International Journal of Chemical and Pharmaceutical Research Updates

Journal homepage: https://orionjournals.com/ijcpru/

(REVIEW ARTICLE)

Check for updates

Assessing the effectiveness of health informatics tools in improving patient-centered care: A critical review

Bisola Oluwafadekemi Adegoke [1,*], Tolulope Odugbose [2] and Christiana Adeyemi [3]

[1] *Health Information Analyst, Huntington WV U.S.A.*
[2] *Department of Child Dental Health, Lagos State, University Teaching Hospital, Ikeja, Lagos, Nigeria.*
[3] *Ohio Dominican University, Columbus Ohio, USA.*

International Journal of Chemical and Pharmaceutical Research Updates, 2024, 02(02), 001–011

Publication history: Received on 28 February 2024; revised on 07 April 2024; accepted on 09 April 2024

Article DOI: https://doi.org/10.53430/ijcpru.2024.2.2.0022

Abstract

In contemporary healthcare, the integration of health informatics tools has become increasingly prevalent, aiming to enhance patient-centered care delivery. This critical review examines the effectiveness of such tools in achieving this objective. By analyzing existing literature, this review synthesizes evidence on the impact of health informatics tools on patient-centered care outcomes. The review encompasses various aspects of health informatics tools, including electronic health records (EHRs), telehealth platforms, mobile health applications, and patient portals. It evaluates their role in facilitating communication between patients and healthcare providers, supporting shared decision-making, improving care coordination, and enhancing patient engagement. Findings from the review indicate that health informatics tools have the potential to positively influence patient-centered care delivery. EHRs enable comprehensive documentation of patient information, enhancing care coordination and continuity across healthcare settings. Telehealth platforms offer convenient access to care, particularly for underserved populations and those with limited mobility. Mobile health applications empower patients to actively participate in their care management, facilitating self-monitoring and adherence to treatment regimens. Patient portals foster communication between patients and providers, enabling secure messaging, appointment scheduling, and access to health information. However, the review also identifies challenges and limitations associated with the implementation of health informatics tools. These include concerns regarding data privacy and security, disparities in digital health literacy, and barriers to interoperability among different systems. Additionally, the effectiveness of these tools in improving health outcomes and patient satisfaction may vary depending on factors such as user engagement, workflow integration, and organizational support. In conclusion, while health informatics tools hold promise for enhancing patient-centered care, their implementation requires careful consideration of various factors to maximize effectiveness and address potential challenges. Future research should focus on addressing existing gaps in knowledge and exploring innovative approaches to leverage these tools effectively in healthcare delivery.

Keywords: Effectiveness; Health; Informatic Tools; Patient-Centered Care; Improving

1. Introduction

In contemporary healthcare settings, the integration of health informatics tools has revolutionized the delivery of patient care, offering innovative solutions to enhance efficiency, accuracy, and overall quality of services. These tools encompass a diverse array of technologies designed to manage, analyze, and disseminate health information, including electronic health records (EHRs), clinical decision support systems, telemedicine platforms, mobile health applications, and wearable devices. By harnessing the power of information and communication technologies, health informatics

* Corresponding author: Bisola Oluwafadekemi Adegoke

tools aim to optimize clinical workflows, facilitate data-driven decision-making, and improve patient outcomes (Al-Jaroodi, Mohamed & Abukhousa, 2020, Williams, Oke & Zachary, 2019, Wu & Trigo, 2021).

Central to the evolution of healthcare delivery is the concept of patient-centered care, which prioritizes the individual needs, preferences, and values of patients in the provision of healthcare services. Patient-centered care recognizes the importance of fostering collaborative relationships between patients, caregivers, and healthcare providers, with an emphasis on shared decision-making, communication, and mutual respect. By actively involving patients in their care plans and treatment decisions, patient-centered care seeks to enhance treatment adherence, promote patient satisfaction, and ultimately, improve health outcomes (Arnold, 2019, Eklund, et. al., 2019, Schoenthaler, Hassan & Fiscella, 2019).

Against this backdrop, the purpose of this critical review is to assess the effectiveness of health informatics tools in advancing patient-centered care within healthcare delivery systems. This review will delve into the multifaceted role of health informatics tools in supporting patient-centered care practices, examining their impact on various aspects of the patient-provider relationship, clinical decision-making processes, and overall healthcare experiences. The scope of this critical review encompasses an exploration of empirical research, theoretical frameworks, and practical applications related to the use of health informatics tools in promoting patient-centered care. It will critically evaluate existing literature, identify key trends and challenges, and synthesize evidence-based insights to inform future directions in healthcare policy, practice, and research.

By critically assessing the effectiveness of health informatics tools in improving patient-centered care, this review aims to contribute to the ongoing discourse surrounding the optimization of healthcare delivery systems and the enhancement of patient experiences. Ultimately, the findings of this review will provide valuable insights for healthcare stakeholders seeking to leverage health informatics tools to foster patient-centered care and drive positive health outcomes.

