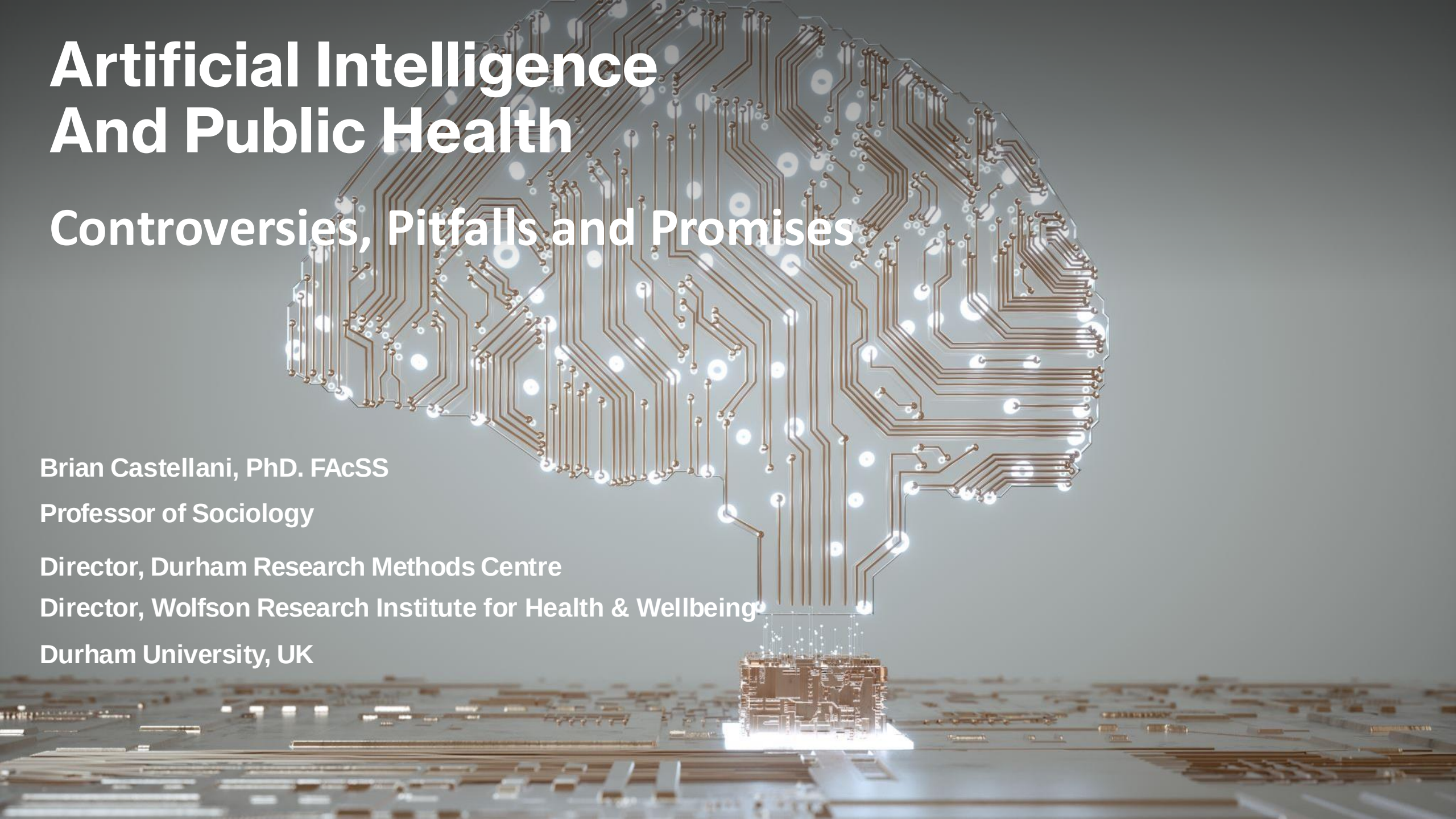
Artificial Intelligence And Public Health

Controversies, Pitfalls and Promises



Brian Castellani, PhD. FAcSS

Professor of Sociology

Director, Durham Research Methods Centre

Director, Wolfson Research Institute for Health & Wellbeing

Durham University, UK

Everywhere we see today the promise of AI and digital infrastructures to improve the quality, engagement and efficiency of healthcare and public health.

Forbes

The Promise And Challenges Of AI In Healthcare

Corey Scurlock Forbes Councils Member
Forbes Business Council COUNCIL POST | Membership (Fee-Based)

Jul 10, 2023, 07:30am EDT

Dr. Corey Scurlock MD, MBA is the CEO & founder of Equum Medical.

GETTY

Faster drug discoveries, personalised medical care and early detection of critical illnesses are real possibilities.

Artificial intelligence – more specifically Generative or GenAI – is set to push the boundaries of what's possible in the healthcare industry.

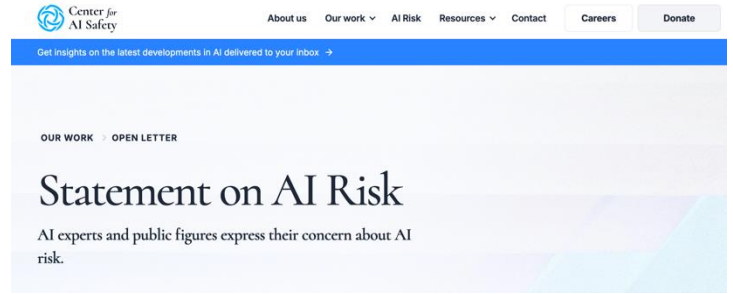
The transformative power of that technology is likely to ring in a future where new drugs would be discovered a few years earlier, patients receive drug dosage and affordable care that is tailored to their specific conditions and needs, and survival rates improve as some critical illnesses are diagnosed sooner, and at an affordable price.

