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Article

AI-driven telemedicine: Optimizing daily dietary recommendations amidst the COVID-19 pandemic

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Abstract: Amidst the COVID-19 pandemic, the imperative of physical distancing has underscored the necessity for telemedicine solutions. Traditionally, telemedicine systems have operated synchronously, requiring scheduled appointments. This study introduces an innovative telemedicine system integrating Artificial Intelligence (AI) to enable asynchronous communication between physicians and patients, eliminating the need for appointments and providing round-the-clock access from any location. The AI-Telemedicine system was developed utilizing Google Sheets and Google Forms. Patients can receive dietary recommendations from the AI acting as the physician and submit self-reports through the system. Physicians have access to patients' submitted reports and can adjust AI settings to tailor recommendations accordingly. The AI-Telemedicine system for patients requiring daily dietary recommendations has been successfully developed, meeting all nine system requirements. System privacy and security are ensured through user account access controls within Google Sheets. This AI-Telemedicine system facilitates seamless communication between physicians and patients in situations requiring physical distancing, eliminating the need for appointments. Patients have round-the-clock access to the system, with AI serving as a physician surrogate whenever necessary. This system serves as a potential model for future telemedicine solutions.

Keywords: artificial intelligence; telemedicine; COVID-19; patient portals; physical distancing

1. Introduction

Amidst the COVID-19 pandemic (Sharma, 2020), the need for physical distancing has propelled the widespread adoption of telemedicine in numerous healthcare facilities (Battineni et al., 2021; Brotman and Kotloff, 2021; Shoemaker et al., 2021). Typically, patients with chronic conditions consult physicians for recommendations and subsequently manage their medications at home. However, in non-crisis situations, telemedicine systems offer an alternative, with hospitals dispatching medications via post following remote consultations. Presently, telemedicine predominantly operates through basic telephone, video calls or online Apps, necessitating synchronous appointments between physicians and patients (Andrews et al., 2020). Synchronous systems operate in real-time, meaning all parts of the system communicate and process tasks simultaneously, often requiring immediate responses (video conferencing or live chatting). Asynchronous systems, on the other hand, do not require real-time interaction. Tasks or messages are processed and responded to at different times, allowing for delays between communication (Email or online forums). The key difference is the timing of interaction: synchronous

systems require instant communication, while asynchronous systems allow for flexibility and delayed responses.

The integration of Artificial Intelligence (AI) augments telemedicine systems, enhancing their intelligence and functionality (De Croon et al., 2021; Shoemaker et al., 2021). AI finds extensive applications across various domains, including telemedicine, where it facilitates healthcare information technology, collaborative information analysis, intelligent diagnostic assistance, and patient monitoring (Burton, 2021; El-Sherif et al., 2022). Through AI, clinicians can engage in interactive environments and maintain comprehensive virtual knowledge bases for patients, thus optimizing condition management and progression tracking (Evelson et al., 2021; Pacis et al., 2018). Moreover, AI-driven telemedicine has shown promise in improving public health outcomes (Pieczynski et al., 2021).

Shen et al. (2019) recently conducted a comprehensive review of AI applications in disease diagnosis. Additionally, AI's role in real-time clinical practice and the use of conversational agents for managing chronic medical conditions have been explored (Schachner et al., 2020; Yin et al., 2021). A separate review examined AI's integration within community-based healthcare settings (Damiani et al., 2023; Lam et al., 2022). Moreover, the impact of AI on drug management, including its comparison with clinician performance and its potential to reduce medication errors, has been analyzed in recent studies (d'Elia et al., 2022; Damiani et al., 2023).

AI-telemedicine eliminates the need for synchronous appointments between physicians and patients, offering enhanced convenience. Physicians can access patient reports at their discretion, while patients can seek recommendations at any time (Kuziemsky et al., 2019). This intelligent system enables AI to perform physician tasks and provide recommendations under physician control, ensuring continuous support for patients (Bhaskar et al., 2020). The system maintains privacy standards by restricting access to patient records and recommendations (Kaplan, 2020). Access rights can be managed effectively through platforms like Google Sheets, limiting access to only the physician and patient. However, the AI tele healthcare increased and improved its functionality to the healthcare system, the need to structure and strengthen of tele healthcare systems for local hospitals administered is inevitable. Therefore, this study presents the innovative approach to structure impactful driven telemedicine to optimize daily dietary recommendations during the COVID-19 pandemic. This research aimed to develop a remote daily dietary plan recommendation system, enabling patients to receive dietary guidance from physicians at any time and from any location. The system features telemedicine functionality and incorporates an AI component acting as an artificial physician. Key characteristics include the patient's ability to design menus according to preference, receive recommendations through the AI system, report daily dietary plans to the physician, and receive recommendations via the AI system.

