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Implications of real-time health data integration on medical records and administrative workflows

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Abstract

Background: The medical field is transforming as a result of the integration of electronic health records (EHRs) and wearable health technology. This has created new opportunities for data-driven decision-making and patient care. The rising use of wearable devices among patients and within the healthcare sector highlights the necessity to comprehend how this integration affects healthcare systems.

Methods: This scoping review explores the existing landscape of integrating wearable health technology into EHRs, with an emphasis on data analytics and decision-making within medical secretarial and records management. By conducting an extensive search using Internet search engines and databases, we pinpointed significant challenges and opportunities related to the integration of patient data from wearable devices into healthcare systems.

Results: According to the study, wearable technology has great potential for controlling long-term illnesses and enhancing patient outcomes. Nonetheless, issues like data privacy, interoperability, and the complexity of data management must be tackled for the broad acceptance of wearable health technology in healthcare environments. The study highlights the significance of security measures, compliance with regulations like HIPAA, and the creation of transparent consent practices to safeguard patient confidentiality.

Conclusion: Data security, interoperability, and patient privacy must be given top priority by healthcare systems to fully realize the promise of wearable health technology in improving patient care and decision-making. Cooperative initiatives among application developers, health systems, and regulatory agencies are crucial to address current obstacles and guarantee the smooth incorporation of wearable device data into electronic health records.

Keywords: Patient privacy, data analytics, wearable technology, electronic health records, and decision-making

1. Introduction

Electronic health records (EHRs) have a history that dates back to the 1960s; however, their widespread adoption progressed slowly until the enactment of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 [1-4]. This legislation greatly expedited the adoption of EHR systems by healthcare providers. From 2001 to 2011, the proportion of physicians using EHR systems increased significantly from 18% to 57% [5]. Initiatives such as Meaningful Use highlighted the significance of quality care, care coordination, and the protection of personal health information, thereby encouraging the adoption of EHRs. As of 2015, around 87% of office-based physicians had adopted EHR systems within their practices [6, 7]. Among the various EHR vendors, Epic, Cerner, and Meditech stand out as the most frequently utilized platforms within healthcare systems [8].

The legislation encouraging meaningful use not only accelerated EHR adoption but also supported the improvement of EHR features designed to enhance patient experiences. Healthcare systems are increasingly depending on the capabilities, offerings, and innovations of EHRs to effectively capture patient data [9]. New features, including secure messaging between patients and providers, along with options for patients to view, download, and transmit their EHRs, are increasingly becoming common. These advancements are crucial for optimizing the exchange of patient data between healthcare providers and their patients [7].

The integration of EHRs with medical devices, such as wearable health and fitness tracking devices, stands out as one of the most innovative advancements in this field. At

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first, device integration was centered around monitoring fundamental vital signs; however, the scope of data gathered has greatly broadened as health systems aim to adapt to changing standards and adopt innovative care models, all while utilizing progress in digital technologies [10, 11]. This review seeks to offer an overview of the swiftly changing environment of patient data integration into EHRs, with a particular focus on health systems and organizations that leverage data gathered from consumergrade wearable devices to improve patient outcomes.

1. Wearable Devices: Availability and Adoption

Wearable devices include various technologies like wristbands, smartwatches, and mobile sensors that gather a range of health-related data, including blood sugar levels, exercise habits, sleep patterns, and mood [12]. Patient data can be collected either through direct consumer reporting or passively through sensors integrated into applications that interface with these devices via application programming interfaces (APIs). This data is frequently compiled through platforms such as Apple's HealthKit, which gathers information from various health applications [13].

A recent consumer survey conducted by Accenture revealed that a notable percentage of US adults are receptive to wearing technology that monitors their health metrics [14]. The emergence of mobile integration platforms like Google Fit and Apple HealthKit is anticipated to lead to a growth in the number of healthwearable users in the upcoming years [15]. The increasing use of devices to track health-related information indicates a parallel increase in the accessibility of patient data for health management objectives [16]. Major health systems are expected to increase their adoption of wearable technology in preventative care strategies, tracking vital signs such as heart rate and blood pressure [17, 18]. At present, more than 400 devices compatible with EHR systems are available, and this figure is expected to increase considerably soon [19].

1.1. The Clinical Impact of Wearable Devices

Wearable devices offer significant promise in helping patients and healthcare providers manage chronic conditions like diabetes, heart disease, and chronic pain [20]. The Pew Research Center reports that 60% of adults in the US keep track of their weight, diet, or exercise, whereas 33% pay attention to health indicators like blood pressure, blood sugar, or sleep patterns. Furthermore, 8% utilize medical devices such as glucose meters [21]. Studies examining the clinical effects of wearable technology on patient health outcomes have produced varied findings. Although certain studies suggest that wearable devices do not result in notable changes in physical activity or sleep patterns, other research emphasizes enhancements in patients' subjective health outcomes [22-25].

Recent literature reviews examining the clinical effects of wearable devices and their impact on behavior change have demonstrated promising outcomes for digital health technologies [26]. Nonetheless, numerous studies highlight the necessity for more thorough data analyses from commercially available tools and their impact on patient health [27]. Further research is needed to clarify the clinical outcomes linked to wearable health technology.

