

Exploring the Landscape of eHealth in Promoting Physical Activity and Healthy Dietary Intake

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Abstract Physical activity (PA) and healthy dietary intake (HDI) play pivotal roles in preventing noncommunicable diseases. With the growing influence of information and communication technologies, electronic health (eHealth) interventions have emerged as a promising avenue for primary prevention in healthcare. These interventions leverage digital platforms to disseminate information and foster positive behavior changes related to PA and HDI. This narrative review aims to provide a comprehensive overview of the current landscape of eHealth interventions targeting PA and HDI, delving into contemporary trends, identifying challenges, and presenting recommendations for future research directions. The review culminates in a synthesis of major conclusions drawn from the collective evidence, emphasizing novel or crucial aspects discovered through the research. Additionally, we highlight the contributions of eHealth interventions in the broader context of preventive healthcare, emphasizing their potential to mitigate the burden of chronic diseases. By providing a nuanced understanding of the current state of eHealth interventions for PA and HDI, this review aims to guide future research endeavors and contribute to the ongoing discourse on leveraging technology for public health advancement.

Keywords eHealth, Physical Activity, Dietary Intake, Current Trends, Challenges, Recommendations

1. Introduction

Physical activity (PA) and healthy dietary intake (HDI) are crucial in preventing noncommunicable diseases and improving psychological well-being [1]. In 2016, a combined total of 41 million deaths worldwide could be attributed to cardiovascular diseases, diabetes, cancer, and obesity [2]. However, people of all age groups in our modern society often fail to meet recommended levels of PA and adopt HDI [3][4][5][6][7]. Sedentary behaviors, such as excessive sitting during work and leisure time, have increased over the years [8][9]. To address this issue, guidelines have been established to promote PA and HDI. However, merely having these recommendations in place is insufficient to drive significant changes in health behavior and alleviate the global burden of these diseases [10]. It is essential to focus on fostering healthy behaviors at all stages of life, and investing in primary prevention can be a sustainable approach. People who are already in good health may find it easier to adopt healthy habits, as opposed to individuals facing obesity or other health conditions that create additional barriers to engaging in HDI [11]. An encouraging approach for primary prevention in healthcare is the use of electronic health (eHealth) interventions, also known as eHealth interventions. These interventions leverage the use of information and communication technologies to promote health [12][13]. By harnessing the power of technology, eHealth interventions can potentially reach a broader audience, making it easier to disseminate information and encourage positive behavior changes related to PA and HDI. Implementing eHealth

interventions in primary care settings can have a significant impact on reducing the prevalence of noncommunicable diseases and improving overall health outcomes.

eHealth refers to the utilization of information and CT, particularly the Internet, to enhance or facilitate health and healthcare services [14]. A wide array of eHealth intervention technologies is available, playing a pivotal role in advancing healthcare interventions and services in the digital age. These technologies are utilized to improve health outcomes and facilitate healthcare interventions [15]. eHealth technologies present a distinctive opportunity to implement behavioral interventions targeting the entire population aimed at addressing PA and HDI. Given that approximately 4 billion people across the globe have regular access to the internet, these technologies have wide-reaching potential to positively impact public health on a global scale [16].

The adoption of novel tools, such as online social networks, has experienced remarkably swift growth [17]. The availability of high-speed broadband connections has facilitated the swift transmission of information in visually appealing formats. Additionally, there has been a swift rise in the quantity of health-related apps, utilized by approximately 5 billion mobile phone users worldwide. These trends have significantly impacted the way people access and engage with digital content and services, providing ample opportunities for the integration of eHealth technologies in various aspects of healthcare and wellness [18][19]. The presence of health apps has spurred the advancement of a new era of devices for tracking PA. These trackers now seamlessly synchronize with smartphone applications and offer functionalities that go well beyond what traditional pedometers can provide [20]. In general, eHealth technologies present a wealth of features and functionalities that create promising possibilities for implementing scalable and cost-effective behavior change interventions [21].

To address the rising rates of obesity and chronic diseases, numerous behavior change interventions have been developed to enhance PA and dietary intake (DI) of individuals [22]. Many of these interventions have traditionally been delivered in face-to-face settings, which can be costly and hinder large-scale implementation [23][24]. There is a need for cost-effective interventions that can effectively improve PA and DI in large populations [25][26]. eHealth technologies, such as the Internet, mobile devices, and smartphone applications, provide promising opportunities for promoting PA and HDI on a population-wide scale [15][27].

