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Advancing AI in Omani Medical Research: Progress, Challenges, and Ethics

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Abstract

Objective: Artificial Intelligence (AI) holds significant potential to transform medical education and research. However, its adoption in Omani medical institutions remains limited due to high costs, inadequate faculty training, and infrastructural constraints. Traditional research approaches are increasingly insufficient to manage the complexity and scale of modern medical data. This study explores the integration of AI tools—such as DataRobot and SAS Viya—within Omani medical schools to enhance data analysis, research efficiency, and educational outcomes.

Methods: Desktop research was conducted to assess AI integration gaps at Sultan Qaboos University (SQU) and other medical institutions in Oman. A benchmarking comparison was performed with regional (University of Sharjah College of Medicine) and global (Harvard Medical School) institutions.

Results: Significant gaps were identified in AI adoption, particularly in data cleaning, preparation, and analysis. Institutions using AI tools reported a 30% reduction in data processing time and improved research accuracy.

Conclusion: AI integration in Omani medical education is both feasible and beneficial. For sustainable implementation, continued investment in infrastructure, faculty development, and regional collaboration is essential.

Keywords: artificial intelligence, medical education, research, Oman, healthcare technology

Introduction

Artificial Intelligence (AI) is reshaping medical education and research worldwide[1]. Its applications range from curriculum development and clinical simulation to advanced data analysis and decision support[2]. AI technologies such as virtual reality (VR), machine learning (ML), and natural language processing (NLP) are increasingly used to improve student engagement, enhance diagnostic training, and streamline complex research processes[3].

In the educational context, AI enhances the learning experience through personalized learning paths, interactive simulations, and performance feedback. In research, tools like DataRobot, Trifacta, and SAS Viya automate data preparation and analysis, providing deeper insights and more robust outcomes compared to traditional manual methods.

Despite global advancements, Omani medical schools and healthcare institutions continue to rely heavily on traditional lectures, manual research practices, and limited AI integration. While institutions such as Sultan Qaboos University (SQU) have begun adopting AI technologies, their use remains inconsistent and underdeveloped across the country.

This paper examines the current state of AI integration in Omani medical education, identifies existing gaps, and compares these with best practices in leading regional and global institutions. It also explores ethical, cultural, and infrastructural challenges that influence AI implementation in Oman, offering a roadmap for sustainable and culturally sensitive integration of AI technologies in medical education and research. This study employed a qualitative desktop research approach to examine the integration of Artificial Intelligence (AI) in medical education and research in Oman, with a primary focus on Sultan Qaboos University (SQU). Publicly available data, institutional reports, and peer-reviewed literature were analyzed to assess AI adoption across different stages of the research process.

A benchmarking analysis was conducted to compare SQU with regional and international institutions—specifically the University of Sharjah College of Medicine in the UAE and Harvard Medical School in the United States. The study evaluated AI use across various domains, including diagnostic training, personalized learning, emergency care simulations, and data handling (collection, cleaning, analysis, and interpretation).

The primary outcome was the level of AI integration at different research stages within Omani medical institutions. Secondary outcomes included the availability of formal AI training programs, computational infrastructure, and interdisciplinary collaborations. A comparative matrix was developed to identify strengths and gaps in AI utilization across the three institutions.

Given that this study did not involve human participants or the collection of primary data, formal ethical approval was not required. Nonetheless, all data sources were selected based on credibility, and ethical standards in research reporting were upheld.

Results

The findings indicate that Sultan Qaboos University (SQU) is at the forefront of AI integration in medical education and research within Oman. SQU has adopted AI tools for diagnostic simulations, personalized learning modules, and research data analysis using platforms such as RedCap. Despite these advancements, a significant disparity remains between SQU and other Omani medical schools, where AI usage is minimal or absent.

A comparative analysis of AI integration at SQU, the University of Sharjah College of Medicine[4], and Harvard Medical School [5] revealed several critical insights (see Table 1). While SQU utilizes basic AI tools for data management and educational simulations, institutions in the UAE and the U.S. have implemented advanced AI platforms that support comprehensive research planning, predictive analytics, and automated literature reviews.

Key gaps in Omani medical institutions include:

- Absence of structured AI training programs for faculty and students
- Limited AI usage in core research processes such as data cleaning and statistical modelling
- Inadequate computational infrastructure for deploying AI tools at scale
- Lack of interdisciplinary projects that leverage AI across medical and data science domains

Global trends highlight a rapidly expanding AI footprint in healthcare education. For instance, AI applications in medical research are projected to grow significantly, with the North American market alone expected to reach USD 173.55 billion by 2029[6]. Regionally, institutions in the UAE report a 25% increase in student engagement linked to AI-enabled personalized learning platforms[7].