2. Materials and methods

The system underwent development through the following sequential steps:

Step 1: planning the system

The researcher devised a plan to create a telemedicine system featuring an intelligent component acting as an artificial expert. Specifically designed for patients requiring daily calorie management and physician recommendations, the system was conceptualized to streamline dietary control.

Step 2: designing the system requirements

The system comprises two primary interfaces: the physician site and the patient site, alongside an intelligent system functioning as an artificial physician. This AI component offers patients suggestions and recommendations as they devise their daily dietary plans (DDP). Physicians, in turn, set recommended food types and daily calorie limits, which are integrated into the AI system. Patients can then report their dietary plans to the physician once finalized.

Step 3: prototyping the system

An overview of the system is depicted in **Figure 1**.

Step 4: developing the system

Utilizing Google Sheets and Google Forms, the software was developed with separate interfaces for patients and physicians.

Patient's site:

Patients select their gender and devise a food intake plan based on recommended food types provided by the physician. The system automatically calculates total calorie intake and compares it with the appropriate gender-specific calorie requirements. Recommendations are provided until the system deems the plan as satisfactory. Once finalized, patients can submit their dietary plan to the physician via a Google Form link provided below the AI recommendation interface.

Physician's site:

Physicians review patient reports daily, adjusting recommended daily calorie intake and refining food recommendations accordingly. These modifications are linked to the AI recommendation component and displayed on the patient's interface.

Step 5: testing the system

Following full system development, rigorous testing was conducted by the developer, leveraging firsthand experience.

Google Sheets offers an accessible, easy-to-use platform for managing patient data, especially for smaller healthcare setups. Unlike specialized healthcare systems, it requires minimal technical knowledge and is widely available. Its collaborative features allow multiple healthcare providers to input and track data in real-time. Simplifying the technical setup by using common terms and step-by-step guides will help non-technical users understand and utilize it effectively. Google Sheets was chosen for its flexibility, low cost, and integration with other Google tools.

The patient site is designed for individuals to input health data, report symptoms, and access personalized care plans, while the physician site enables healthcare professionals to review patient information, adjust treatments, and provide medical advice. The patient site emphasizes user-friendly interaction, whereas the physician site focuses on data analysis and clinical decision-making tools. Both platforms work together to enhance communication and care.

Figure 1. AI-telemedicine system prototype.

3. Results

The patient-side software interface is illustrated in **Figure 2**. Once a patient formulates a satisfactory daily dietary plan, they can record it on a Google Form, which is subsequently stored in a Google Sheet within the system, as depicted in **Figure 3**. This sheet accumulates daily plans for review by the patient's doctor, who can adjust recommended food types and calorie intake for the following day directly within the system, as indicated in **Figure 3**. These adjustments are seamlessly integrated into the AI system, influencing recommendations provided during the patient's dietary planning process. An overview of the entire system is provided in **Figure 4**.

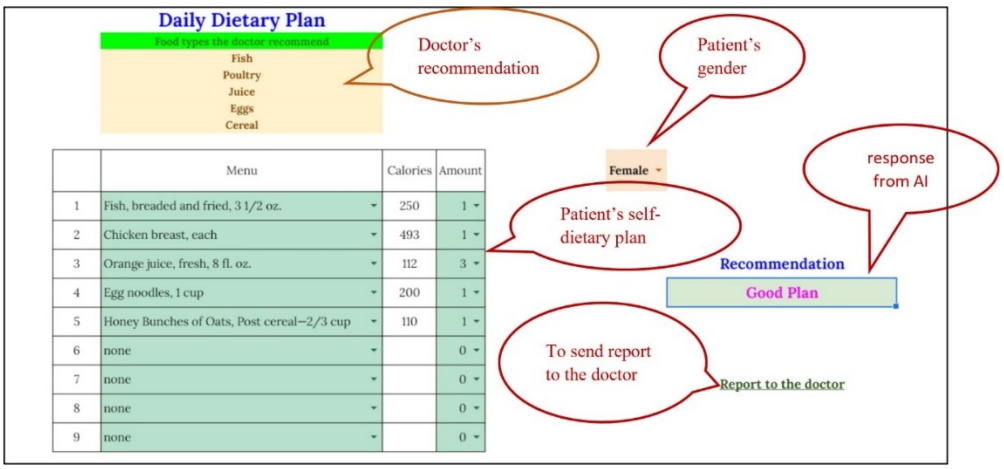

Figure 2. Patient site of AI-telemedicine system.