These are some changes that are waiting to happen, with healthcare companies and regulators moving ahead cautiously to ensure that the technological developments currently under way are safe for the patients, according to an expert panel at the HSBC Global Investment Summit.

But we also see warnings and calls for pause by various stakeholders, including some of those creating this technology.

A.I. Poses 'Risk of Extinction,' Industry Leaders Warn

Leaders from OpenAI, Google DeepMind, Anthropic and other A.I. labs warn that future systems could be as deadly as pandemics and nuclear weapons.



☑ AI Scientists ☑ Other Notable Figures

Geoffrey Hinton
Emeritus Professor of Computer Science, University of Toronto

Yoshua Bengio
Professor of Computer Science, U. Montreal / Mila

Demis Hassabis
CEO, Google DeepMind

Sam Altman
CEO, OpenAI

Dario Amodei
CEO, Anthropic

Dawn Song
Professor of Computer Science, UC Berkeley

Ted Lieu
Congressman, US House of Representatives

Bill Gates
Gates Ventures

Ya-Qin Zhang
Professor and Dean, AIR, Tsinghua University

Ilya Sutskever
Co-Founder and Chief Scientist, OpenAI

Igor Babuschkin
Co-Founder, xAI

Shane Legg
Chief AGI Scientist and Co-Founder, Google DeepMind

What is the reality of this promise?

Should we embrace it, or should we be worried and resist it?

Do we have a choice?

Or are those even the right questions to ask?

I would like to suggest a slightly different question:

How can we identify and address the barriers and levers to change around AI so that people and their healthcare providers can make better and more effective use of this new technology.

Why this question?

AI is not going away.

Getting rid of AI is not an option.

However, deciding how and where it is most effective, given its current abilities, and addressing the levers and barriers to its effective usage is something we can address.

What is AI?

Let’s ask ChatGPT. . .

ChatGPT 4o

What is AI?

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines designed to think, learn, and perform tasks typically requiring human cognition.

AI systems can process information, recognize patterns, make decisions, and solve problems autonomously.

These systems use algorithms, data, and computational power to perform tasks like speech recognition, image analysis, language translation, and even playing complex games.

Professor Marwala is a South African artificial intelligence engineer, a computer scientist, a mechanical engineer and a university administrator.

He is currently Rector of the United Nations University and UN Under-Secretary-General.

In August 2023 Marwala was appointed to the United Nations scientific advisory council.

He was previously a vice-chancellor and principal of the University of Johannesburg.

Let's see what he has to say?

LECTURE

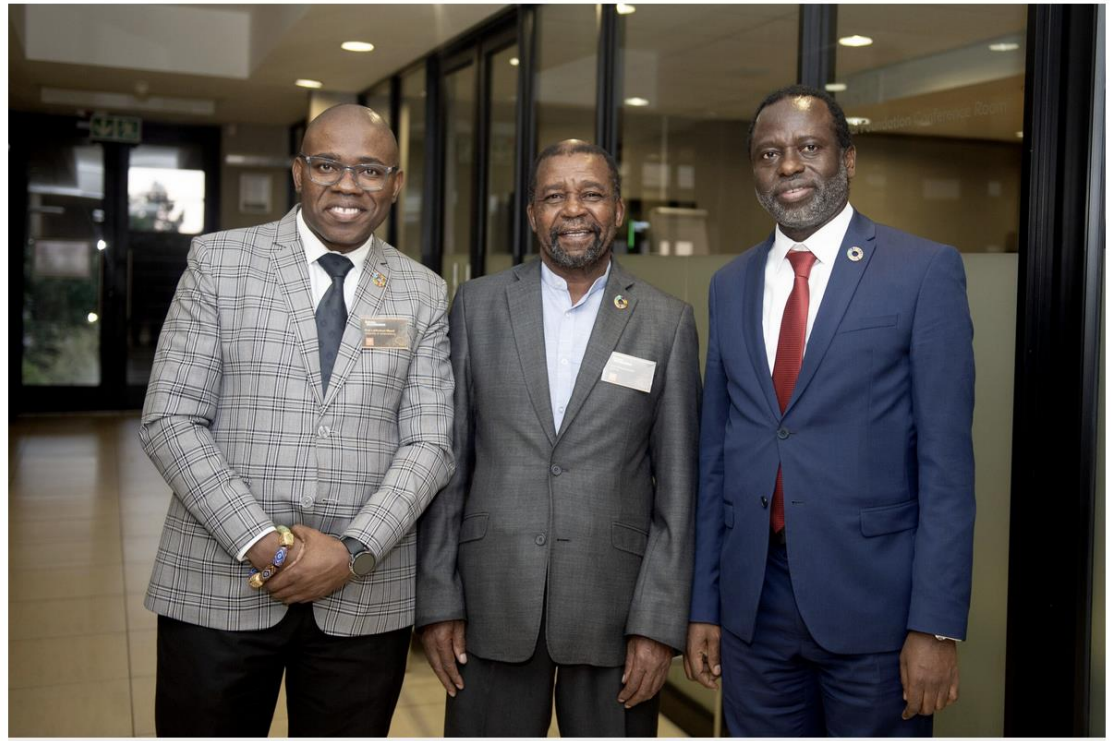
The perils and welfare effects of AI: whither South Africa?

