Multidimensional Analysis of the Implementation and Impact of Digital Twins in Healthcare

Keywords: Digital Twin, Digital Health, Healthcare, 5G

01. Introduction
Digital twins, which are virtual representations of physical objects or systems, have been increasingly used in various industries for simulation and predictive purposes. In healthcare, the concept of Health Digital Twins (HDTs) has emerged as a promising approach for developing and testing diagnostic and prognostic algorithms using virtual representations of patients. HDTs are typically multidimensional and can represent a patient's physical, physiological, and environmental features obtained from different sources, allowing for real-time monitoring and personalized care. 

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03. Methods
We conducted a targeted literature search using the criteria: Health Digital Twin. Articles that mentioned clinical applications were selected for analysis and data extraction considering disease, medical specialty, diagnoses (according to ICD-10), chart data (i.e. vital signs and lab tests), demographics (sex, age, race), wearables data, privacy and ethics considerations. We also analyzed their impact on quality of care, patient satisfaction and healthcare resources use (HRU). We present a narrative description of these findings.

04. Results
From 203 articles mentioning the search terms, 17 met the criteria and underwent full-text analysis. Medical specialties included: cardiology; neurology; oncology; surgery; critical care; gerontology; nutrition; infectious diseases; precision medicine, surgery, critical care; gerontology; nutrition; infectious diseases; precision medicine; dermatology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology; cardiology; oto-rhino-laryngology; neuro-ophthalmology. It is important to note that only one article mentioned the use of 5G technology that would allow the incorporation of real-time sensor data. Also, 5 articles mentioned the use of cloud computing to keep the HDT up to date with all data sources (Figure 4).

05. Conclusion
In conclusion, while HDTs have shown promise in healthcare, their adoption into clinical practice is still in its early stages. The results of our multidimensional analysis suggest that further research is necessary to assess the safety, accuracy, and impact of HDTs on patient outcomes and healthcare resource utilization. Careful consideration of the ethical and privacy implications associated with the use of sensitive patient data is also necessary for the widespread adoption of HDTs in real-world patient care pathways.

References
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