Despite the widely recognized advantages of engaging in PA and maintaining a healthy diet [28], a significant portion of contemporary societies does not adhere to the recommended guidelines for these behaviors [29]. Consequently, the lack of physical activity and unhealthy dietary patterns are the primary factors contributing to the rising levels of obesity in these populations [30][31]. Intervention programs targeting behavior change

encompass a spectrum from individual-level strategies to community-wide campaigns across various settings, with generally modest effects regarding PA, diet, and weight loss [32]. The lack of substantial impact has been attributed to issues of effectiveness, reach, and sustainability [32].

An emerging field of research focuses on integrating eHealth technologies to enable more personalized behavior change interventions [33][34][35]. The term "eHealth" is gaining prominence as the Internet expands and allows access to a diverse range of health information.

In the realm of eHealth tools, researchers have extensively explored various behavior change techniques and persuasive system designs to better understand how to motivate users and enhance their retention [36]. Despite these efforts, there remains a significant lack of comprehensive evidence that offers a concise overview of the prevailing trends, challenges, and recommendations impacting the suitability, involvement, and user-friendliness of eHealth services, specifically with a focus on promoting PA and HDI. Addressing this knowledge gap is crucial to fully unlock the potential of health technology. Consequently, this paper sets out to examine the current trends, challenges, and recommendations concerning the suitability, involvement, and user-friendliness of eHealth services explicitly designed to encourage physical activity, advocate for healthy diets, or address both factors simultaneously. By illuminating these aspects, the research seeks to offer valuable insights that can guide the creation and adoption of more efficient and accessible eHealth solutions.

1.1. Objectives of the Study

1. Explore and analyze the existing literature to gain a comprehensive understanding of the current trends, challenges, and recommendations in the realm of eHealth services dedicated to promoting PA and HDI.
2. Identify gaps and knowledge deficiencies in the literature related to the suitability, involvement, and user-friendliness of eHealth services, with a focus on their impact on PA and HDI.

1.2. Research Questions

1. What are the current trends, challenges, and recommendations in the design and implementation of eHealth tools aimed at promoting physical activity (PA) and advocating for healthy dietary intake (HDI)?
2. How suitable, involving, and user-friendly are existing eHealth services in the context of promoting PA and HDI, and what factors contribute to their effectiveness or limitations?

2. Method

Over a span of six months, from June 2023 to October 2023, a narrative review was conducted to

comprehensively explore studies related to eHealth in Physical Activity and healthy dietary intake.

Narrative reviews are highly esteemed for their capacity to enhance comprehension of a specific subject by offering critical analysis and interpretation [37]. This philosophy is in harmony with the research objective, as the authors aimed to narrate the narrative embedded in the literature concerning the encounters with eHealth technology [38].

To ensure inclusivity, four prominent online databases (PubMed, Google Scholar, Scopus, and Web of Science) were employed for data retrieval. The search strategy involved the use of specific search terms and keywords such as "eHealth," "Physical Activity," and "healthy dietary intake" to capture a diverse range of relevant articles. Various combinations of these keywords were applied to optimize the identification of pertinent literature. The assessment of articles was based on their alignment with the overall objectives of the literature review, and only those considered highly relevant were included in the final selection.

3. Result and Discussion

3.1. eHealth in Physical Activity (PA) and Healthy Dietary Intake (HDI)

3.1.1. eHealth in Physical Activity (PA)

Physical activity (PA) is of paramount importance in public health, as emphasized by the World Health Organization (WHO) [39]. To promote active societies, environments, individuals, and functional systems, the World Health Organization (WHO) has established The Physical Activity Global Action Plan to address the global health challenge of inactivity and promote physical activity from 2018 to 2030 [40]. Within this global initiative, one of the specified policy actions is to strengthen healthcare sectors in their efforts to encourage physical activity and address sedentary behavior [40].

To achieve this goal, integrating counseling processes within medical facilities has been endorsed as a promising strategy in healthcare settings to promote physical activity. Health interventions have shown promise in encouraging physical activity within primary healthcare settings [41][42].

eHealth presents a hopeful avenue for facilitating behavior change and improving health results. Numerous studies have examined the impact of digital lifestyle interventions, demonstrating favorable short-term impacts on disease-specific clinical outcomes, levels of physical activity, and dietary habits [18][19][43][44][45][46][47]. Additional studies have revealed that technology-based physical activity interventions are 12% more effective in boosting activity levels when compared to non-technology-based methods [48]. Nevertheless, a

considerable number of individuals who initially download smartphone health apps discontinue their use shortly after [49]. To maximize the effectiveness of health-promoting technology, it is vital to identify the factors that influence engagement with and adherence to these interventions [50], [51].