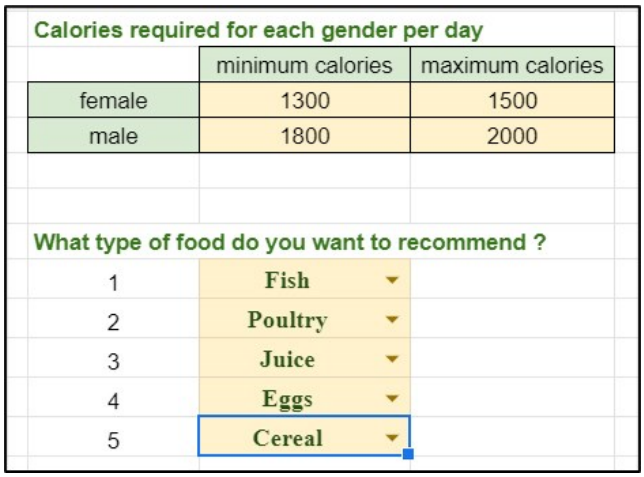

Figure 3. Physician site of AI-telemedicine system.

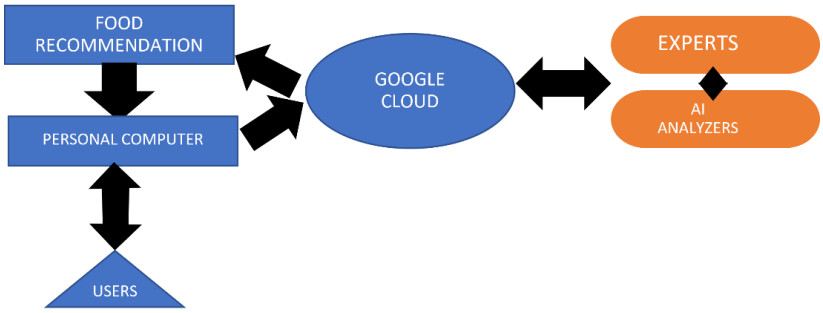

Figure 4. Overall, AI-telemedicine system.

Following full system development, comprehensive testing was conducted with the testing encompassed the following key points: implementation of two distinct sites: physician and patient sites, ensuring privacy measures for both sites, enabling system accessibility from any location and at any time, facilitating recommendation exchange between both sites amidst physical distancing circumstances, patient consultation with the AI system akin to consulting a physician, patient reporting of personal records to the physician via the AI-telemedicine system, physician access to patient reports transmitted through the AI-telemedicine system, physician capability to adjust the AI system to modify patient recommendations via the AI-telemedicine system, patient receipt of physician recommendations through the AI-telemedicine system from any location and at any time, the results indicate that the developed AI-telemedicine system satisfactorily meets all system requirements.

4. Discussion

In real-life scenarios, traditional telemedicine systems necessitate scheduled appointments between physicians and patients, typically conducted via phone or video calls, requiring both parties to be available simultaneously. Conversely, AI-telemedicine operates without appointments, allowing patients to engage asynchronously through internet-connected devices (Mansberger et al., 2013). Telemedicine, coupled with advancements in artificial intelligence (AI), is revolutionizing healthcare delivery (Voran, 2015). AI algorithms analyze vast amounts of patient data, aiding in diagnosis and treatment planning with unprecedented accuracy and speed (Ahmed et al., 2020). Through telemedicine platforms, patients can now consult with healthcare providers remotely, accessing expert care regardless of geographic barriers (Chen et al., 2021). AI-powered virtual assistants streamline administrative tasks, enhancing the efficiency of telemedicine encounters. Moreover, AI-enabled remote monitoring systems track patients' health parameters in real-time, enabling proactive interventions and personalized care plans (Wang, 2023). This synergy between telemedicine and AI holds immense potential to improve healthcare accessibility, quality, and outcomes, heralding a new era of patient-centered medicine (Noorbakhsh-Sabet et al., 2019). AI-Telemedicine offers several strengths, notably eliminating the need for appointments and enabling access for both physicians and patients anytime, anywhere, on any internet-enabled device. Additionally, it facilitates seamless exchange of recommendations through AI, akin to in-person interactions (Javanmard, 2024). However, its weaknesses include the requirement for system customization for each physician-patient pair, demanding