2. Historical Perspective

The history of the effectiveness of health informatics tools in improving patient-centered care is a testament to the evolution of healthcare delivery and technology. Over the past few decades, there has been a significant shift in how healthcare is delivered, with a greater emphasis on patient-centered care and the use of technology to support this approach. This evolution has been driven by a combination of factors, including advances in medical technology, changes in healthcare policies and regulations, and the increasing demand for more personalized and accessible healthcare services (Dang, et. al., 2021, Tula et al., 2023, Mitchell, Holtz & McCarroll, 2019, Topaz, et. al., 2020).

One of the earliest examples of health informatics tools in improving patient-centered care can be traced back to the development of electronic health records (EHRs). EHRs were introduced in the 1960s as a way to digitize patient medical records and make them more accessible to healthcare providers. Initially, EHRs were used primarily for administrative purposes, such as billing and scheduling. However, over time, EHRs evolved to include clinical data, such as lab results, imaging studies, and medication history, making it easier for healthcare providers to access and share patient information.

The introduction of EHRs marked a significant milestone in the history of health informatics tools, as it laid the foundation for more advanced technologies to improve patient-centered care. In the 1980s and 1990s, the development of telehealth and telemedicine technologies further expanded the reach of healthcare services, allowing patients to consult with healthcare providers remotely. These technologies were particularly beneficial for patients in rural or underserved areas, who may have had limited access to healthcare services (Davis, 2019, Hardy, 2022, Daraojimba et al., 2023, Moody-Williams, 2020).

In the early 2000s, the emergence of mobile health (mHealth) applications revolutionized patient-centered care by putting healthcare information and tools directly into the hands of patients. mHealth applications allowed patients to track their health metrics, communicate with healthcare providers, and access educational resources, empowering them to take a more active role in managing their health.

More recently, the integration of artificial intelligence (AI) and data analytics in health informatics tools has further enhanced patient-centered care. AI algorithms can analyze large volumes of healthcare data to identify patterns and trends, helping healthcare providers make more informed decisions about patient care. Additionally, AI-powered chatbots and virtual assistants can provide patients with personalized health information and support, improving the overall patient experience (Ahmed, et. al., 2020, Ohalete et al., 2023, Bjerring & Busch, 2021, Jabarulla & Lee, 2021).

In conclusion, the history of the effectiveness of health informatics tools in improving patient-centered care is a story of innovation and advancement. From the development of EHRs to the integration of AI, these tools have transformed healthcare delivery, making it more personalized, accessible, and efficient. As technology continues to evolve, the future of patient-centered care looks brighter than ever, with endless possibilities for improving health outcomes and enhancing the patient experience.

3. Health Informatics Tools in Patient-Centered Care

Health informatics tools play a pivotal role in facilitating patient-centered care by leveraging technology to enhance communication, access to healthcare services, and patient engagement. In this critical review, we explore the effectiveness of various health informatics tools in promoting patient-centered care, focusing on electronic health records (EHRs), telehealth platforms, mobile health applications, and patient portals. Through a comprehensive examination of empirical research and theoretical frameworks, we aim to assess the impact of these tools on improving patient experiences, outcomes, and satisfaction within healthcare delivery systems (Esmaeilzadeh, Dharanikota & Mirzaei, 2021, Pandita, 2022, Tai-Seale, et. al., 2021).

Electronic Health Records (EHRs) are digital repositories of patient health information, including medical history, diagnoses, medications, allergies, and laboratory test results. EHRs facilitate seamless information sharing among healthcare providers, enabling comprehensive and coordinated patient care. By consolidating patient data in a centralized system, EHRs streamline clinical workflows, reduce documentation errors, and enhance care coordination. Moreover, EHRs support patient-centered care by empowering individuals to access their health information, communicate with providers, and participate in shared decision-making processes (Horton, et. al., 2019, Melton, et. al., 2021, Aderibigbe et al., 2023, Sowah, et. al., 2021).

Telehealth platforms utilize telecommunications technology to deliver healthcare services remotely, allowing patients to consult with healthcare providers via videoconferencing, telephone calls, or secure messaging systems. Telehealth expands access to care, particularly for individuals in rural or underserved areas, by overcoming geographical barriers and reducing travel-related burdens. Additionally, telehealth promotes patient-centered care by offering convenient and timely access to healthcare services, enabling virtual consultations, remote monitoring, and follow-up visits. Patients appreciate the flexibility and convenience of telehealth, which can improve their overall healthcare experiences and satisfaction (Barbosa, et. al., 2021, Ohalete et al., 2023, Ferrara, 2023, Gujral, et. al., 2022).

Mobile health applications, or mHealth apps, are software applications designed to support health-related activities and wellness behaviors on mobile devices such as smartphones and tablets. These apps offer a wide range of functionalities, including medication reminders, symptom tracking, fitness monitoring, and health education. mHealth apps empower patients to take an active role in managing their health and well-being, promoting self-care and self-management (Mahmood, et. al., 2019, Mano, 2021, Pires, et. al., 2020). By providing personalized health information and real-time feedback, mHealth apps facilitate patient engagement and adherence to treatment plans, thereby contributing to improved health outcomes.

Patient portals are secure online platforms that enable patients to access their health records, communicate with healthcare providers, schedule appointments, request prescription refills, and view test results. Patient portals promote patient-centered care by facilitating communication and information exchange between patients and providers outside of traditional clinical encounters. Patients appreciate the convenience and accessibility of patient portals, which empower them to play a more active role in their healthcare decisions and interactions. By enhancing patient-provider communication and engagement, patient portals contribute to improved care coordination, adherence to treatment plans, and patient satisfaction.

