



Enhancing Healthcare Quality Through AI and Digital Health Transformation: Opportunities and Challenges

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Agenda

01 **Healthcare Systems & Quality**

02 **Digital Health Transformation (DHT), WHO DHT Strategy**

03 **AI, DHT & the Healthcare Journey**

04 **Odeh's 12 QRs Driven AI Healthcare Model**

05 **AI & Healthcare Quality: Domain-Specific Perspectives**



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HealthCare System

“The organization of people, institutions, and resources that deliver healthcare services to meet the health needs of a specific population.”¹

- ➔ Organisation of **services & resources.**
- ➔ Delivery of **healthcare services.**
- ➔ Meet the **health needs of a population.**

¹World Health Organization. (2000). *The World Health Report 2000: Health Systems: Improving Performance*. Geneva: WHO.



HealthCare Quality

”The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.”¹

- *Improving* health outcomes
- *Adhering* to evidence-based practices
- *Ensuring care* is effective and safe
- *Aligning with* current professional standards.

¹Definition provided by the **Institute of Medicine**. (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: The National Academies Press. *Institute of Medicine (IOM)*, is now part of the **National Academy of Medicine (NAM)**.



How GA4DH Views “Digital Health”?

*“The **employment of AI and Digital Technologies** to empower healthcare providers, whether individuals or institutions, to deliver innovative solutions that **support the** enrichment and enhancement of the **healthcare journey** for individuals, while adhering to ethical, cultural, and regulatory requirements.”¹*

¹<https://www.ga4dh.org>, accessed November 10, 2025



How GA4DH Views “Digital Health Transformation”?

*“The **process** of **employing** AI & Digital Technologies to empower healthcare providers, whether individuals or institutions, to deliver innovative solutions that **support the** enrichment and enhancement of the **healthcare journey** for individuals, while adhering to ethical, cultural, and regulatory requirements.”¹*

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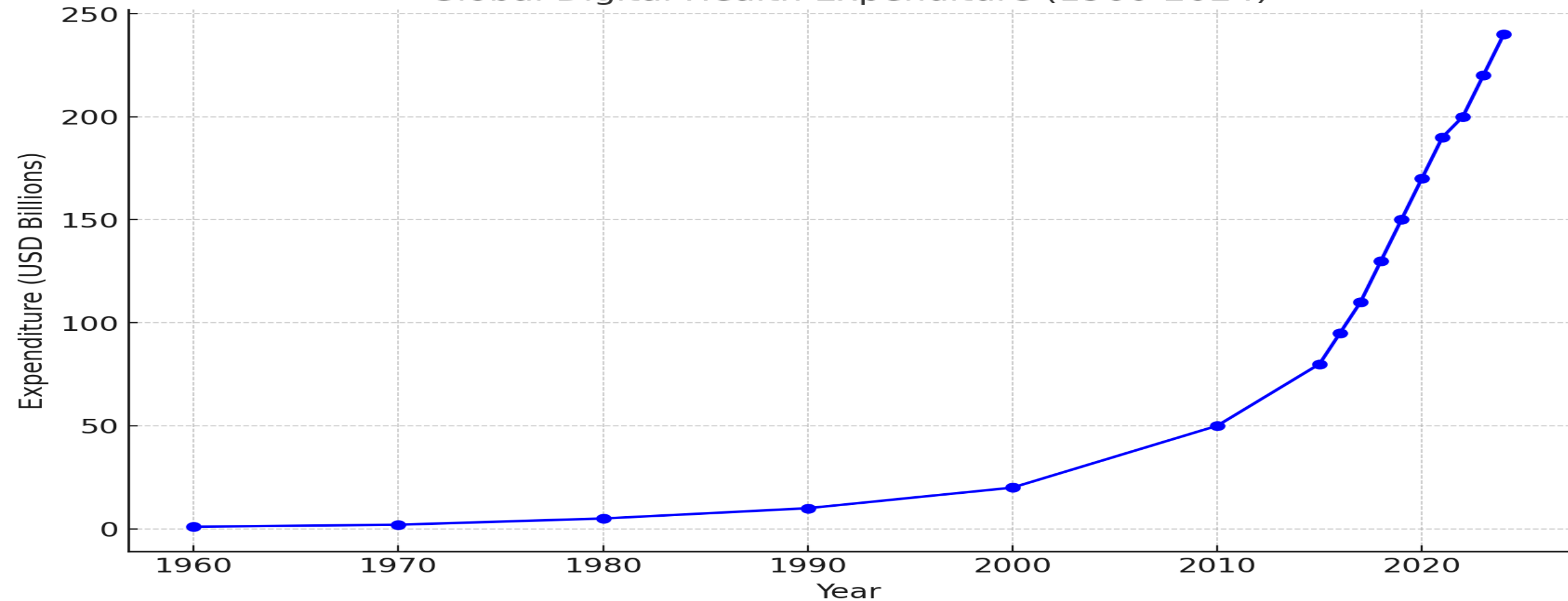
“WHO” View of Digital Health