access and proficiency from both parties in utilizing the system, and reliance on mutual understanding of the system's functionalities (Bi et al., 2019). On the other hand, traditional telemedicine systems have strengths such as no requirement for specialized system design and no need for users to learn and access a distinct system. However, they are limited by the requirement for appointments between physicians and patients, and both parties must be available at the scheduled appointment time for telemedicine sessions, potentially necessitating rescheduling if either party is unavailable (Javanmard, 2024; Maleki and Forouzanfar, 2024).

Artificial intelligence (AI) has emerged into the mainstream, riding on the coattails of significant advancements in computing power. Within the dynamic landscape of the healthcare industry, marked by transformative shifts, one of the most recent adopters of AI technology is telehealth (George et al., 2023; Khalifa et al., 2024). Its applications range from the issuance of electronic healthcare cards to the provision of personalized counseling services (Pinto-Coelho, 2023). In the United States, AI is exerting a profound influence on telehealth practices (Javaid et al., 2022). Leveraging AI in telehealth enables clinicians to make real-time, data-driven decisions, thereby enhancing patient experiences and optimizing health outcomes as healthcare providers endeavor to expand virtual care options across the care continuum (Xu et al., 2021). The integration of AI's strengths in data processing and analysis into telehealth research reflects its widespread adoption across various sectors. Given the inherent challenges in deploying telemedicine solutions, there is an urgent imperative to enhance its capabilities and refine its processes to address specific healthcare challenges effectively (Santoro et al., 2022).

The expanding utilization of AI in telemedicine is manifesting in four primary directions: patient monitoring, healthcare information technology, intelligent diagnostic assistance, and collaborative information analysis with specialized professionals. This trajectory underscores the transformative role of AI in shaping the future of healthcare delivery, promising innovative solutions and improved patient care outcomes through synergistic integration with telemedicine practices (Sherani et al., 2024). As the internet's reach expands and data processing capabilities soar, the global healthcare industry, particularly telemedicine, is poised for unprecedented growth opportunities. Emerging technologies such as data sharing and analysis, wearables, cloud computing, robotics, and the Internet of Things (IoT) present fertile ground for innovation in the coming decade (Schachner et al., 2020). Against this backdrop, the role of artificial intelligence (AI) in healthcare technology administration and deployment becomes increasingly pivotal. In healthcare, AI plays a crucial role in managing the deluge of data, enhancing precision in complex medical procedures, and meeting the escalating demand for medical services (Panesar, 2021). The automation of hospital logistics is imperative to optimize resource allocation and streamline healthcare delivery processes. Telemedicine, defined as the remote provision of medical consultations, examinations, and procedures, along with facilitating interprofessional collaboration in healthcare, stands out as a dynamic and ever-evolving field (Lewis et al., 2019). It is often characterized as an "open and continuously evolving science" that responds and adapts to evolving healthcare needs and contexts by integrating novel technological advancements (Gouripur, 2024).

The primary objectives of telemedicine encompass expanding access to healthcare services, fostering seamless communication among healthcare providers, and enhancing time efficiency while concurrently reducing logistical costs. These goals underscore the transformative potential of telemedicine in revolutionizing healthcare delivery, bridging geographical barriers, and ensuring equitable access to quality medical care (Bohr and Memarzadeh, 2020). Over the past decade, research into effective and reliable procedures for medical fields and the application of wireless technology to sensors have experienced significant growth, particularly in areas such as electronic patient records and home monitoring. In the healthcare industry, data has always been instrumental in providing quality patient care and aiding decision-making processes. With the digital transformation of healthcare, a vast amount of data is now being generated from various sources including medical equipment, insurance, life sciences, and medical research (Kaboudan and Salah Eldin, 2023). This influx of data presents an immense opportunity to revolutionize healthcare by offering valuable insights to support decision-making, enhance patient care, respond to real-time situations, and ultimately save lives. Such transformation is made feasible through the utilization of advanced analytics, machine learning, and artificial intelligence techniques, enabling stakeholders to extract meaningful and actionable insights from the data (Parker and Parker, 2023).