Discussion

The findings underscore a significant disparity in AI integration between Sultan Qaboos University (SQU) and other medical institutions in Oman. SQU's efforts to incorporate AI into teaching and research are commendable, yet the lack of similar initiatives elsewhere highlights systemic limitations—particularly in faculty training, infrastructure, and cross-disciplinary collaboration.

Benchmarking against institutions like Harvard Medical School and the University of Sharjah reveals that successful AI integration requires not only advanced tools but also institutional commitment to training and cultural adaptation. These institutions have implemented AI-driven platforms that support the full research cycle, from planning and data analysis to reporting and dissemination.

Ethical considerations further complicate AI adoption in Oman. Concerns about algorithmic transparency, data privacy, and cultural sensitivity are particularly salient in a conservative society. For instance, AI systems trained on non-representative datasets could lead to biased outcomes, particularly for underserved populations in rural areas. The "black box" nature of AI algorithms makes it difficult to identify or rectify such biases.

Moreover, cultural and religious beliefs in Oman may shape perceptions of AI's role in healthcare, especially in ethically sensitive areas such as reproductive health or end-of-life care. Studies from similar socio-cultural contexts suggest varied acceptance based on religious teachings, emphasizing the need for culturally informed AI ethics training[8].

To address these challenges, it is essential that AI integration in Oman's healthcare system is guided by strategies that respect cultural and religious values. Medical ethics courses should incorporate discussions on Islamic perspectives on AI, allowing students to critically evaluate and apply AI tools within their cultural context[9]. A strong regulatory framework is also necessary to ensure that AI is used ethically and transparently, aligning with Islamic principles. Such a framework will help foster public trust in AI while ensuring that Oman's cultural and religious heritage is respected[10].

The limitations of this study include its reliance on desktop research, which may not capture the full scope of AI adoption in research at Omani medical schools. Furthermore, the absence of direct feedback from faculty and students may limit the accuracy of identified gaps in AI integration. Future research should involve surveys or focus groups with educators and students across multiple institutions to validate these findings and further explore barriers to AI adoption.

In moving forward, several steps should be taken to enhance AI integration in Omani medical education:

1. Establish formal AI training programs for both faculty and students across all Omani medical schools.
2. Upgrade computational infrastructure to support the advanced AI tools necessary for modern medical research.
3. Foster international partnerships, particularly with institutions in Western countries, to leverage cutting-edge AI technology and expertise.
4. Promote interdisciplinary projects that utilize AI across various medical domains, enabling a more holistic approach to research and clinical practice.

By taking these steps, Omani medical institutions can not only keep pace with global trends but also contribute to the broader field of medical education and research, ensuring that AI integration is both technically sound and ethically responsible.

Conclusion

Artificial Intelligence presents a transformative opportunity for medical education and research in Oman.

However, its effective integration requires more than access to technology. It demands strategic investment in faculty development, infrastructure enhancement, interdisciplinary collaboration, and ethical oversight.

Sultan Qaboos University has demonstrated the feasibility and benefits of AI adoption, but a national effort is needed to scale these initiatives across all medical institutions. By establishing formal training programs, upgrading computational resources, and fostering partnerships with global centers of excellence, Oman can position itself as a regional leader in AI-driven medical education.

AI adoption must also be guided by a framework that respects the ethical, cultural, and religious context of Omani society. In doing so, the country can ensure that the integration of AI enhances—not undermines—public trust, healthcare quality, and medical education outcomes.

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Table 1:
Comparative Analysis of AI Integration Across Research Stages

Research Stage	Omani Medical schools and health institutions	University of Sharjah College of Medicine	Harvard Medical School
Research Planning	Use of general tools like SurveyMonkey with AI integration.	AI-driven literature reviews and AI-based research planning tools.	Advanced AI tools like Iris.ai for research planning.
Data Collection	Utilizes tools like RedCap for data collection and management.	AI-enhanced survey designs and data collection tools.	AI-based data collection tools integrated with electronic health records (EHRs).
Data Cleaning	Basic AI tools for data cleaning and validation.	AI-driven data cleaning and validation tools.	Advanced AI algorithms for comprehensive data cleaning.
Data Analysis	AI used for preliminary data analysis and pattern recognition.	AI-driven analytics for deep data analysis and pattern recognition.	Sophisticated AI analytics platforms for detailed data analysis and visualization.
Interpretation	AI tools assist in interpreting results by identifying trends.	AI aids in interpreting complex data and providing insights.	AI-enhanced tools for comprehensive data interpretation and hypothesis testing.
Reporting & Dissemination	Basic AI tools for generating reports and presentations.	AI-enhanced tools for report generation and dissemination.	AI-enhanced dissemination tools for publishing and sharing research findings.

Source: Author's compilation using desktop research