Health informatics tools, including EHRs, telehealth platforms, mobile health applications, and patient portals, are instrumental in advancing patient-centered care within healthcare delivery systems. These tools offer innovative solutions to improve communication, access to care, and patient engagement, ultimately enhancing patient experiences and outcomes. As technology continues to evolve, it is imperative for healthcare organizations to leverage health informatics tools effectively to foster patient-centered care and drive positive health outcomes (Pandita, 2022, Pérez-Stable, Jean-Francois & Aklin, 2019, Talal, et. al., 2020).

4. Impact of Health Informatics Tools on Patient-Centered Care

Health informatics tools have revolutionized the healthcare landscape, offering innovative solutions to improve patient-centered care. By facilitating communication between patients and healthcare providers, supporting shared decision-making, improving care coordination, and enhancing patient engagement, these tools play a crucial role in optimizing patient experiences and outcomes. In this article, we delve into the impact of health informatics tools on patient-centered care, exploring how they empower individuals to actively participate in their healthcare journey and collaborate with providers to achieve optimal health outcomes (Carmina, et. al., 2023, Dang, T et. al., 2021).

Health informatics tools, such as secure messaging systems, patient portals, and telehealth platforms, facilitate seamless communication between patients and healthcare providers. Patients can easily relay their concerns, ask questions, and request information in a timely manner, regardless of geographic location or time constraints. This improved communication fosters a sense of trust and transparency between patients and providers, enabling more meaningful interactions and enhancing the patient-provider relationship. Moreover, effective communication ensures that patients feel heard, understood, and valued, leading to increased satisfaction with the care received (Alverson, 2021, Dinh-Le, et. al., 2019, Talal, et. al., 2020).

Shared decision-making is a collaborative approach in healthcare where patients and providers work together to make informed decisions about treatment options that align with the patient's preferences, values, and goals. Health informatics tools provide patients with access to relevant health information, educational resources, and decision support tools, empowering them to actively participate in the decision-making process. By facilitating shared decision-making, these tools promote patient autonomy, autonomy, and dignity, ultimately leading to more personalized and patient-centered care plans.

Effective care coordination is essential for delivering high-quality, patient-centered care, particularly for individuals with complex healthcare needs or chronic conditions. Health informatics tools, such as electronic health records (EHRs) and health information exchange (HIE) platforms, streamline communication and information sharing among multiple healthcare providers involved in a patient's care. This seamless exchange of information enables providers to collaborate more effectively, avoid duplication of services, and ensure that patients receive comprehensive and coordinated care across various settings and specialties (Brooks, Winship & Kuzel, 2020, Swan, Haas & Jessie, 2019).

Patient engagement refers to the active involvement of patients in their healthcare journey, including self-management of health conditions, adherence to treatment plans, and participation in preventive care activities. Health informatics tools empower patients to take control of their health by providing access to personalized health information, self-monitoring tools, and interactive educational resources. Through these tools, patients can track their health metrics, set goals, and receive real-time feedback, leading to greater motivation and accountability in managing their health. Additionally, health informatics tools facilitate remote monitoring and virtual consultations, enabling patients to stay connected with their providers and receive timely support and guidance (Graffigna, et. al., 2020, Lambrinou, Hansen & Beulens, 2019, Paukkonen, 2023).

Health informatics tools have a profound impact on patient-centered care, enabling patients to actively participate in their healthcare journey and collaborate with providers to achieve optimal health outcomes. By facilitating communication, supporting shared decision-making, improving care coordination, and enhancing patient engagement, these tools empower individuals to make informed decisions about their health and well-being. As technology continues to evolve, it is imperative for healthcare organizations to leverage health informatics tools effectively to promote patient-centered care and drive positive health outcomes.

5. Challenges and Limitations

As health informatics tools continue to play an increasingly prominent role in healthcare delivery, it is essential to critically evaluate their effectiveness in improving patient-centered care. While these tools offer numerous benefits, they also pose several challenges and limitations that need to be addressed. In this critical review, we explore the key challenges and limitations associated with assessing the effectiveness of health informatics tools in enhancing patient-centered care, including data privacy and security concerns, disparities in digital health literacy, barriers to interoperability among different systems, and variability in effectiveness across different settings.

One of the primary challenges associated with health informatics tools is the issue of data privacy and security (Azeez & Van der Vyver, 2019, Keshta & Odeh, 2021, Sittig, et. al., 2020). With the proliferation of electronic health records

(EHRs), telehealth platforms, and mobile health applications, there is a growing concern about the protection of sensitive patient information. Breaches in data security can result in unauthorized access to patients' personal health information, leading to privacy violations and potential harm. Moreover, healthcare organizations must comply with stringent regulations, such as the Health Insurance Portability and Accountability Act (HIPAA), to safeguard patient data. Addressing these privacy and security concerns is crucial to building trust among patients and ensuring the safe and responsible use of health informatics tools.