In addition to analyzing historical data, these techniques enable predictive analytics to forecast future outcomes and prescriptive analytics to determine the optimal course of action for current situations (Ali, 2024). By harnessing the power of data, healthcare stakeholders can optimize resource utilization, improve processes and services, and reduce operational and financial costs (Mesko, 2017). However, as our understanding of AI and data analytics expands, even greater potential applications emerge. Telemedicine, for instance, seeks to enhance productivity by allocating resources according to the most pressing needs while also providing access to a broader range of specialized knowledge and trained personnel (Ness et al., 2024).

In this study, we delved into the significance of AI and its potential future application to the goals of telemedicine. We would explore the various uses of AI in telehealth, patient monitoring, healthcare IT, and information analysis.

In addition to these outlined objectives, this research further examines the feasibility of utilizing Google Sheets and Google Forms as practical tools within telehealth applications. Google Sheets offers a versatile platform for organizing, analyzing, and sharing data, while Google Forms allows for efficient data collection and patient feedback. Their integration into telehealth processes can facilitate efficient communication between healthcare providers and patients, streamline the collection of health-related data, and support collaborative efforts in healthcare management.

The simplicity and accessibility of Google Sheets and Google Forms enable healthcare professionals to create custom data collection systems that can be tailored to specific telehealth needs. This adaptability fosters more precise patient monitoring, facilitates tracking of health metrics, and allows for rapid dissemination of information across healthcare teams. Furthermore, these tools are cloud-based, ensuring secure storage and easy access to data, contributing to a more seamless telehealth experience.

However, it is crucial to consider the limitations and challenges associated with these technologies. Privacy and data security concerns must be carefully addressed,

given the sensitive nature of healthcare information. Compliance with healthcare regulations and data protection laws is essential to ensure patient confidentiality. Additionally, while these tools can facilitate data collection and analysis, they might be suitable for more complex AI-driven telehealth applications that require advanced analytics or machine learning capabilities.

This research encourages further exploration into integrating Google Sheets and Google Forms within telehealth systems, acknowledging their potential benefits while also addressing the necessary precautions to maintain data integrity and patient privacy. By incorporating these technologies into the broader discussion on AI in telehealth, this study contributes to a more comprehensive understanding of the tools and strategies that can drive the future of personalized healthcare delivery.

Overall, AI in telehealth holds significant promise for sustainability by revolutionizing healthcare delivery and improving patient outcomes through data-driven decision-making and personalized care approaches (Mahadasa, 2017). AI in telehealth offers several benefits that contribute to sustainability such as reduced carbon footprint as in the Telehealth eliminates the need for patients to travel to clinics or hospitals for routine appointments, thereby reducing the carbon footprint associated with transportation. By decreasing the number of vehicles on the road, telehealth can mitigate air pollution and greenhouse gas emissions (Alam et al., 2023).

Furthermore, telehealth enables healthcare providers to use resources more efficiently. For instance, AI algorithms can predict which patients are at risk of developing certain conditions, allowing providers to intervene early and potentially prevent the need for more costly interventions later on. It enhanced patient outcomes that through AI-driven analysis of patient data and personalized care plans, telehealth empowers patients to manage chronic conditions more effectively, reducing the necessity for hospitalizations and emergency department visits. improved access to care is another benefit of telehealth that extends access to care, particularly for individuals in rural or remote areas who may face challenges in reaching healthcare facilities. This expansion helps diminish health disparities and ensures equitable access to quality care for all (Kasula and Whig, 2023).

Incorporating Google Sheets and Google Forms into AI-based telehealth systems represents a practical and sustainable approach to healthcare delivery. These tools offer simplicity, flexibility, and cloud-based functionality that can greatly benefit telehealth operations.

Google Sheets serves as a robust platform for organizing, analyzing, and sharing data. In the context of AI in telehealth, Google Sheets can streamline data-driven decision-making by enabling healthcare providers to maintain and analyze large datasets. This allows for a clearer understanding of patient needs and the ability to track key metrics over time, fostering personalized care and resource optimization. The ease of use and collaborative features make it a valuable asset in a telehealth setting.