Prof. Tshilidzi Marwala

6 December 2023

University of Johannesburg, Auckland Park, South Africa

On Wednesday, December 6, 2023, the Mapungubwe Institute for Strategic Reflection (MISTRA), in collaboration with the University of Johannesburg (UJ), hosted the MISTRA Annual Lecture featuring Professor Tshilidzi Marwala. As the former Vice Chancellor and Principal of UJ, Prof Marwala, now the Under Secretary of the United Nations and Rector of the UN University, delivered a lecture on the perils and welfare effects of Artificial Intelligence (AI).



(L-R) Professor Letlhokwa Mpedi UJ Vice- Chancellor and Principal, Executive Director of MISTRA, Joel Netshitenzhe and UN University Rector Professor Tshilidzi Marwala. Picture: Nokuthula Mbatha/University of Johannesburg

For Marwala, AI is a technique that essentially makes machines intelligent.

While computers traditionally relied on people to tell them what to do and how to react, AI means that machines can learn and make their own decisions.

The basic idea behind AI is to see whether we can give computers some of the decision-making abilities that we as humans have.

There are three broad types of AI – prediction machines, clustering machines and generative machines.

Prediction machines, such as ANNs or CNNs, are designed to forecast future outcomes or make predictions based on historical data.

- Using large datasets to predict the survival curve of patients with Type 2 Diabetes or those most at risk for Long-COVID.

Clustering machines, such as k-Means, are used for grouping similar data points together based on certain characteristics, and ultimately identifying patterns within data that might not be immediately apparent to humans.

- Detecting symptom patterns for diagnosis.
- Culling through large datasets to identify malignant tumours.

Generative machines, including Chat GPT and GANs are capable of creating new content, such as images, text, or even music, that resembles human-created content based on algorithms that learn patterns from existing data.

- Using ChatGPT to interview patients, asking patients new questions based on their particular answers.

So, what is so great
about AI in healthcare?

Let’s ask ChatGPT. . .

AI in healthcare refers to the application of artificial intelligence technologies to improve and optimize various aspects of the healthcare system.

These technologies, which include machine learning, natural language processing, computer vision, and robotics, are used to enhance the accuracy, efficiency, and accessibility of medical services.

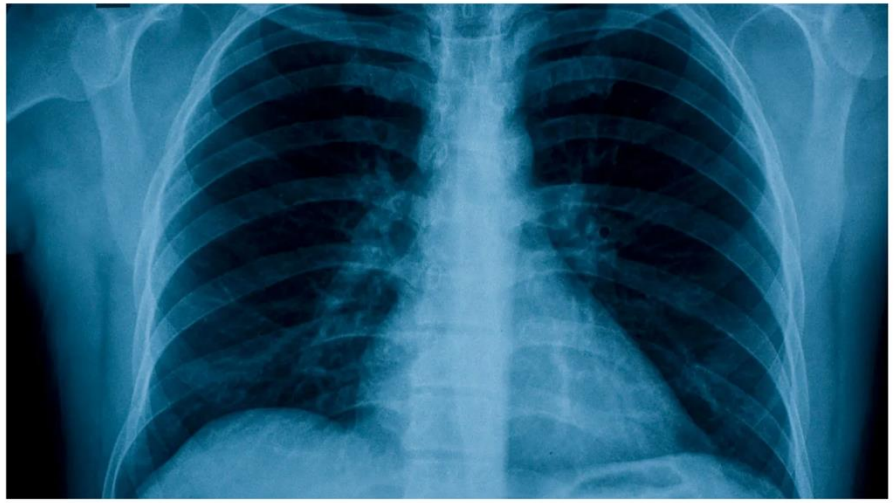
Key Areas Where AI is Used in Healthcare:

1. **Medical Imaging and Diagnostics**: AI can analyse medical images (like X-rays, MRIs, and CT scans) to detect abnormalities such as tumours, fractures, or other conditions with high accuracy. Machine learning algorithms can identify patterns in imaging data that might be missed by human eyes, leading to earlier and more accurate diagnoses.

ScienceNews
INDEPENDENT JOURNALISM SINCE 1921

AI could take medical imaging to the next level

Artificial intelligence can help doctors spot disease, but it's not taking over medicine



AI computer models can scan medical images like this chest X-ray and glean details about a person's cardiovascular and metabolic health.
YUMIYUM/ISTOCK/GETTY IMAGES PLUS

By Meghan Rosen
June 17, 2024 at 11:30 am
When radiologist Pouneh Razavi reads a patient's mammogram, she hunts for blips in the X-ray image that could indicate breast cancer. Then, a second reader looks at the image, and the two compare results.

But that second reader is no human doctor — it's artificial intelligence. Since March, Razavi and her colleagues at Johns Hopkins School of Medicine have been using AI software as a second set of eyes.

It's early days, so her team is still learning from the software, and it can learn from them, too. Images from Razavi's practice could help train the AI on blips that it missed, so it improves over time. The jury's still out on its performance — Razavi's colleagues are still collecting data — but "we're excited about it," she says. Her patients are, too. "So far, everyone has just found it fascinating."

Key Areas Where AI is Used in Healthcare:

2. **Predictive Analytics**: AI can analyse large datasets from electronic health records (EHRs) to predict patient outcomes, identify high-risk patients, and suggest personalized treatment plans. Predictive models can forecast the likelihood of disease outbreaks, hospital readmissions, and even individual patient responses to treatments.