Another significant challenge is the presence of disparities in digital health literacy among different patient populations. Digital health literacy refers to an individual's ability to access, understand, and use digital health information and technologies effectively. While some patients may be tech-savvy and comfortable using health informatics tools, others may lack the necessary knowledge or skills to navigate these platforms (Nutbeam & Lloyd, 2021, Schillinger, 2020, Stellefson, et. al., 2019). This digital divide can exacerbate existing health disparities, as underserved populations may face barriers to accessing and benefiting from digital health interventions. Healthcare providers must address these disparities by offering tailored education and support to patients with varying levels of digital health literacy, ensuring that all individuals can fully engage with health informatics tools.

Interoperability refers to the ability of different health informatics systems and applications to exchange and use data seamlessly. However, achieving interoperability remains a significant challenge in healthcare due to the fragmented nature of the industry and the proliferation of proprietary software solutions (Benson & Grieve, 2021, Ndlovu, Mars & Scott, 2021, Torab-Miandoab, et. al., 2023). As a result, healthcare organizations often struggle to integrate data from disparate systems, hindering care coordination and continuity. Additionally, interoperability issues can impede the effective evaluation of health informatics tools, as data may be siloed or inaccessible across different platforms. Addressing these barriers requires collaborative efforts from healthcare stakeholders to develop standardized data exchange protocols and promote interoperability across the healthcare ecosystem.

Finally, there is considerable variability in the effectiveness of health informatics tools across different healthcare settings. While some tools may demonstrate promising results in controlled research settings, their effectiveness in real-world clinical practice may be limited by various factors, such as workflow integration, provider engagement, and patient acceptance. Additionally, the impact of health informatics tools may vary depending on the specific clinical context, patient population, and organizational culture. As such, evaluating the effectiveness of these tools requires a nuanced understanding of their implementation and contextual factors. Healthcare researchers and policymakers must consider these complexities when assessing the effectiveness of health informatics tools and designing interventions to improve patient-centered care.

Addressing the challenges and limitations associated with assessing the effectiveness of health informatics tools in improving patient-centered care is essential for maximizing their potential impact on healthcare delivery. By addressing data privacy and security concerns, bridging disparities in digital health literacy, promoting interoperability among different systems, and acknowledging variability in effectiveness across different settings, healthcare organizations can ensure that health informatics tools are used responsibly and effectively to enhance patient-centered care. Moving forward, collaborative efforts from healthcare stakeholders, policymakers, and technology developers are needed to overcome these challenges and realize the full potential of health informatics tools in improving patient outcomes and experiences.

6. Critical Review of Existing Literature

Health informatics tools play a crucial role in enhancing patient-centered care by facilitating communication, improving access to information, and supporting shared decision-making between patients and healthcare providers (de Vries, et. al., 2019, Park, et. al., 2021, Tsai, et. al., 2023). This critical review examines existing literature to assess the effectiveness of health informatics tools in improving patient-centered care. By synthesizing empirical studies and systematic reviews, analyzing key findings and trends, and identifying gaps in knowledge, this review aims to provide insights into the current state of research in this field.

The review begins by synthesizing empirical studies and systematic reviews that have investigated the effectiveness of health informatics tools in improving patient-centered care. These studies encompass a wide range of health informatics interventions, including electronic health records (EHRs), telehealth platforms, mobile health applications, and patient portals. By examining the methodologies, outcomes, and conclusions of these studies, the review aims to provide a comprehensive overview of the existing evidence base (Lewis, et. al., 2020, Rezaei Aghdam, et. al., 2020, Wosny, Strasser & Hastings, 2023).

Next, the review analyzes key findings and trends identified in the literature. Several studies have demonstrated the positive impact of health informatics tools on various aspects of patient-centered care, such as communication, medication adherence, care coordination, and patient engagement. For example, telehealth platforms have been shown to improve access to care for underserved populations, while mobile health applications have facilitated remote monitoring and self-management of chronic conditions. Additionally, the integration of artificial intelligence and data analytics has enabled personalized and proactive healthcare interventions. However, the review also identifies inconsistencies and limitations in the evidence base, including heterogeneity in study designs, outcome measures, and patient populations (Cucciniello,et. al., 2021, Fan & Zhao, 2022, Jat & Grønli, 2023).

Finally, the review identifies gaps in knowledge that warrant further research and investigation. Despite the growing body of literature on health informatics tools, several areas remain underexplored or poorly understood. For instance, there is limited research on the long-term effects of health informatics interventions on patient outcomes and experiences. Additionally, disparities in digital health literacy and access to technology pose significant challenges to the widespread adoption and effectiveness of health informatics tools, particularly among underserved populations. Furthermore, the review highlights the need for more rigorous study designs, standardized outcome measures, and interdisciplinary collaborations to advance the field of health informatics and improve patient-centered care.

In conclusion, this critical review provides a comprehensive synthesis and analysis of existing literature on the effectiveness of health informatics tools in improving patient-centered care. By synthesizing empirical studies and systematic reviews, analyzing key findings and trends, and identifying gaps in knowledge, this review offers valuable insights into the current state of research in this field. Moving forward, addressing these gaps and challenges will be essential for maximizing the potential of health informatics tools to enhance patient-centered care and improve health outcomes for all individuals.