By leveraging information and communication technologies [13], eHealth interventions have the potential to reach a broader audience, making it easier to disseminate information and encourage positive behavior changes related to PA and HDI. Implementing eHealth interventions in primary care settings aligns with the goals of primary prevention, contributing significantly to reducing the prevalence of noncommunicable diseases and improving overall health outcomes.

3.1.2. eHealth in Healthy Dietary Intake (HDI)

Studies have revealed that the propensity for developing chronic illnesses as a result of poor dietary choices does not solely escalate with advancing age [52], but also accelerates among middle-aged individuals [53]. To postpone the occurrence of such conditions, commonly linked to insufficient dietary patterns and nutritional habits in the middle-aged and elderly population, it becomes imperative to improve diet and nutrition [54]. Maintaining a well-balanced diet is essential not just in the management of chronic conditions but also in the prevention of their development [55][56], in response to the escalating prevalence of obesity and chronic diseases, a multitude of interventions have been devised to improve the dietary intake (DI) of individuals [22].

In the quest to uphold a wholesome diet and lifestyle, numerous individuals have embraced eHealth services. eHealth is a rapidly developing domain in healthcare that leverages diverse technologies to oversee and provide health services to users. In recent years, the adoption of eHealth technologies in the healthcare sector has been steadily increasing [57][58]. Consequently, the research community has shown significant interest in the evaluation of eHealth technologies' effectiveness in delivering healthcare services and achieving positive health outcomes for users [57][59][60][61]. A diverse range of eHealth intervention technologies is accessible, playing a crucial role in propelling healthcare interventions and services into the digital age. These technologies are applied to enhance health outcomes and streamline healthcare interventions [15].

eHealth holds immense potential in promoting and encouraging healthy dietary intake. By leveraging technology and innovative interventions, eHealth can play a vital role in improving public health and addressing the global challenge of poor dietary habits. However, it is essential to address the issue of user engagement and adherence to ensure the long-term effectiveness of eHealth interventions in promoting healthier lifestyles.

4. Current Trends, Challenges and Recommendations

eHealth interventions offer a promising approach to promoting physical activity and healthy dietary intake, addressing the global burden of noncommunicable diseases. Current trends show an increasing adoption of mobile apps, wearable devices, and virtual coaching, supported by gamification and social media engagement. However, challenges related to user engagement, health disparities, data privacy, evidence base, and integration with healthcare systems must be addressed. By conducting rigorous research, tailoring interventions to diverse populations, fostering collaboration, and enhancing user experience, eHealth interventions can have a substantial impact on public health and preventive healthcare.

4.1. Current Trends in eHealth Interventions for PA and HDI

1. **Mobile Applications:** The widespread use of smartphones has led to an increase in mobile health applications focused on promoting physical activity and healthy dietary intake. These apps offer personalized workout plans, diet tracking, and behavior change support, making it convenient for users to access health-related information and stay motivated.
2. **Wearable Devices:** The popularity of wearable fitness trackers, such as smartwatches and fitness bands, has grown significantly. These devices monitor physical activity levels, heart rate, and sleep patterns, providing real-time feedback and encouraging users to engage in more active lifestyles.
3. **Virtual Coaching and Telehealth:** eHealth interventions now include virtual coaching and telehealth services, where individuals can connect with healthcare professionals and nutritionists remotely. These online consultations offer personalized guidance and support, enabling better adherence to physical activity and dietary recommendations.
4. **Social Media and Online Communities:** Social media platforms and online communities play a significant role in disseminating health information and fostering peer support. These platforms facilitate knowledge sharing, social interaction, and encouragement, which can positively influence physical activity and dietary choices.

4.2. Challenges in Implementing eHealth Interventions for PA and HDI

1. **User Engagement and Adherence:** Sustaining user engagement and adherence to eHealth interventions can be challenging. Many individuals download health apps but fail to use them consistently over time.

Understanding the factors influencing user motivation and retention is critical to maximizing the effectiveness of these interventions.

Ethical Consideration: Ensuring sustained user engagement and adherence involves understanding user motivations and factors influencing retention. Ethical concerns may arise if interventions are designed to manipulate users without their informed consent or if there are coercive elements that compromise autonomy.

2. **Health Disparities:** eHealth interventions may not reach vulnerable populations, including those with limited access to technology or digital literacy. Ensuring equitable access and tailoring interventions to diverse populations are essential to address health disparities.

Ethical Consideration: Addressing health disparities through eHealth interventions involves ensuring equitable access and tailoring interventions to diverse populations. Ethical concerns may arise if certain groups are systematically excluded or if interventions inadvertently widen existing health inequalities.