This paper aims to perform a scoping review of the wearable health technology landscape, offering an overview of the latest innovations in EHR integration. In line with other scoping reviews, we employed internet search engines in conjunction with database searches to encompass the swift advancements in the incorporation of remotely collected patient data into health systems [28]. Our investigation focused on developing a specific list of organizations at the forefront of wearable health technology, along with their partnerships.

2. Challenges of Integrating Wearable Devices in Healthcare

The incorporation of wearable health technology into healthcare systems presents a remarkable opportunity for revolutionizing patient care. Nonetheless, several significant challenges need to be tackled to enable the broad acceptance of these devices by healthcare professionals. Important matters encompass worries about patient privacy, the ability of systems to work together, and the immense amount of data produced by these devices [29, 30]. It is crucial to tackle these challenges to guarantee that wearable technology can be utilized effectively in providing safe and high-quality care to patients. While there are possible solutions available, additional innovation is essential for the widespread adoption of wearable health technologies.

One of the primary challenges in integrating wearable health technology is safeguarding the confidentiality and privacy of patient data. Due to the delicate nature of health information, it is essential to implement key checkpoints within the workflow to protect patient privacy [31]. At present, the literature reveals a deficiency in empirical evidence concerning effective security measures for wearable devices [32]. To reduce the risks of cybersecurity breaches and the potential loss or theft of patient records linked to wearable health technologies, healthcare institutions must guarantee that devices are connected to secure networks and that there is ongoing monitoring of the hospital's data network [33]. To ensure data privacy, health systems might need to create separate, secure networks specifically for wearable devices, separate from their primary operational networks [34].

As wearable technology evolves, the compilation and transfer of patient datasets grow increasingly complex [35]. Securing patient consent is essential, as ongoing physiological monitoring may be viewed as intrusive by patients [36]. Additionally, the improper use of personal health information by external entities can result in discrimination, alterations in insurance coverage, or even identity theft [15]. Consequently, consent notices should be clear and specific, outlining the types of information collected, the frequency of data collection, and the third parties that have access to patient data, thereby ensuring that patients truly provide informed consent [37]. To ensure the future of wearable health technology and its integration with EHRs, it is essential to establish further policies and standards that safeguard patient confidentiality and privacy.

The incorporation of patient data gathered from wearable devices remains an emerging field in health technology. Consequently, numerous health systems do not possess the essential platforms required to consistently gather data from diverse patient devices for incorporation into EHRs [38]. At present, device manufacturers and EHR vendors utilize a range of communication methods that can be unique, proprietary, and closed [39]. The disparities impede efficient communication and data exchange among different devices and EHR systems, resulting in notable interoperability issues.

As a result, this absence of interoperability has led to the formation of fragmented datasets that diminish in value due to their inability to be seamlessly integrated into a patient's historical health data [40]. Recent research has concentrated on attaining plug-and-play interoperability to standardize platforms and link these information silos, a standard already common in consumer electronics, where users anticipate straightforward and seamless functionality [41]. Plug-and-play standards require user-friendliness, compatibility, efficient device scalability, and reconfigurability among various vendors. Systems should have the ability to identify new devices, negotiate communication protocols, and enable devices to synchronize and operate collaboratively [42].

With the rising demand for interoperability, thirdparty applications aimed at tackling these challenges are gaining greater visibility. Strengthening partnerships and collaborative opportunities between application developers and health systems is crucial for attaining high levels of interoperability and enabling seamless communication among EHR platforms, patient devices, and healthcare providers. Enhancing these relationships can improve healthcare efficiency, facilitate safer transitions of care, and ultimately contribute to lowering healthcare costs [43].

The incorporation of wearable health technology into electronic health records produces substantial amounts of data that necessitate meticulous organization and analysis before being effectively used by patients and healthcare providers [43]. Storing continuous streams of patient data presents considerable challenges for health systems that might not be prepared to manage an increasingly large database [44]. Decisions about the lifecycle of this data and its incorporation into provider workflows pose distinct challenges in leveraging remotely collected data for patient care. For example, applications such as Apple Health and PulseOn for Android offer heart rate data at intervals of 60 seconds and 3 seconds, respectively. The transmission of these substantial amounts of data requires backend analysis to transform it into a more straightforward, user-friendly format [45].

The vast amount of data produced by wearable devices has sparked continuous conversations among hospitals about the best ways to extract and present pertinent patient information to healthcare providers. Numerous healthcare providers encounter alert fatigue stemming from the excessive volume of notifications produced by clinical decision support systems [46]. Although machine learning and artificial intelligence (AI) algorithms offer potential solutions to this issue, existing algorithms are frequently evaluated under fixed conditions that may not truly represent real-world situations [35]. Solutions that effectively integrate patient data must be able to sift through large volumes of information and provide meaningful, actionable insights to providers [21].

