 Mar 2025).