3. **Data Privacy and Security:** As eHealth interventions collect sensitive health data, ensuring data privacy and security is crucial. Protecting users' information and complying with data protection regulations are paramount to maintain trust in these technologies.

Ethical Consideration: Collecting sensitive health data requires a strong commitment to data privacy and security. Ethical concerns may arise if there is a lack of transparency regarding data usage, if user consent is not obtained appropriately, or if there are inadequate measures to protect against data breaches.

4. **Evidence-Based Approaches:** there is a need for more rigorous research to establish their long-term effectiveness and impact on health outcomes. Conducting well-designed randomized controlled trials and systematic reviews is essential to build robust evidence.

Ethical Consideration: Conducting rigorous research to establish the long-term effectiveness of eHealth interventions is essential for ethical implementation. Ethical concerns may arise if interventions are widely adopted without sufficient evidence, potentially leading to ineffective or even harmful outcomes.

5. **Integration with Healthcare Systems:** Integrating eHealth interventions with existing healthcare systems can be challenging due to the complexity of healthcare settings, varying regulations, and interoperability issues. Collaborating with healthcare providers and policymakers is necessary for successful integration.

Ethical Consideration: Successfully integrating

eHealth interventions with healthcare systems requires collaboration with providers and policymakers. Ethical concerns may arise if there is a lack of transparency in these collaborations, if the integration results in unequal access to healthcare, or if there are conflicts of interest that compromise patient well-being.

In summary, ethical considerations in implementing eHealth interventions for physical activity and health disparities include ensuring user autonomy, addressing disparities, safeguarding data privacy, establishing evidence-based practices, and transparently integrating interventions into existing healthcare systems. Adhering to ethical principles is crucial to maximize the positive impact of eHealth interventions while minimizing potential risks and negative consequences.

4.3. Recommendations for Future Research and Implementation

1. Promote a comprehensive assessment of the enduring effects of eHealth interventions on physical activity and dietary habits by advocating for heightened emphasis on longitudinal studies. Ensure the allocation of resources and grants by health agencies and research institutions, specifically directing them toward projects that prioritize long-term effectiveness and outcomes. This approach facilitates a thorough understanding of the extended impact of eHealth interventions on individuals' health behaviors.
2. Tailor Interventions to Diverse Populations: Consideration of cultural, socio-economic, and individual differences is crucial when designing eHealth interventions. Tailoring the content and delivery to specific population segments can enhance engagement and effectiveness. Integrate cultural competence training into the education and certification requirements for eHealth developers, and ensure funding for projects that emphasize cultural tailoring is made available.
3. Promote cohesive eHealth development by fostering collaboration among researchers, healthcare professionals, app developers, and policymakers. This entails creating funding opportunities and incentives for interdisciplinary research teams, alongside establishing collaborative platforms and conferences to facilitate knowledge exchange and partnership building. This approach ultimately leads to comprehensive, evidence-based solutions and innovative approaches with broader implementation.
4. Enhancing the user experience and user interface of eHealth applications can lead to better engagement and retention. User-friendly designs, personalized content, and intuitive navigation are critical elements

for success. Additionally, advocate for continuous professional development for healthcare providers and incentives for innovative user interface solutions to enhance overall engagement and retention.

5. Integrating evidence-based behavior change techniques, such as goal setting, self-monitoring, and feedback, into eHealth interventions can boost their effectiveness in promoting sustained behavior change. Additionally, propose health sector policies mandating the integration of evidence-based behavior change techniques in eHealth interventions, emphasize user education, provider training, and continuous evaluation to enhance effectiveness and user outcomes.

5. Conclusions

eHealth interventions hold tremendous potential in promoting physical activity and healthy dietary intake, contributing to the prevention of noncommunicable diseases. The current trends demonstrate a rise in mobile applications, wearable devices, virtual coaching, and social media engagement, all of which play a significant role in facilitating behavior change. However, challenges related to user engagement, health disparities, data privacy, evidence base, and integration with healthcare systems must be addressed to ensure the widespread and sustainable impact of these interventions.

To overcome these challenges and maximize the effectiveness of eHealth interventions, future research should focus on conducting longitudinal studies to assess long-term impact, tailoring interventions to diverse populations, fostering collaboration between stakeholders, improving user experience and interface, and implementing evidence-based behavior change techniques. By addressing these aspects, eHealth interventions can become powerful tools in encouraging healthy behaviors, reducing the burden of chronic diseases, and ultimately improving public health on a global scale. Embracing the potential of eHealth interventions will empower individuals to take charge of their health, leading to a healthier and more active society for generations to come.

Declaration of Conflicts of Interest

The authors assert that they do not have any competing interests.

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