*“The **field of knowledge and practice** associated with the development and use of digital technologies **to improve health**. Digital health expands the concept of eHealth to include digital consumers, with a wider range of smart-devices and connected equipment. It also encompasses other uses of digital technologies for health such as the Internet of things, artificial intelligence, big data and robotics.”*

Source: World Health Organization. (2021). *Global strategy on digital health 2020-2025*.
World Health Organization. https://www.who.int/docs/default-source/documents/ga4dh/en-ga4dh_a72_28-en.pdf



Global Digital Health Expenditure (1960-2024)



- [1] World Health Organization (WHO) (2021) *Global strategy on digital health 2020-2025*. Available at: <https://www.who.int/publications/i/item/9789240020924> (Accessed: 20 September 2024).
[2] Statista (2022) *Digital health market size worldwide from 2019 to 2025*. Available at: <https://www.statista.com/statistics/1092869/digital-health-market-size-globally/> (Accessed: 20 September 2024).
[3] Grand View Research (2023) *Digital health market analysis and forecast report*. Available at: <https://www.grandviewresearch.com/industry-analysis/digital-health-market> (Accessed: 20 September 2024).
[4] McKinsey & Company (2020) *Digital health: A call to action*. Available at: <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/digital-health-a-call-to-action> (Accessed: 20 September 2024).

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Digital Health Healthcare Priorities: Odeh's 12 QRs (Quality Requirements) Driven Digital & AI Healthcare Model