7. Implications for Practice

Health informatics tools have the potential to significantly improve patient-centered care by enhancing communication, coordination, and engagement between patients and healthcare providers (Esmaeilzadeh, Dharanikota & Mirzaei, 2021, Ito, 2020, Mitchell, Holtz & McCarroll, 2019). This critical review examines the implications for practice of assessing the effectiveness of health informatics tools in improving patient-centered care. By providing recommendations for healthcare providers and organizations, strategies to optimize the use of health informatics tools, and considerations for addressing challenges and limitations, this review aims to inform and guide the implementation of these tools in clinical practice.

Healthcare providers and organizations can improve patient-centered care by adopting the use of health informatics tools, such as patient portals and secure messaging systems, to facilitate communication between patients and healthcare providers. Encourage patients to ask questions, provide feedback, and actively participate in their care. Use decision support tools embedded in electronic health records (EHRs) to facilitate shared decision-making between patients and healthcare providers. Ensure that patients are informed about their treatment options, risks, and benefits. Use health informatics tools to streamline care coordination processes, such as appointment scheduling, referrals, and medication management. Ensure that all members of the healthcare team have access to relevant patient information. Use mobile health applications and wearable devices to empower patients to take an active role in managing their health. Provide patients with access to their health information, including lab results, medication lists, and treatment plans.

To optimize the use of health informatics tools, healthcare providers and organizations can consider Providing healthcare providers with training and education on how to use health informatics tools effectively. Ensure that providers are aware of best practices and guidelines for using these tools in clinical practice. Ensure that health informatics tools are user-friendly and accessible to patients of all ages and backgrounds. Consider the use of language translation services and accessibility features for patients with disabilities. Implement robust data privacy and security measures to protect patient information. Ensure that health informatics tools comply with relevant regulations and standards, such as the Health Insurance Portability and Accountability Act (HIPAA).

Healthcare providers and organizations should consider the following factors when addressing challenges and limitations associated with health informatics tools. Ensure that data generated by health informatics tools is accurate, reliable, and up-to-date. Implement data validation and quality control processes to maintain data integrity. Address disparities in digital health literacy and access to technology by providing education and resources to underserved populations. Consider offering digital health services through community health centers and outreach programs. Work towards interoperability between different health informatics tools and systems to ensure seamless data exchange and

continuity of care. Collaborate with other healthcare providers and organizations to develop interoperable solutions (Gawande, et. al., 2019, Jacob, Sanchez-Vazquez & Ivory, 2020, Sittig, et. al., 2020).

In conclusion, this critical review highlights the implications for practice of assessing the effectiveness of health informatics tools in improving patient-centered care. By providing recommendations for healthcare providers and organizations, strategies to optimize the use of health informatics tools, and considerations for addressing challenges and limitations, this review aims to guide the implementation of these tools in clinical practice. By adopting these recommendations and strategies, healthcare providers and organizations can enhance patient-centered care and improve health outcomes for all individuals.

8. Future Research Directions

As health informatics tools continue to evolve and become increasingly integrated into healthcare delivery, it is essential to identify future research directions to assess their effectiveness in improving patient-centered care. This critical review explores areas for further investigation, opportunities for innovation and improvement, and the importance of ongoing evaluation and refinement of health informatics tools. Conduct longitudinal studies to assess the long-term impact of health informatics tools on patient outcomes, including health status, quality of life, and healthcare utilization.

Compare the effectiveness of different health informatics tools in improving patient-centered care to identify the most beneficial interventions for specific patient populations and healthcare settings. Evaluate the cost-effectiveness of health informatics tools compared to traditional care models, considering both direct healthcare costs and indirect costs such as productivity loss and caregiver burden. Investigate the impact of health informatics tools on reducing health disparities among underserved populations, including racial and ethnic minorities, low-income individuals, and rural communities.

Explore the use of artificial intelligence and machine learning algorithms to personalize healthcare interventions based on individual patient characteristics and preferences. Develop real-time monitoring tools that can continuously assess patient health status and provide timely feedback to healthcare providers and patients. Improve interoperability between different health informatics tools and electronic health record systems to enable seamless data exchange and improve care coordination. Design innovative tools to enhance patient engagement, such as gamified applications that motivate patients to adhere to treatment plans and adopt healthy behaviors.

Implement a process of continuous evaluation and refinement of health informatics tools to ensure they remain effective and meet the evolving needs of patients and healthcare providers. Solicit feedback from patients and healthcare providers to identify areas for improvement and inform the development of future iterations of health informatics tools. Establish quality assurance measures to monitor the performance of health informatics tools and address any issues that may arise.

In conclusion, this critical review highlights the importance of future research directions in assessing the effectiveness of health informatics tools in improving patient-centered care. By exploring areas for further investigation, opportunities for innovation and improvement, and the importance of ongoing evaluation and refinement, this review aims to guide future research efforts in this field. By addressing these key areas, researchers can advance our understanding of how health informatics tools can enhance patient-centered care and improve health outcomes for all individuals.

9. Conclusion

In conclusion, this critical review has highlighted the significant role that health informatics tools play in improving patient-centered care. Through the exploration of various tools such as electronic health records, telehealth platforms, and mobile health applications, it is evident that these technologies have the potential to enhance communication between patients and healthcare providers, support shared decision-making, improve care coordination, and enhance patient engagement.