Google Forms, on the other hand, facilitates efficient data collection and patient feedback. Telehealth providers can use Google Forms to gather patient information, conduct surveys, and even assess patient satisfaction. This data collection capability is crucial for AI-based telehealth systems, allowing healthcare professionals to build comprehensive patient profiles and tailor care plans accordingly. The integration of

Google Sheets and Google Forms creates a seamless workflow, from data collection to analysis and reporting.

In terms of sustainability, these tools contribute to a greener healthcare system. By reducing the need for paper-based records and eliminating unnecessary travel for patients, telehealth inherently reduces its carbon footprint. Google Sheets and Google Forms, being cloud-based, also offer a secure and accessible method for storing patient data, reducing the risk of physical loss or damage.

However, it's essential to recognize the limitations and challenges associated with using these tools in telehealth. Privacy and data security must be top priorities, as healthcare information is highly sensitive. Compliance with data protection regulations and healthcare laws is crucial to maintaining patient trust and confidentiality. Additionally, while Google Sheets and Google Forms can support basic AI functions, more advanced AI applications may require specialized platforms with enhanced analytics and machine learning capabilities.

In summary, integrating Google Sheets and Google Forms into AI telehealth systems can offer a feasible, sustainable, and efficient approach to healthcare delivery. These tools support the core objectives of telehealth, promoting personalized care, reducing environmental impact, and improving access to healthcare, especially for those in remote or underserved areas. By leveraging these technologies, healthcare providers can create a more inclusive and sustainable telehealth system that benefits both patients and the environment.

Finally, the system introduced in our research paper as one feasible and available AI in telehealth holds promise for sustainability by minimizing waste, optimizing efficiency, and fostering better patient outcomes. By harnessing technology to deliver superior care, we can establish a more sustainable healthcare system that benefits both patients and the environment.

The implementation of AI in healthcare requires a deep understanding of the associated risks and limitations. Key challenges include data privacy, security, and cybersecurity concerns, as well as biases inherent in training datasets. Additionally, legal, regulatory, and interoperability issues present significant hurdles for AI adoption in healthcare systems. It is also important to highlight the challenges posed by reliability and accountability concerns, alongside resistance from healthcare professionals to adapt to new technologies. Furthermore, the high cost of AI systems, overreliance on AI, data quality issues, and ethical concerns must be considered as critical limitations in the application of AI in healthcare.

Using Google Sheets for sensitive medical data has some limitations, particularly when it comes to ensuring healthcare regulatory compliance. While it offers convenience and accessibility, maintaining the necessary security standards, such as data encryption and access controls, can be more challenging compared to specialized systems. Managing larger datasets may also require additional effort to ensure accuracy and efficiency. With proper attention to privacy settings and safeguards, Google Sheets can still be a useful tool for smaller-scale healthcare tasks, though it may be better to add more security to meet the demands of more complex medical data management.

5. Conclusion

The developed system is an AI-telemedicine platform, necessitated by the COVID-19 outbreak and the imperative of physical distancing. Offering asynchronous communication, this system provides convenient avenues for patients and physicians to exchange recommendations. Additionally, this system can serve as a prototype model for other AI-telemedicine systems catering to diverse diseases and recommended content.

Study limitations:

The current system operates in a one-to-one mode, facilitating communication between one patient and one physician exclusively. Scaling this system to accommodate multiple physicians/patients requires setting up individual systems. The future work of creating the desirable system for specific patients to collect the data and analysis them will consider for in future study.

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References

Ahmed, Z., Mohamed, K., Zeeshan, S., & Dong, X. (2020). Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine. The Journal of Biological Databases and Curation, baaa010. https://doi.org/10.1093/database/baaa010

Alam, M., Alam, A., Khan, E. R., et al. (2023). AI for Sustainable Smart City Healthcare. China Petroleum Processing and Petrochemical Technology, 23(2), 2245–2258.

Ali, A. (2024). Artificial Intelligence in Medical Devices: Pioneering the Future of Healthcare Delivery. EasyChair Preprint. pp. 2516–2314.

Andrews, E., Berghofer, K., Long, J., et al. (2020). Satisfaction with the use of telehealth during COVID-19: An integrative review. International journal of nursing studies advances, 2, 100008.