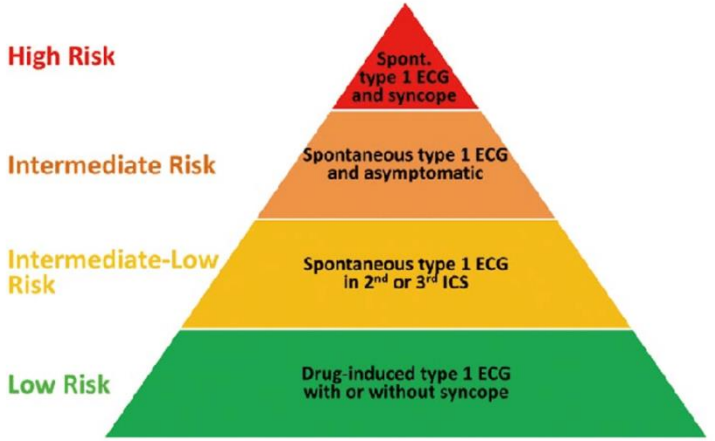
PROVIDING CLINICAL DECISION SUPPORT

Clinical decision support is one of the most impactful use cases for healthcare predictive analytics.

Successful risk scoring can bolster clinical decision-making, enabling health systems to identify risk factors within a patient population and pursue risk mitigation. Risk scores are developed by flagging relevant risk factors for an adverse event, such as a family history of high blood pressure, and investigating how one or more factors impact a patient's risk.

Risk scores can then be incorporated into risk-scoring models, which pull data from multiple sources to stratify risk on an individual or population level.

Risk scoring and stratification have many use cases in healthcare, including helping care teams forecast disease progression or treatment success. This is particularly useful for clinical decision support in chronic disease management.



Justified Stories with Agent-Based Modelling for Local COVID-19 Planning

Jennifer Badham[a] , Pete Barbrook-Johnson[b] , Camila Caiado[a] and Brian Castellani[a]

[a]Durham University, United Kingdom; [b]Centre for Research in Social Simulation, University of Surrey, United Kingdom

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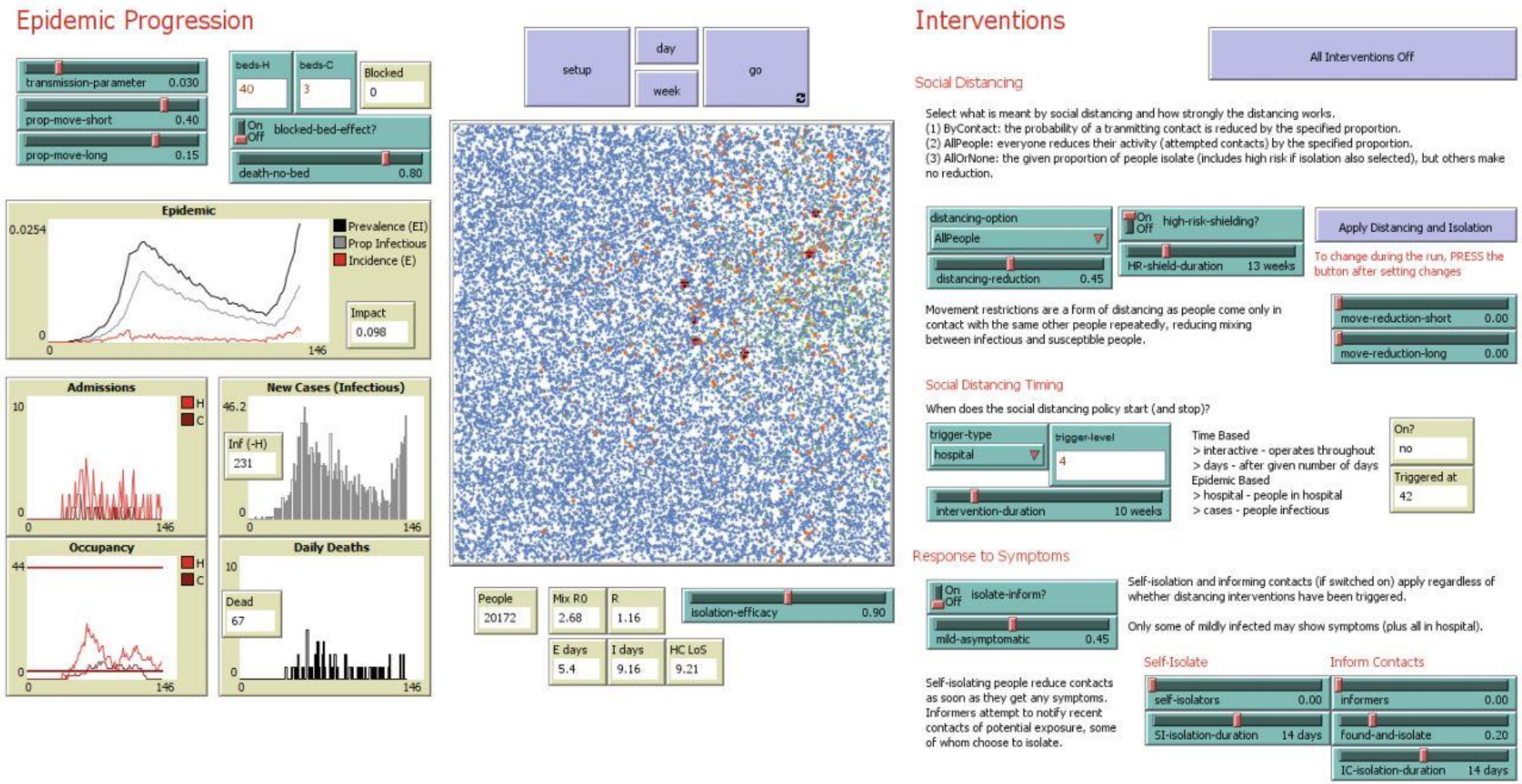


Key Areas Where AI is Used in Healthcare:

3. **Drug Discovery and Development**: AI accelerates the process of drug discovery by identifying potential drug candidates and predicting their effects on the human body. It can also help in the design of clinical trials by identifying suitable patient populations and optimizing trial protocols.

nature

Setting the agenda in research

Comment

JEKESAI NJIKIZANA/AFP/GETTY

AI can help to tailor drugs for Africa — but Africans should lead the way

Gemma Turon, Mathew Njoroge, Mwila Mulubwa, Miquel Duran-Frigola & Kelly Chibale

Computational models that require very little data could transform drug development research in Africa, as long as infrastructure, trained staff and secure databases are available.