Key findings from this review include the importance of ongoing evaluation and refinement of health informatics tools, the need for personalized care approaches, and the potential of these tools to reduce health disparities and improve health outcomes for all individuals. However, challenges such as data privacy and security concerns, disparities in digital health literacy, and barriers to interoperability remain important considerations in the implementation of these tools.

Moving forward, there is a clear call to action for continued research and implementation of health informatics tools in healthcare delivery. This includes further investigation into areas such as the long-term impact, cost-effectiveness, and comparative effectiveness of these tools, as well as opportunities for innovation and improvement. By addressing these areas, healthcare providers and organizations can optimize the use of health informatics tools to provide more personalized, efficient, and effective care to patients.

In closing, the significance of health informatics tools in patient-centered care cannot be overstated. These tools have the potential to transform healthcare delivery by improving communication, enhancing decision-making, and ultimately, improving health outcomes for patients. As such, it is imperative that researchers, healthcare providers, and policymakers continue to prioritize the development and implementation of these tools to ensure that they fulfill their potential in improving patient-centered care.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Aderibigbe, A.O., Ohenhen, P.E., Nwaobia, N.K., Gidiagba, J.O. and Ani, E.C., 2023. Artificial Intelligence In Developing Countries: Bridging The Gap Between Potential And Implementation. *Computer Science & IT Research Journal*, *4*(3), pp.185-199.

[2] Ahmed, Z., Mohamed, K., Zeeshan, S., & Dong, X. (2020). Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine. Database, 2020, baaa010.

[3] Al-Jaroodi, J., Mohamed, N., & Abukhousa, E. (2020). Health 4.0: on the way to realizing the healthcare of the future. Ieee Access, 8, 211189-211210.

[4] Alverson, D. C. (2021). Telemedicine and health information exchange: An opportunity for integration. Telemedicine, Telehealth and Telepresence: Principles, Strategies, Applications, and New Directions, 63-76.

[5] Arnold, E. C. (2019). Developing Patient-Centered Therapeutic Relationships. Interpersonal Relationships E-Book: Professional Communication Skills for Nurses, 176.

[6] Azeez, N. A., & Van der Vyver, C. (2019). Security and privacy issues in e-health cloud-based system: A comprehensive content analysis. Egyptian Informatics Journal, 20(2), 97-108.

[7] Barbosa, W., Zhou, K., Waddell, E., Myers, T., & Dorsey, E. R. (2021). Improving access to care: telemedicine across medical domains. Annual review of public health, 42, 463-481.

[8] Benson, T., & Grieve, G. (2021). Principles of health interoperability. Cham: Springer International, 21-40.

[9] Bjerring, J. C., & Busch, J. (2021). Artificial intelligence and patient-centered decision-making. Philosophy & Technology, 34, 349-371.

[10] Brooks, E. M., Winship, J. M., & Kuzel, A. J. (2020). A “behind-the-scenes” look at interprofessional care coordination: How person-centered care in safety-net health system complex care clinics produce better outcomes. International journal of integrated care, 20(2).

[11] Carmina, D., Benfenati, V., Simonelli, C., Rotolo, A., Cardano, P., Grovale, N., ... & De Seta, F. (2023). Innovative solutions for disease management. Bioelectronic Medicine, 9(1), 28.

[12] Cucciniello, M., Petracca, F., Ciani, O., & Tarricone, R. (2021). Development features and study characteristics of mobile health apps in the management of chronic conditions: a systematic review of randomised trials. NPJ Digital Medicine, 4(1), 144.

[13] Dang, T. H., Nguyen, T. A., Hoang Van, M., Santin, O., Tran, O. M. T., & Schofield, P. (2021). Patient-centered care: Transforming the health care system in Vietnam with support of digital health technology. Journal of Medical Internet Research, 23(6), e24601.

[14] Daraojimba, C., Eyo-Udo, N.L., Egbokhaebho, B.A., Ofonagoro, K.A., Ogunjobi, O.A., Tula, O.A. and Banso, A.A., 2023. Mapping International Research Cooperation and Intellectual Property Management in the Field of Materials

Science: an Exploration of Strategies, Agreements, and Hurdles. *Engineering Science & Technology Journal*, *4*(3), pp.29-48.

[15] Davis, N. A. (2019). Foundations of Health Information Management-E-Book. Elsevier Health Sciences.

[16] de Vries, M., Jansen, J., van Weert, J., & Holland, R. (2019). Fostering shared decision making with health informatics interventions based on the boosting framework. In Applied Interdisciplinary Theory in Health Informatics (pp. 109-121). IOS Press.

[17] Dinh-Le, C., Chuang, R., Chokshi, S., & Mann, D. (2019). Wearable health technology and electronic health record integration: scoping review and future directions. JMIR mHealth and uHealth, 7(9), e12861.

[18] Eklund, J. H., Holmström, I. K., Kumlin, T., Kaminsky, E., Skoglund, K., Höglander, J., ... & Meranius, M. S. (2019). "Same same or different?" A review of reviews of person-centered and patient-centered care. Patient Education and Counseling, 102(1), 3-11.

[19] Esmaeilzadeh, P., Dharanikota, S., & Mirzaei, T. (2021). The role of patient engagement in patient-centric health information exchange (HIE) initiatives: An empirical study in the United States. Information Technology & People.