Battineni, G., Nittari, G., Sirignano, A., & Amenta, F. (2021). Are telemedicine systems effective healthcare solutions during the COVID-19 pandemic? Journal of Taibah University Medical Sciences, 16(3), 305.

Bhaskar, S., Bradley, S., Sakhamuri, S., et al. (2020). Designing futuristic telemedicine using artificial intelligence and robotics in the COVID-19 era. Frontiers in public health, 8, 556–789.

Bi, W. L., Hosny, A., Schabath, M. B., et al. (2019). Artificial intelligence in cancer imaging: clinical challenges and applications. CA: a cancer journal for clinicians, 69(2), 127–157.

Bohr, A., & Memarzadeh, K. (2020). The rise of artificial intelligence in healthcare applications. In Artificial Intelligence in healthcare. pp. 25–60.

Brotman, J. J., & Kotloff, R. M. (2021). Providing outpatient telehealth services in the United States: before and during coronavirus disease 2019. Chest, 159(4), 1548–1558.

Burton, S. L. (2021). Artificial Intelligence (AI), Disability, and Telemedicine/Telehealth: Building an Academic Program. In Implementation Strategies for Improving Diversity in Organizations. pp. 193–223.

Chen, Z. H., Lin, L., Wu, C. F., et al. (2021). Artificial intelligence for assisting cancer diagnosis and treatment in the era of precision medicine. Cancer Communications, 41(11), 1100–1115.

d'Elia, A., Gabbay, M., Rodgers, S., et al. (2022). Artificial intelligence and health inequities in primary care: a systematic scoping review and framework. Family medicine and community health, 10(Suppl 1). e001670.

Damiani, G., Altamura, G., Zedda, M., et al. (2023). Potentiality of algorithms and artificial intelligence adoption to improve medication management in primary care: a systematic review. BMJ open, 13(3), e065301.

De Croon, R., Van Houdt, L., Htun, N. N., et al. (2021). Health recommender systems: systematic review. Journal of Medical Internet Research, 23(6), e18035.

El-Sherif, D. M., Abouzid, M., Elzarif, M. T., et al. (2022). Telehealth and Artificial Intelligence insights into healthcare during the COVID-19 pandemic. Paper presented at the Healthcare.

Evelson, L. I., Zingerman, B. V., Borodin, R. A., et al. (2021). Telemedicine monitoring with artificial intelligence elements. In: Advances in Intelligent Systems and Computing, Proceedings of Advances in Artificial Systems for Medicine and Education IV 4.

George, A. S. H., Shahul, A., & George, A. S. (2023). Artificial Intelligence in Medicine: A New Way to Diagnose and Treat Disease. Partners Universal International Research Journal, 2(3), 246–259.

Gouripur, K. (2024). The Impact of Artificial Intelligence on Healthcare: A Revolution in Progress. The North and West London Journal of General Practice, 10(1).

Javaid, M., Haleem, A., Singh, R. P., et al. (2022). Significance of machine learning in healthcare: Features, pillars and applications. International Journal of Intelligent Networks, 3, 58–73.

Javanmard, S. (2024). Revolutionizing Medical Practice: The Impact of Artificial Intelligence (AI) on Healthcare. Open Access Journal of Applied Science and Technology, 2(1), 01–16.

Kaboudan, A., & Salah Eldin, W. (2023). AI-Driven Medical Imaging Platform: Advancements in Image Analysis and Healthcare Diagnosis. Journal of the ACS Advances in Computer Science, 14(1).

Kaplan, B. (2020). Revisiting health information technology ethical, legal, and social issues and evaluation: telehealth/telemedicine and COVID-19. International Journal of Medical Informatics, 143, 104239.

Kasula, B. Y., & Whig, P. (2023). AI-Driven Machine Learning Solutions for Sustainable Development in Healthcare—Pioneering Efficient, Equitable, and Innovative Health Service. International Journal of Sustainable Development Through AI, ML and IoT, 2(2), 1–7.

Khalifa, M., Albadawy, M., & Iqbal, U. (2024). Advancing clinical decision support: The role of artificial intelligence across six domains. Computer Methods and Programs in Biomedicine Update, 5, 1–7.

Kuziemsky, C., Maeder, A. J., John, O., et al. (2019). Role of artificial intelligence within the telehealth domain. Yearbook of medical informatics, 28(01), 035–040.