The user interface (UI) for providers plays a vital role in securing their engagement and commitment throughout the implementation of wearable technology. As a result, healthcare organizations are increasingly integrating user experience (UX) and UI designers into their cross-functional information technology (IT) teams to meet these demands [47]. The diverse skills of these teams can enhance UIs by merging IT knowledge with insights into wearable patient data. Improving the experience of providers can lead to greater time efficiency and enhanced quality of care for patients. Innovations in wearable health technology.

To address the challenges of integrating wearable health technology with electronic health records (EHRs),

numerous health systems and organizations have embraced a user-centered design approach. This approach emphasizes the adaptation of workflows and collaboration with external applications to improve the integration of remote patient data [5, 24]. Many healthcare providers have initiated or executed projects that combine wearables with EHR systems, collaborating with platforms like Apple Health, Google Fit, Fitbit, Nokia, and Withings [15]. At present, numerous devices available can establish direct connections to EHRs through HealthKit and Google Fit. Currently, information like steps and weight is gathered and shown, with continuous initiatives aimed at broadening the range of data collected and integrated over time [45, 47].

Even with these advancements, EHRs continue to encounter considerable limitations in their ability to connect with various other devices, highlighting the need for new solutions to address challenges associated with interoperability and data visualization for the information that is currently being gathered [23]. The landscape of wearable health technology features a variety of start-up collaborations with healthcare providers and innovations from insurance companies, all focused on tackling these essential challenges and fostering the expansion of wearable usage in conjunction with EHR integration capabilities.

3. Discussion

This scoping study evaluated the existing advancements in wearable health technology and electronic health records (EHRs) across multiple sectors, such as healthcare systems, start-ups, and insurance companies. It recorded important trends in innovation, collaborations, incentives, and the difficulties related to wearable devices. Our findings reveal a distinct movement towards the use of mobile health devices, propelled by the accessibility of digital tools and the gamification of health data collection. Nonetheless, various obstacles obstruct the successful integration of wearable health technology, potentially hindering its broad acceptance within health systems. This report details existing strategies to tackle the challenges of merging wearable health technology with EHRs, emphasizing the future trajectory of wearable health innovation and possible collaborations to boost adoption.

The rise of technologies created by start-ups beyond conventional EHR systems highlights an increasing focus on addressing challenges associated with wearable health technology, especially concerns such as information overload and system interoperability. For example, companies such as Redox are addressing interoperability by developing technologies that link hospitals' EHR systems with external applications, regardless of the software vendor. In a similar vein, Validic and Human API aim to reduce provider workloads by simplifying the process of data collection from devices and providing processed, easily understandable results.

Ensuring patient privacy continues to be a major challenge amid the growth of wearable technology, rewards programs, remote monitoring, and artificial intelligence (AI). Obtaining informed patient consent is essential to specify the data being collected and the third parties that may access this information. This matter will remain a central concern as organizations work to develop tailored patient experiences informed by the data gathered from patients. For instance, Conversa is utilizing conversational AI technology to enable automated and tailored virtual care through the use of patient-generated data. The emergence of health-tracking rewards programs by insurance companies indicates an increasing focus on wearable health technology designed to improve consumer health. The initiatives undertaken by insurance companies to integrate wearables via rewards programs can enhance data collection and highlight the necessity for start-up technologies to deliver a smooth experience for both providers and consumers. As wearable health technology merges with gamification and rewards initiatives, the integration of patient data across different platforms is expected to become increasingly common.

This report acts as a preliminary investigation into wearable innovations, rather than a thorough examination, due to the fast-changing landscape of wearable health technology. As organizations continue to share their experiences, tackle challenges, and create more efficient workflows, the opportunity to revolutionize patient care and simplify the integration of mobile health devices will improve health outcomes and elevate the overall quality of care.

4. Limitations

Although we established a detailed process to explore and document the existing landscape of wearable technology in this study, various challenges impede the development of a complete overview. The report focuses mainly on Epic, as we were unable to access internal EHR portals from alternative systems. Furthermore, there are limited health systems that proactively promote or share their integration initiatives on public platforms. Individuals who engage in this frequently employ diverse terminology (e.g., remote data integration, device integration) that might not have been included in our search criteria. With the growing popularity of wearable health technology in recent years, new entities and terms have probably surfaced since our last search was performed.

5. Conclusion

Wearable health technology is set to significantly improve transparency between patients and providers, along with aiding in the management of chronic conditions. Technologies that enable the effective transfer of data from patients to providers are crucial for enhancing the patient care experience and empowering individuals to manage their health actively. The designs and developments that lie ahead in this digital realm will rely on continuous assessments of effective strategies, recognition of obstacles, and investigation of possible remedies to address current issues.

Through the dissemination of our findings, we have highlighted significant challenges and innovative solutions in this swiftly changing domain. Our work acts as a crucial initial step in creating an efficient process for recognizing pertinent entities and offering resources associated with the adoption of wearable health technology and EHR integration for healthcare organizations. As this area continues to evolve, we expect that our findings will guide future research on wearable health technology, enhancing the understanding of its incorporation into healthcare systems.

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Egypt. J. Chem. 67, SI: M. R. Mahran (2024)

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