How a person will respond to a drug is, in part, determined by their genetics. Africa holds the world's most genetically diverse human population, and the United Nations estimates that, by 2050, the continent will be home to nearly 25% of the world's people. Yet pharmacogenomics research — studies of how genetic variation plays into drug responses — is sorely lacking in African populations.

Less than 5% of the data in the pharmacogenomics database PharmGKB are from African populations[1]. And of more than 300 drugs for which the US Food and Drug Administration provides pharmacogenetic advice, only 15 have been studied in African groups[2].

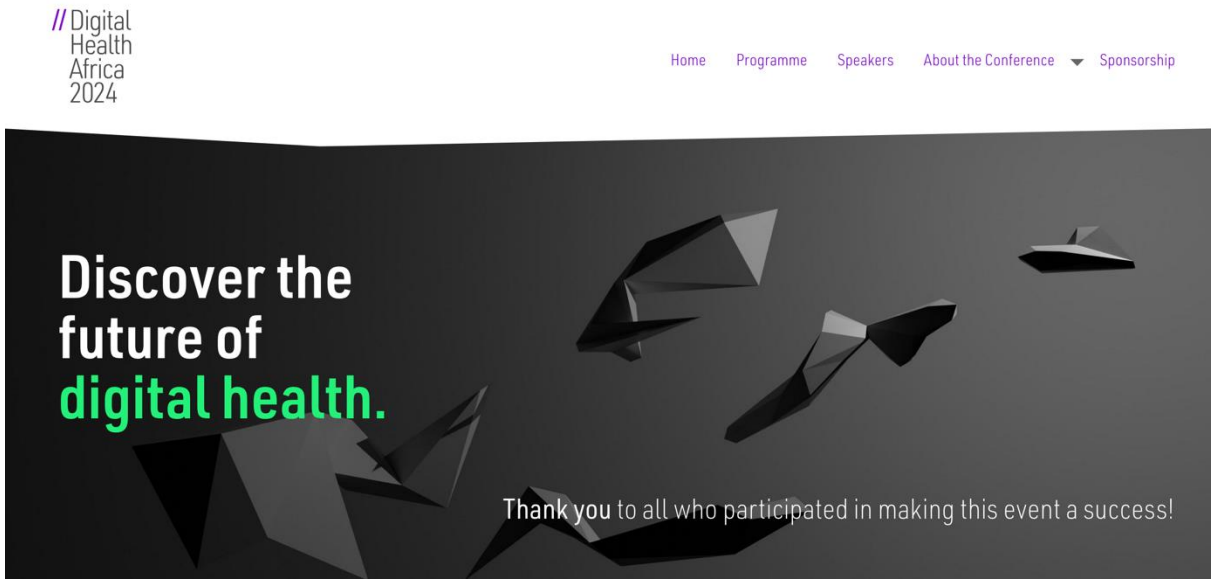
Artificial intelligence (AI) can help to close the gap. AI models trained to identify pharmacogenetic variants — DNA mutations that might affect how a drug acts — are emerging in many countries in the global north. But a dearth of genetic data for African populations, along with a lack of training and infrastructure, is holding up the use of such models in Africa. Here, we outline ways to overcome these hurdles.

Africa needs pharmacogenetics

Pharmacogenetic data have two key purposes. First, they can be used to select the best drugs for an individual person — for example, people with a pharmacogenetic mutation in an immune-response gene called HLA-B are hypersensitive to the antiviral drug abacavir, and should therefore be prescribed alternatives[3]. Second, such information can be used to refine the dose of existing drugs. For instance, a mutation in the gene *CYP2C9*, which encodes a cytochrome P450 enzyme involved in drug metabolism, results in reduced breakdown of the commonly used blood thinner warfarin.

Key Areas Where AI is Used in Healthcare:

4. **Personalized Medicine**: AI enables the customization of healthcare, tailoring treatments to individual patients based on their genetic makeup, lifestyle, and other factors. This approach can improve treatment outcomes and reduce side effects.



The healthcare landscape in Africa is undergoing a transformative shift through Digital Health Innovations, predominantly driven by the integration of Artificial Intelligence (AI), Telemedicine, and advanced computing. These technologies are playing a pivotal role in addressing complex healthcare challenges exacerbated by underfunding and resource limitations. South Africa's digital health initiatives and Kenya's early AI deployments exemplify the significant impact on healthcare delivery and patient outcomes. Telemedicine, gaining prominence during the COVID-19 pandemic, has emerged as a key component in this digital revolution, offering alternative healthcare solutions despite its evolving efficacy.

However, the successful implementation of these technologies is contingent upon addressing critical issues such as data protection, privacy, and regulatory frameworks. Furthermore, digital health interventions have contributed to lowering healthcare costs and enhancing clinical research, addressing broader challenges like lower life expectancy and high maternal mortality. This digital transformation, while promising, requires strategic frameworks to ensure effective resource utilization and sustainable impact on African healthcare.

Key Areas Where AI is Used in Healthcare:

5. **Virtual Health Assistants**: AI-powered chatbots and virtual assistants can provide patients with real-time health information, reminders for medication, or even mental health support. These tools can reduce the burden on healthcare professionals by handling routine queries and tasks.

nature africa

New AI chatbot will make African health data more usable

Tool will help researchers navigate complex data-sharing regulations hampering science, its creators say.