Security

Sustainability

*Ethical
Adherence*

*Privacy &
Confidentiality*

Digital
HealthCare
Priorities –
QUALITY
Requirements

*Regulatory
Adherence*

InterOperability

Safety

Scalability

Reliability

Accessibility

Equitability

Transparency

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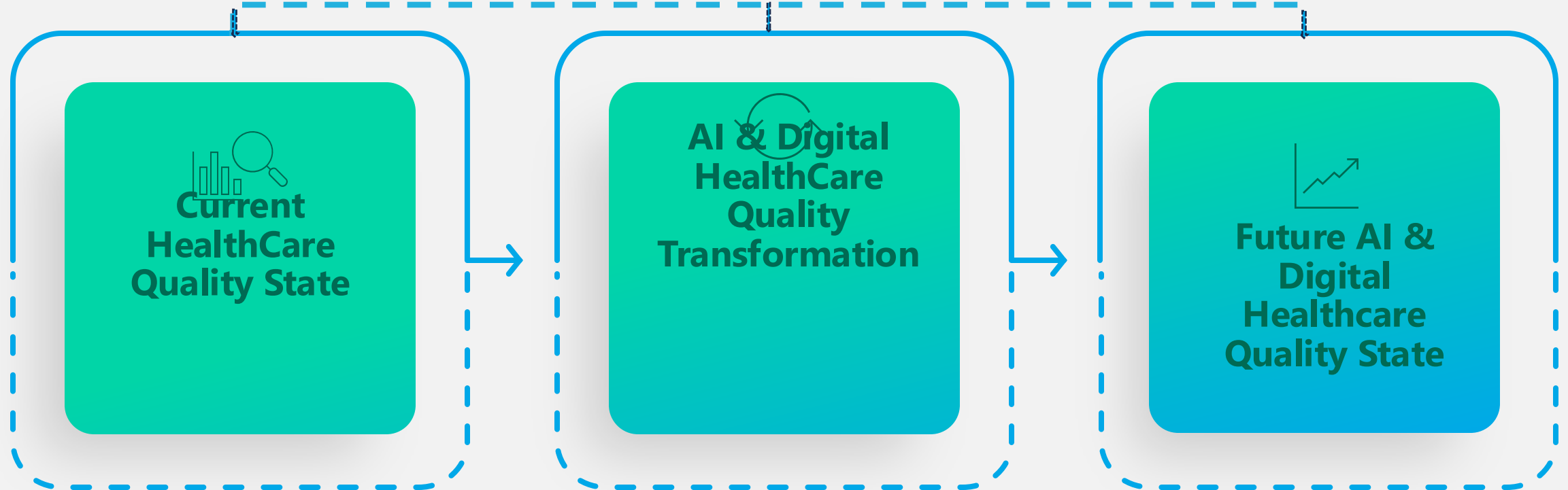


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AI & Digital Health Transformation: Odeh' View, Healthcare Quality Roadmapping



Driven by AI & Digital Health Design

DIGITAL HEALTH TRANSFORMATION

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Patient Journey \subseteq *Healthcare Journey*

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AI & Healthcare Journey – Domain Quality Perspectives



AI & Healthcare Integration



**AI Ethical Issues &
Regulating Healthcare**



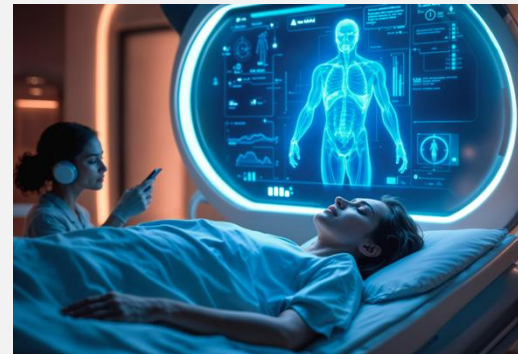
AI in Diagnostics



AI & Precision Medicine



**AI & Robotics Assisted
Surgery**



AI & Patient Monitoring



AI in Drug Discovery



AI & Predictive Analytics

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AI in Healthcare

- **Role & Impact:**

- more accurate diagnostics,
- efficient resource management,
- predictive healthcare analytics (anticipate patient needs before crises occur).

- **Opportunities:**

- Automation of routine tasks,
- Enhanced Decision-Making,
- Personalized care.

- **Limitations & Flaws:**

- Risks of bias in AI algorithms,
- Data privacy concerns,
- Over-reliance on automated systems may lead to reduced human oversight.

- **Impact on Quality:**

- Applied ethically and with higher accuracy, → significantly improve care quality;
- Algorithmic Flaws Adversely Impactful: Mis-diagnoses, trust undermined ...



AI in Healthcare: Historical Context and Evolution

- **Role & Impact:**

- ➔ From early Rule-Based Systems to Machine Learning (ML) & Deep ML.

- **Opportunities:**

- ➔ Foundations for Scalable, Data-driven Quality Management Tools.

- **Limitations & Flaws:**

- ➔ Historically, early systems lacked robustness against data variability;

- ➔ Current systems can inherit biases from training data. Data privacy concerns.

- **Impact on Quality:**

- ➔ Continuous refinement has improved reliability but underscores the importance of rigorous validation.



AI & Healthcare Journey – Domain Quality Perspectives



AI & Healthcare Integration

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Challenges in AI Healthcare Integration

- **Role & Impact:**

- Effective integration of AI into healthcare workflows can enhance efficiency and consistency, improving overall quality management..