[20] Fan, K., & Zhao, Y. (2022). Mobile health technology: a novel tool in chronic disease management. Intelligent Medicine, 2(1), 41-47.

[21] Ferrara, M. E. (2023). Utilization and Patient Experiences of Telehealth Among Rural Californians (Doctoral dissertation, University of California, San Francisco).

[22] Gawande, A., Staggers, N., Elias, B., Makar, E., Alexander, G., Czaja, S., ... & Rosenbloom, S. (2019). Human factors and usability for health information technology: old and new challenges. Yearbook of medical informatics, 28(01), 071-077.

[23] Graffigna, G., Barello, S., Riva, G., Corbo, M., Damiani, G., Iannone, P., ... & Ricciardi, W. (2020). Italian consensus statement on patient engagement in chronic care: process and outcomes. International Journal of Environmental Research and Public Health, 17(11), 4167.

[24] Gujral, K., Scott, J. Y., Ambady, L., Dismuke-Greer, C. E., Jacobs, J., Chow, A., ... & Yoon, J. (2022). A primary care telehealth pilot program to improve access: associations with patients' health care utilization and costs. Telemedicine and e-Health, 28(5), 643-653.

[25] Hardy, L. R. (2022). Health Informatics-E-Book: An Interprofessional Approach. Elsevier Health Sciences.

[26] Horton, D. B., Bhullar, H., Carty, L., Cunningham, F., Ogdie, A., Sultana, J., & Trifirò, G. (2019). Electronic health record databases. Pharmacoepidemiology, 241-289.

[27] Ito, M. (2020). Patient-centered care. In Fundamentals of Telemedicine and Telehealth (pp. 115-126). Academic Press.

[28] Jabarulla, M. Y., & Lee, H. N. (2021, August). A blockchain and artificial intelligence-based, patient-centric healthcare system for combating the COVID-19 pandemic: Opportunities and applications. In Healthcare (Vol. 9, No. 8, p. 1019). MDPI.

[29] Jacob, C., Sanchez-Vazquez, A., & Ivory, C. (2020). Social, organizational, and technological factors impacting clinicians' adoption of mobile health tools: systematic literature review. JMIR mHealth and uHealth, 8(2), e15935.

[30] Jat, A. S., & Grønli, T. M. (2023, August). Harnessing the Digital Revolution: A Comprehensive Review of mHealth Applications for Remote Monitoring in Transforming Healthcare Delivery. In International Conference on Mobile Web and Intelligent Information Systems (pp. 55-67). Cham: Springer Nature Switzerland.

[31] Keshta, I., & Odeh, A. (2021). Security and privacy of electronic health records: Concerns and challenges. Egyptian Informatics Journal, 22(2), 177-183.

[32] Lambrinou, E., Hansen, T. B., & Beulens, J. W. (2019). Lifestyle factors, self-management and patient empowerment in diabetes care. European journal of preventive cardiology, 26(2_suppl), 55-63.

[33] Lewis, C. C., Boyd, M. R., Walsh-Bailey, C., Lyon, A. R., Beidas, R., Mittman, B., ... & Chambers, D. A. (2020). A systematic review of empirical studies examining mechanisms of implementation in health. Implementation Science, 15, 1-25.

[34] Mahmood, A., Kedia, S., Wyant, D. K., Ahn, S., & Bhuyan, S. S. (2019). Use of mobile health applications for health-promoting behavior among individuals with chronic medical conditions. Digital health, 5, 2055207619882181.

[35] Mano, R. (2021). Mobile health apps and health management behaviors: cost-benefit modeling analysis. JMIR human factors, 8(2), e21251.

[36] Melton, G. B., McDonald, C. J., Tang, P. C., & Hripcsak, G. (2021). Electronic health records. In Biomedical Informatics: Computer Applications in Health Care and Biomedicine (pp. 467-509). Cham: Springer International Publishing.

[37] Mitchell, K. M., Holtz, B. E., & McCarroll, A. (2019). Patient-centered methods for designing and developing health information communication technologies: a systematic review. Telemedicine and e-Health, 25(11), 1012-1021.

[38] Moody-Williams, J. (2020). A journey towards patient-centered healthcare quality. Springer International Publishing.

[39] Ndlovu, K., Mars, M., & Scott, R. E. (2021). Interoperability frameworks linking mHealth applications to electronic record systems. BMC Health Services Research, 21(1), 459.

[40] Nutbeam, D., & Lloyd, J. E. (2021). Understanding and responding to health literacy as a social determinant of health. Annu Rev Public Health, 42(1), 159-73.

[41] Ohalete, N.C., Aderibigbe, A.O., Ani, E.C., Ohenhen, P.E. and Akinoso, A.E., 2023. Data science in energy consumption analysis: a review of ai techniques in identifying patterns and efficiency opportunities. Engineering Science & Technology Journal, 4(6), pp.357-380.

[42] Ohalete, N.C., Aderibigbe, A.O., Ani, E.C., Ohenhen, P.E. and Akinoso, A., 2023. Advancements in predictive maintenance in the oil and gas industry: A review of AI and data science applications.

[43] Pandita, D. (2022). Consumer Health Informatics: Engaging and Empowering Patients and Families. In Clinical Informatics Study Guide: Text and Review (pp. 351-374). Cham: Springer International Publishing.