By Linda Nordling

Credit: Tippapatt/ iStock / Getty Images Plus

Law researchers in Africa have designed an artificial intelligence (AI) tool to help scientists on the continent share their data. They say the tool will help deal with complex laws governing data-sharing, which are “hindering a lot of science” according to Aliki Edgcumbe, a law scholar based at the University of KwaZulu-Natal, in South Africa, and one of the tool’s creators.

The chatbot, due to be launched next month, will be a free resource that scientists can use to untangle the legal side of data-sharing. It has been trained on the data regulations of 12 African countries – Botswana, Cameroon, Ghana, Kenya, Malawi, Nigeria, Rwanda, South Africa, Tanzania, The Gambia, Uganda and Zimbabwe – but more countries could be added, Edgecumbe says. Built using the same technology as ChatGPT, it “looks and feels” like talking to any other AI chatbot, she adds.

The tool has been developed by the Harnessing Data Science for Health Discovery and Innovation in Africa (DS-I Africa), a US$74.5 million five-year research programme funded by the National Institutes of Health in the United States to build data science capacity in Africa. The tool was initially envisaged as a written guide, but the launch of ChatGPT3 in November 2022 inspired Edgcumbe and her colleagues to adapt the technology for their own purpose.

Key Areas Where AI is Used in Healthcare:

6. **Robotic Surgery**: AI-powered robots assist in surgeries, offering greater precision and control than human hands alone. These systems can minimize invasive procedures, reduce recovery times, and improve patient outcomes.

MYBROADBAND
TRUSTED IN TECH

GADGETS | 29.06.2024

South Africa's life-changing surgery robots

By Staff Writer

Within South Africa's beleaguered public health sector – unsettled by budget cuts, understaffing, and divisive NHI legislation – cutting edge surgical robots that have been used to perform more than 600 surgeries at two Cape Town public hospitals are beacons of excellence that offer a glimmer of hope. Spotlight's Biénne Huisman visited Dr Tim Forgan at Tygerberg Hospital to learn more.

Cutting-edge robotic surgery might not immediately come to mind when one thinks of public hospitals, but in a first for public healthcare in South Africa, such systems are being used at two hospitals in the Western Cape.

The da Vinci Xi systems enable surgeons to control operations from a console – steering three arms with steel "hands" equipped with tiny surgical instruments; plus a fourth arm bearing a video camera (the laparoscope).

The system translates a surgeon's hand movements in real time, with enhanced precision, range and visuals, compared to manual surgery.

Key Areas Where AI is Used in Healthcare:

7. **Administrative Automation**: AI helps in automating administrative tasks such as scheduling, billing, and managing patient records. This reduces the workload on healthcare staff and allows them to focus more on patient care.

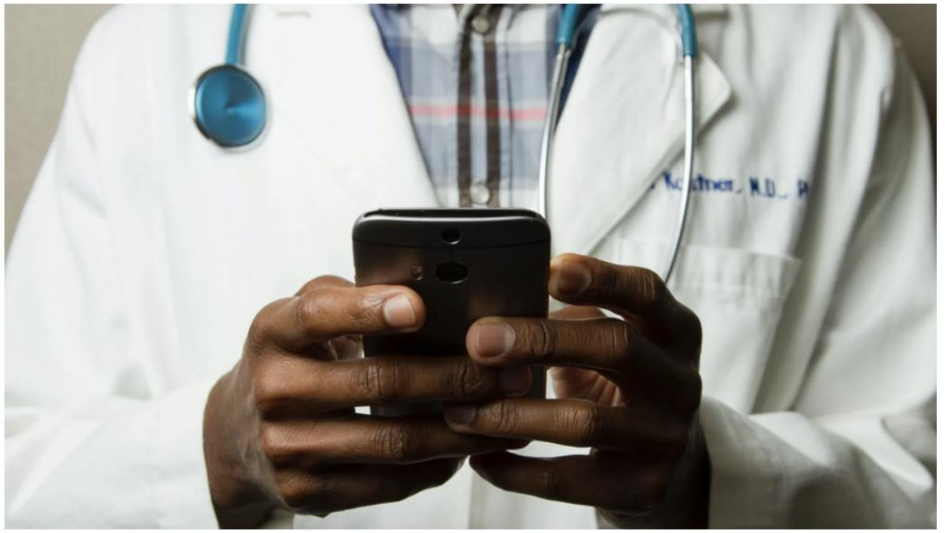
IOL

Written by

Wesley Diphoko

Editor-In-Chief, Fast Company South Africa

We need national health digital systems to make NHI a reality



One day you will walk into a general practitioner's room and they will know everything they need to know about your t health situation before you even speak, says the author. Photo: Supplied

Published May 21, 2024

Key Areas Where AI is Used in Healthcare:

8. **Remote Monitoring**: AI facilitates remote patient monitoring through wearable devices that track vital signs and other health metrics. These devices can alert healthcare providers to potential issues in real-time, enabling timely interventions.