Lam, T. Y. T., Cheung, M. F. K., Munro, Y. L., et al. (2022). Randomized controlled trials of artificial intelligence in clinical practice: systematic review. Journal of Medical Internet Research, 24(8), e37188.

Lewis, S. J., Gandomkar, Z., & Brennan, P. C. (2019). Artificial Intelligence in medical imaging practice: looking to the future. Journal of Medical radiation sciences, 66(4), 292–295.

Mahadasa, R. (2017). Decoding the Future: Artificial Intelligence in Healthcare. Malaysian Journal of Medical and Biological Research, 4(2), 167174.

Maleki Varnosfaderani, S., & Forouzanfar, M. (2024). The Role of AI in Hospitals and Clinics: Transforming Healthcare in the 21st Century. Bioengineering, 11(4), 337.

Mansberger, S. L., Gleitsmann, K., Gardiner, S., et al. (2013). Comparing the effectiveness of telemedicine and traditional surveillance in providing diabetic retinopathy screening examinations: a randomized controlled trial. Telemedicine and e-Health, 19(12), 942–948.

Mesko, B. (2017). The role of artificial intelligence in precision medicine. Taylor & Francis. Volume 2. pp. 239–241.

Ness, S., Xuan, T. R., & Oguntibeju, O. O. (2024). Influence of AI: Robotics in Healthcare. Asian Journal of Research in Computer Science, 17(5), 222–237.

Noorbakhsh-Sabet, N., Zand, R., Zhang, Y., & Abedi, V. (2019). Artificial intelligence transforms the future of health care. The American journal of medicine, 132(7), 795–801.

Pacis, D. M. M., Subido, E. D. C., & Bugtai, N. T. (2018). Trends in telemedicine utilizing artificial intelligence. In: Proceedings of the AIP conference.

Panesar, A. (2021). Machine learning and AI for healthcare. Springer International Publishing.

Parker, G., & Parker, C. (2023). Future Benefits and Challenges of Artificial Intelligence in Healthcare. Available online: https://ssrn.com/abstract=4497511 (accessed on 10 August 2024).

Pieczynski, J., Kuklo, P., & Grzybowski, A. (2021). The role of telemedicine, in-home testing and artificial intelligence to alleviate an increasingly burdened healthcare system: Diabetic retinopathy. Ophthalmology and therapy, 10(3), 445–464.

Pinto-Coelho, L. (2023). How Artificial Intelligence Is Shaping Medical Imaging Technology: A Survey of Innovations and Applications. Bioengineering, 10(12), 1435.

Santoro, M., Strolin, S., Paolani, G., et al. (2022). Recent applications of artificial intelligence in radiotherapy: where we are and beyond. Applied Sciences, 12(7), 3223.

Schachner, T., Keller, R., & v Wangenheim, F. (2020). Artificial intelligence-based conversational agents for chronic conditions: systematic literature review. Journal of Medical Internet Research, 22(9), e20701.

Sharma, A. K. (2020). Novel coronavirus disease (COVID-19). Resonance, 25(5), 647–668.

Shen, J., Zhang, C. J. P., Jiang, B., et al. (2019). Artificial intelligence versus clinicians in disease diagnosis: systematic review. JMIR medical informatics, 7(3), e10010.

Sherani, A. M. K., Khan, M., Qayyum, M. U., & Hussain, H. K. (2024). Synergizing AI and Healthcare: Pioneering Advances in Cancer Medicine for Personalized Treatment. International Journal of Multidisciplinary Sciences and Arts, 3(01), 270–277.

Shoemaker, M. M., Lippold, C., Schreiber, R., & Levy, B. (2021). Novel application of telemedicine and an alternate EHR environment for virtual clinical education: A new model for primary care education during the SARS-CoV-2 pandemic. International Journal of Medical Informatics, 153, 104526.

Voran, D. (2015). Telemedicine and beyond. Missouri medicine, 112(2), 129.

Wang, J. (2023). The Power of AI-Assisted Diagnosis. EAI Endorsed Transactions on e-Learning, 8(4).

Xu, Y., Liu, X., Cao, X., et al. (2021). Artificial intelligence: A powerful paradigm for scientific research. The Innovation, 2(4).

Yin, J., Ngiam, K. Y., & Teo, H. H. (2021). Role of artificial intelligence applications in real-life clinical practice: systematic review. Journal of Medical Internet Research, 23(4), e25759.