- **Opportunities:**

- Automation of administrative tasks, improved data sharing, and real-time decision support.

- **Limitations & Flaws:**

- Technical interoperability issues, high initial costs, and resistance from healthcare staff. AI systems can also be misaligned with existing workflows if poorly implemented..

- **Impact on Quality:**

- While integration promises to enhance quality, flawed systems or poor implementation can cause delays or errors, undermining trust and outcomes.



AI & Healthcare Journey – Domain Quality Perspectives



AI Ethical Issue & Regulating Healthcare

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AI & Ethical Considerations in Healthcare

- **Role & Impact:**

- Can ethical AI maintain trust in healthcare?

- **Opportunities:**

- Can AI maintain fair and transparent decision-making?

- **Limitations & Flaws:**

- Biases, lack of accountability, potential misuse, etc.

- **Impact on Quality:**

- Ethical lapses erode trust; rigorous oversight essential.



AI in Improving Quality of Healthcare Regulation

- **Role & Impact: Transforming Quality of Healthcare Regulation**

- Automating compliance check → Data patterns indicating non-compliance.
- Enhanced efficiency and effectiveness of regulatory processes.
- Reducing costs: the time and resources required for compliance checks.
- Improved speed and accuracy of regulatory oversight.
- Example Case Study:
 - Application of AI by FDA AI to streamline the approval process for new drugs and medical devices.
 - Increasing efficiency and reducing review times.

- **Opportunities:**

- **Proactive Monitoring & Intervention:** predicting compliance issues → potential regulatory breaches before they occur.
- **Data Analytics:** Detecting anomalies, trends, and areas of risk → improving regulatory focus. Personalized care.
- **Tailored Regulation: Adaptation** of regulatory frameworks → rules are responsive to the current state of the healthcare environment.
- Obermeyer, Z., & Emanuel, E. J. (2016). Predicting the Future — Big Data, Machine Learning, and Clinical Medicine. The New England Journal of Medicine, 375(13), 1216-1219.

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AI in Improving Quality of Healthcare Regulation

• Flaws & Limitations

- ➔ **Algorithmic Bias:** AI systems can inadvertently introduce or perpetuate biases found in training data, leading to unequal regulatory oversight.
- ➔ **Data Privacy:** Increased use of AI requires stringent data security measures to protect sensitive healthcare data.
- ➔ **Technical Challenges:** Implementing AI in regulatory processes requires complex technical infrastructure and expertise that may not be readily available.
- ➔ **Example Flaws:** Bias in AI-driven decisions can result in skewed regulatory actions, impacting fairness. Source: Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science*, 366(6464), 447-453.

• Impact on Quality of Healthcare Regulation

- ➔ **Enhanced Compliance:** Providing regulators with accurate, timely, and actionable insights.
- ➔ **Increased Efficiency:** Reduced regulatory burden ➔ human resources on strategic priorities.
- ➔ **Agility and Adaptability:** Regulatory bodies adapting to new health challenges ➔ improving regulatory relevance and effectiveness.
- ➔ Topol, E. J. (2019). High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44-56.

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AI & Healthcare Journey – Domain Quality Perspectives



AI in Diagnostics

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AI in Diagnostics

- **Role & Impact:**

- Accelerating diagnosis.
- Improving accuracy.
- Enhance quality with reducing human diagnosis error.

- **Opportunities:**

- Even further aster diagnoses.
- Enhancing early disease detection.
- Vital role in NCD enhanced screening, for example.

- **Limitations & Flaws:**

- ML algorithms accuracy: FP, FN, bias towards specific training on specific populations.
- Current systems can inherit biases from training data. Data privacy concerns.

- **Impact on Quality:**

- Validation protocols.
- Can clinicians oversight be balanced?



AI in Diagnostics - Radiology

- **Role & Impact:**

- Image analysis → diagnostic precision → Improving accuracy → Freeing radiologists' resources.
- Reshaping the future of radiology practice.