TECHCENTRAL

Air pollution in South Africa: IoT devices use AI to monitor hotspots

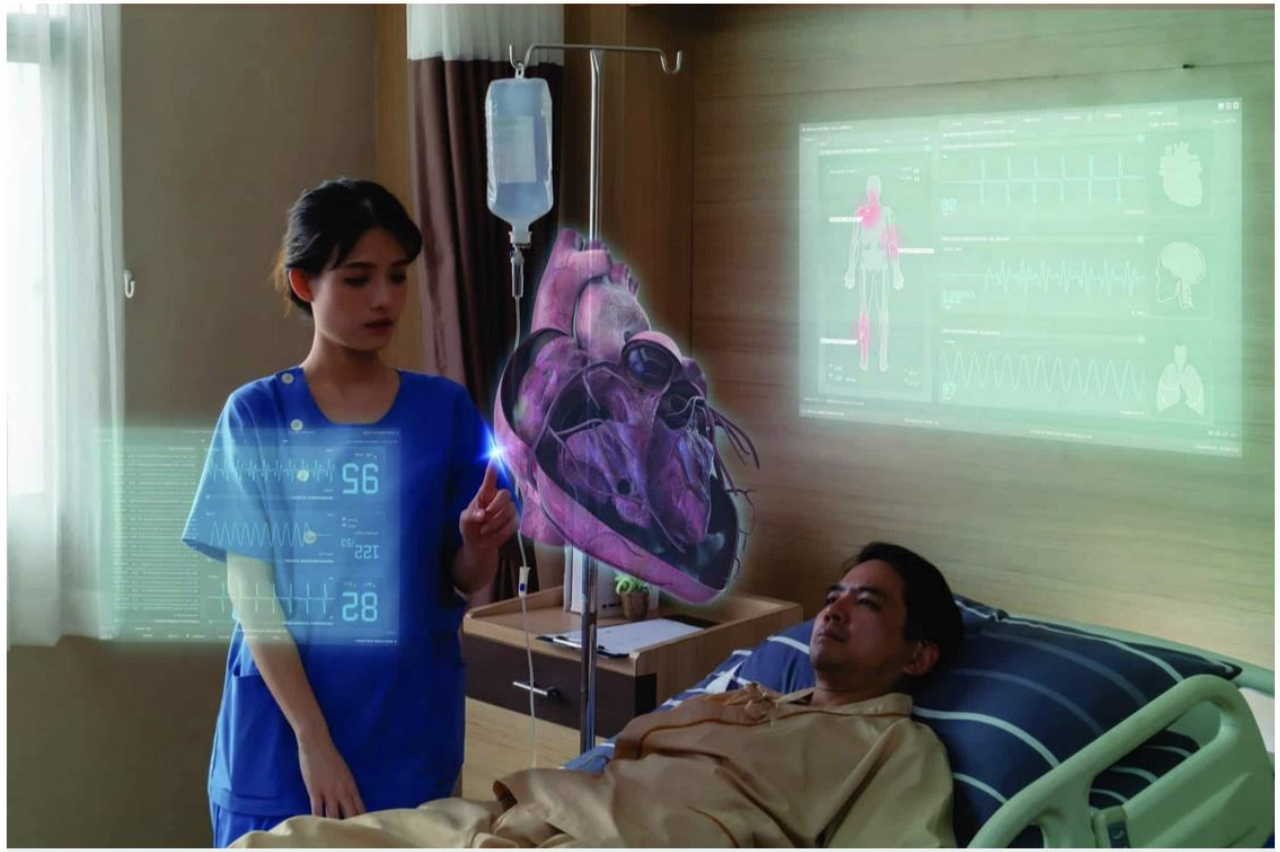
South African scientists have launched a cost-effective air-quality monitoring system built on IoT and AI technologies.

By **Bruce Mellado** — 15 August 2024

Air quality has become one of the most important public health issues in Africa. Poor air quality kills more people globally every year than HIV, TB and malaria combined. And that's just the tip of the iceberg. Air pollution makes people less productive because they get headaches and feel tired.

Expert Views: Could A Digital Twin Save Your Life?

Published 4 months ago
By **Forbes Africa** | Tiana Cline



(Source: Getty Images)

Human digital twins are quickly moving beyond manufacturing and into the medical world – advancing cancer care, speeding up drug development, personalizing clinical trials, and much more.

These are just some examples.

We can also look at AI in public health and mental health.

So, what about the barriers to effectively using this work?

Let’s ask ChatGPT. . .

But also, let’s see what we think of its answers?

Do we agree?

BARRIERS TO CHANGE: In South Africa, the challenges of implementing AI in healthcare are shaped by the country's unique socio-economic, infrastructural, and regulatory environment. Here are some of the key challenges:

1. Data Privacy and Security

• **Regulatory Compliance**: South Africa's Protection of Personal Information Act (POPIA) sets strict guidelines on data privacy. Ensuring compliance while leveraging AI for healthcare is complex.
• **Cybersecurity Risks**: The healthcare sector is increasingly targeted by cybercriminals, and many institutions may lack robust cybersecurity measures to protect sensitive data.

2. Infrastructure and Access

• **Digital Divide**: There is significant inequality in access to healthcare and digital resources. Many rural and underserved areas lack the necessary infrastructure to implement AI effectively.
• **Limited Healthcare IT Systems**: Many healthcare facilities, particularly in rural areas, still rely on paper records or outdated IT systems, making it difficult to integrate AI solutions.

3. Data Quality and Availability

• **Fragmented Data**: Healthcare data in South Africa is often scattered across various public and private systems, making it challenging to gather comprehensive datasets for AI training.
• **Limited Data**: In certain areas, there is a lack of comprehensive, high-quality data, particularly for diseases and conditions that are more prevalent in the South African context.

4. Regulatory and Ethical Issues

• **Regulatory Framework**: The regulatory framework for AI in healthcare is still evolving in South Africa, and there may be uncertainty about how existing regulations apply to new technologies.
• **Ethical Concerns**: Issues such as informed consent, especially in diverse cultural contexts, and the potential for AI to make autonomous decisions in healthcare, are critical ethical challenges.

5. Healthcare Inequality

- **Resource Disparities**: There is a stark contrast between the quality of healthcare available in private and public sectors, with AI solutions more likely to be adopted in well-funded private institutions.
- **Bias in AI Systems**: AI systems trained on global datasets may not account for the specific health challenges and demographics of South Africa, leading to biased or less effective outcomes.