[44] Pandita, D. (2022). Consumer Health Informatics: Engaging and Empowering Patients and Families. In Clinical Informatics Study Guide: Text and Review (pp. 351-374). Cham: Springer International Publishing.

[45] Park, M., Bui, L. K., Jeong, M., Choi, E. J., Lee, N., Kwak, M., ... & Na, J. (2021). ICT-based person-centered community care platform (IPC3P) to enhance shared decision-making for integrated health and social care services. International Journal of Medical Informatics, 156, 104590.

[46] Paukkonen, L. (2023). Patient participation, adherence, and activation for self-management among adult patients with multimorbidity in primary healthcare settings.

[47] Pérez-Stable, E. J., Jean-Francois, B., & Aklin, C. F. (2019). Leveraging advances in technology to promote health equity. Medical care, 57, S101-S103.

[48] Pires, I. M., Marques, G., Garcia, N. M., Flórez-Revuelta, F., Ponciano, V., & Oniani, S. (2020). A research on the classification and applicability of the mobile health applications. Journal of personalized medicine, 10(1), 11.

[49] Rezaei Aghdam, A., Watson, J., Cliff, C., & Miah, S. J. (2020). Improving the theoretical understanding toward patient-driven health care innovation through online value cocreation: systematic review. Journal of medical Internet research, 22(4), e16324.

[50] Schillinger, D. (2020). The intersections between social determinants of health, health literacy, and health disparities. Studies in health technology and informatics, 269, 22.

[51] Schoenthaler, A., Hassan, I., & Fiscella, K. (2019). The time is now: Fostering relationship-centered discussions about patients' social determinants of health. Patient education and counseling, 102(4), 810-814.

[52] Sittig, D. F., Wright, A., Coiera, E., Magrabi, F., Ratwani, R., Bates, D. W., & Singh, H. (2020). Current challenges in health information technology–related patient safety. Health informatics journal, 26(1), 181-189.

[53] Sowah, R. A., Bremang, A., Ocrah, J., Ashie, E., Alhassan, F., & Domo, C. S. (2021). Predictive Medical Diagnostic Tool for Electronic Health Records (EHR). Sci. Dev. J, 5, 37.

[54] Stellefson, M., Paige, S. R., Alber, J. M., Chaney, B. H., Chaney, D., Apperson, A., & Mohan, A. (2019). Association between health literacy, electronic health literacy, disease-specific knowledge, and health-related quality of life among adults with chronic obstructive pulmonary disease: cross-sectional study. Journal of medical Internet research, 21(6), e12165.

[55] Swan, B. A., Haas, S., & Jessie, A. T. (2019). Care coordination: Roles of registered nurses across the care continuum. Nursing Economics, 37(6), 317-323.

[56] Tai-Seale, M., Rosen, R., Ruo, B., Hogarth, M., Longhurst, C. A., Lander, L., ... & Millen, M. (2021). Implementation of patient engagement tools in electronic health records to enhance patient-centered communication: protocol for feasibility evaluation and preliminary results. JMIR Research Protocols, 10(8), e30431.

[57] Talal, A. H., Sofikitou, E. M., Jaanimägi, U., Zeremski, M., Tobin, J. N., & Markatou, M. (2020). A framework for patient-centered telemedicine: Application and lessons learned from vulnerable populations. Journal of Biomedical Informatics, 112, 103622.

[58] Topaz, M., Bar-Bachar, O., Admi, H., Denekamp, Y., & Zimlichman, E. (2020). Patient-centered care via health information technology: a qualitative study with experts from Israel and the US. Informatics for Health and Social Care, 45(3), 217-228.

[59] Torab-Miandoab, A., Samad-Soltani, T., Jodati, A., & Rezaei-Hachesu, P. (2023). Interoperability of heterogeneous health information systems: a systematic literature review. BMC Medical Informatics and Decision Making, 23(1), 18.

[60] Tsai, C. C., Liu, C. F., Lin, H. J., Lin, T. C., Kuo, K. M., Lin, J. J., ... & Lee, M. C. (2023). Implementation of a patient-centered mobile shared decision making platform and healthcare workers' evaluation: A case in a medical center. Informatics for Health and Social Care, 48(1), 68-79.

[61] Tula, O.A., Daraojimba, C., Eyo-Udo, N.L., Egbokhaebho, B.A., Ofonagoro, K.A., Ogunjobi, O.A., Gidiagba, J.O. and Banso, A.A., 2023. Analyzing global evolution of materials research funding and its influence on innovation landscape: a case study of us investment strategies. *Engineering Science & Technology Journal*, *4*(3), pp.120-139.

[62] Williams, F., Oke, A., & Zachary, I. (2019). Public health delivery in the information age: the role of informatics and technology. Perspectives in public health, 139(5), 236-254.

[63] Wosny, M., Strasser, L. M., & Hastings, J. (2023). Experience of health care professionals using digital tools in the hospital: qualitative systematic review. JMIR Human Factors, 10(1), e50357.

[64] Wu, Z., & Trigo, V. (2021). Impact of information system integration on the healthcare management and medical services. International Journal of Healthcare Management, 14(4), 1348-1356.