- **Opportunities:**

- Faster readings,
- Standardised interpretation,
- Cost reduction.
- Accelerating early disease detection, eg Breast Cancer Screening Programmes

- **Limitations & Flaws:**

- Variability in algorithms accuracy → training and testing datasets.
- Over-reliance on AI Black Boxes → Risk of deskilling radiologists.

- **Impact on Quality:**

- Readiness of Validation protocols.
- Can improve diagnostic consistency while flawed ML models compromising safety.



AI & Healthcare Journey – Domain Quality Perspectives



AI in Precision & Personalised Medicine

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AI in Precision & Personalised Medicine

- **Role & Impact:**

- ➔ Personalise treatments ➔ improving healthcare quality outcomes.

- **Opportunities:**

- ➔ More effective treatments.

- ➔ Fewer side effects.

- **Limitations & Flaws:**

- ➔ Complexity of big data data integration;

- ➔ Risk of inaccurate predictions if data is incomplete or biased.

- **Impact on Quality:**

- ➔ Increases efficacy

- ➔ But, what about flawed data that can reduce confidence in AI recommendations?



AI & Healthcare Journey – Domain Quality Perspectives



AI & Robotics-Assisted Surgery

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AI in Robotics-Assisted Surgery


- **Role & Impact:**

- Enhanced surgical precision.
- Reduced complication rates.



- **Opportunities:**

- Minimal invasive surgeries.
- Recovery 
- Repeat operating 
- Cost 

- **Limitations & Flaws:**

- Technical malfunctions.
- Costs 
- Limited availability.

- **Impact on Quality:**

- Significant improved outcomes 
- Flawed robotic systems → Safety 



AI & Healthcare Journey – Domain Quality Perspectives



AI & Patient Monitoring

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AI in Patient Monitoring

- **Role & Impact:**
 - Improved management of chronic diseases.
- **Opportunities:**
 - Early detection of deterioration.
 - Personalised alerts.
- **Limitations & Flaws:**
 - Data overload.
 - False alarms.
 - Privacy issues.
- **Impact on Quality:**
 - Improves safety ↔ Accuracy
 - Flawed data ↔ over-treatment
 - Flawed data ↔ false alarms



AI & Healthcare Journey – Domain Quality Perspectives



AI & Predictive Healthcare Analytics

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AI & Predictive Healthcare Quality Analytics

- **Role & Impact:**

- Anticipates adverse events.
- Promoting higher preventative care.
- Resources' optimisation.

- **Opportunities:**

- Patient safety 
- Hospital readmissions 

- **Limitations & Flaws:**

- Prediction errors (bias in predictive models)
 - Unnecessary interventions.
 - Missed risks.

- **Impact on Quality:**

↔ Transparent Validation Processes. (Do we have them readily available?)



AI & Healthcare Journey – Domain Quality Perspectives



AI in Drug Discovery

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AI in Drug Discovery

- **Role & Impact:**

- ➔ Speeds up identification of therapeutic candidates, increasing treatment options.

- **Opportunities:**

- ➔ Rapid response during health crises.

- **Limitations & Flaws:**

- ➔ AI-generated hypotheses need rigorous validation; potential biases in data may lead to ineffective drugs.

- **Impact on Quality:**

- ➔ Accelerates innovation, but flawed models can lead to costly errors



Conclusion

- **Summary:**

- ➔ AI is poised to revolutionise healthcare with innovations like autonomous diagnostics, AI-driven policy planning, and global health surveillance.

- **Role & Impact:**

- ➔ Central in driving the future of healthcare both positively and negatively; responsible implementation is essential.

- **Opportunities & Flaws:**

- ➔ Exploit AI's opportunities for better outcomes, but be vigilant about biases, privacy issues, and system failures.

- **Final Takeaway on AI & Qualitative Healthcare:**

- ➔ AI integration into healthcare must be guided by ethical principles, rigorous validation, and inclusive policies to truly enhance healthcare quality and equity.



لَئِن شَكَرْتُمْ لَأَزِيدَنَّكُمْ

If you are grateful, I will surely give you more and more.

Thank You ...