6. Cost and Economic Barriers

- **High Implementation Costs**: The cost of developing and deploying AI systems is high, and many public healthcare facilities in South Africa operate on tight budgets.
- **Economic Inequality**: The economic divide in South Africa could lead to disparities in access to AI-enhanced healthcare, with wealthier individuals and private institutions benefiting more.

7. Trust and Acceptance

• **Cultural Differences**: There may be varying levels of trust in AI technologies across different cultural and socio-economic groups, affecting the adoption and effectiveness of these systems.
• **Healthcare Professional Resistance**: There may be resistance from healthcare professionals who are concerned about job displacement or who may not fully trust AI-based decision-making.

8. Educational and Skill Gaps

• **Lack of Expertise**: There is a shortage of professionals with expertise in both AI and healthcare, which is necessary for developing and implementing AI solutions effectively.
• **Training and Upskilling**: Continuous training is required for healthcare workers to effectively use AI tools, and there may be gaps in providing this education.

9. Interoperability

• **System Integration**: Integrating AI with existing healthcare systems can be challenging, especially when dealing with outdated or incompatible technologies.
• **Standardization**: There is a need for standardized protocols to ensure AI systems can communicate with different healthcare IT systems effectively.

10. Sustainability and Maintenance

• **Ongoing Support**: AI systems require ongoing support and updates, which can be difficult to maintain, especially in resource-constrained environments.
• **Sustainability**: Ensuring the sustainability of AI projects, particularly in the public sector, is challenging due to funding and resource constraints.

Addressing these challenges in South Africa requires a coordinated effort among government, healthcare providers, technology companies, and academic institutions. This involves not only developing appropriate AI solutions but also ensuring that these technologies are accessible, equitable, and sustainable across diverse healthcare settings.

LEVERS TO CHANGE: Implementing AI more effectively in healthcare in South Africa requires a multifaceted approach that considers the unique challenges and opportunities within the country's healthcare system. Here are several strategies to achieve this:

1. Strengthening Infrastructure

• **Digital Infrastructure:** Invest in robust digital infrastructure, including reliable internet access, data centers, and cloud services, particularly in rural and underserved areas. This will enable the seamless integration of AI technologies.
• **Electronic Health Records (EHRs):** Implement standardized EHRs across public and private healthcare facilities to ensure data consistency and availability for AI applications, such as predictive analytics and personalized medicine.

2. Developing Local AI Solutions

• **Contextual Relevance:** Encourage the development of AI solutions that address local health challenges, such as infectious diseases (e.g., HIV/AIDS, tuberculosis), maternal and child health, and non-communicable diseases (e.g., diabetes, hypertension).
• **Collaboration with Local Institutions:** Partner with local universities, research institutions, and startups to create AI tools tailored to the South African context, ensuring they are culturally and linguistically appropriate.

3. Training and Capacity Building

- **Healthcare Professionals:** Provide training for healthcare professionals on how to use AI tools effectively in their practice. This includes understanding the benefits and limitations of AI in diagnostics, treatment planning, and patient management.
- **Data Science and AI Skills:** Increase investment in education and training programs focused on AI and data science to build a local talent pool that can drive innovation in healthcare.

4. Ensuring Data Privacy and Security

- **Regulatory Frameworks:** Strengthen regulatory frameworks to protect patient data privacy and ensure compliance with laws like the Protection of Personal Information Act (POPIA). Clear guidelines on data sharing and consent are essential for building trust in AI systems.
- **Secure Data Management:** Implement robust cybersecurity measures to protect healthcare data from breaches, which is critical for the safe use of AI in healthcare.

5. Addressing Ethical and Social Implications

• **Bias Mitigation:** Ensure that AI algorithms are trained on diverse datasets that represent the South African population to avoid biases in healthcare delivery.
• **Equitable Access:** Develop policies to ensure that AI-driven healthcare solutions are accessible to all, including disadvantaged communities, to prevent widening the healthcare inequality gap.

6. Public-Private Partnerships

• **Collaboration:** Foster partnerships between the government, private sector, and non-governmental organizations (NGOs) to drive AI innovation in healthcare. Joint initiatives can help scale successful pilot projects and integrate AI into the broader healthcare system.
• **Funding and Support:** Provide funding and incentives for startups and companies developing AI technologies that can improve healthcare outcomes in South Africa.

7. Piloting and Scaling AI Applications

- **Pilot Projects:** Start with pilot projects in key areas such as telemedicine, disease surveillance, and drug discovery, which can provide valuable insights into the effectiveness of AI in the South African context.
- **Scaling Successes:** Once pilot projects demonstrate success, scale them across the healthcare system, ensuring that lessons learned are applied to improve implementation.

8. Community Engagement and Awareness

- **Public Awareness Campaigns:** Educate the public about the benefits and limitations of AI in healthcare. This will help in gaining public trust and acceptance of AI technologies.
- **Involving Communities:** Engage communities in the development and implementation of AI tools to ensure that they meet the needs of the population and address concerns about their use.

9. Leveraging AI for Public Health

- **Disease Outbreak Prediction:** Utilize AI for real-time disease outbreak prediction and management, which is crucial for responding to public health emergencies.
- **Health System Efficiency:** Apply AI to optimize resource allocation, manage healthcare supply chains, and improve the efficiency of healthcare delivery systems.

10. Monitoring and Evaluation

- **Continuous Assessment:** Establish mechanisms for the continuous monitoring and evaluation of AI applications in healthcare. This will help in identifying areas for improvement and ensuring that AI tools are delivering the expected outcomes.

So, what do we think?

How well did Chat GTP get it right?

What barriers or levers to change did it miss?

What do we need to do next?