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USE OF ARTIFICIAL INTELLIGENCE AS A STRATEGY FOR MONITORING AND CONTROL OF CHRONIC NON-COMMUNICABLE DISEASES: AN INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

Chronic non-communicable diseases are the leading cause of death and morbidity worldwide. Applications for mobile devices are commonly used by the population and thus, the implementation of this tool to guide, prevent and monitor the health status of users becomes extremely important, considering the effectiveness of these actions, already proven by the literature. Objective: to conduct an integrative literature review on the effectiveness of artificial intelligence to promote improvements in the health control of the population in relation to NCDs. Materials and methods: This is an integrative literature review through searches in the following electronic databases: National Center for Biotechnology Information (PubMed), Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrievel System Online (MEDLINE), and Latin American and Caribbean Literature on Health Sciences (LILACS). The inclusion criteria were studies published between 2019 and September 2023; be in English, Portuguese or Spanish and that analyzed the effectiveness of artificial intelligence to assist in better control of NCDs. The analysis of the results was done through a critical review of the contents. Results and discussion: 10 articles were included for detailed analysis. The results indicate that this strategy is effective to improve the control of diseases, especially diabetes mellitus, considering the population as a whole, that is, of all socioeconomic levels and cultural diversity. Conclusion: The performance of this review allowed us to conclude that this resource is a great ally for professionals in the elaboration and execution of health promotion actions aimed at reducing NCDs.

Keywords: Chronic Non-Communicable Diseases. Health. Digital Health.

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INTRODUCTION

Chronic non-communicable diseases (NCDs) are the leading cause of death and morbidity on a global scale. In the Brazilian territory, it is found that 54.7% of the deaths registered in 2019 were attributed to this etiology, while 11.5% were caused by pathological developments. The most prevalent NCDs include cardiovascular diseases, malignant neoplasms, diabetes mellitus, and chronic respiratory pathologies, sharing, as a distinctive feature, the intrinsic association with behavioral risk factors, namely: insufficient level of physical activity, unhealthy diet, alcohol intake, and smoking (BRASIL, 2021a).

Thus, the change in the modus vivendi emerges as an ineluctable need for the regulation of these risk elements, however, the patient's agreement with an attitude of self-supervision emerges as essential (ARNETT ET AL., 2019). In order to achieve this strategy, it is necessary to implement several strategies and initiatives in the field of health promotion, however, there is still a vast field to be explored.

The search for innovative approaches occurs incessantly, and the use of technology is the object of research on the rise, since the smartphone is considered the most prominent instrument for the dissemination of information, and its use is already consolidated among health professionals (MORETTI; OLIVEIRA; SILVA, 2012). A comprehensive analysis of this scenario leads us to a deeper understanding of the implications and potential of integrating technology into NCD management. As NCDs continue to be a global public health concern, it is critical to explore innovative and effective approaches to address this growing challenge.

The application of information technology for health care purposes, called "electronic-health" (mHealth), has high applicability and provides opportunities to face the challenges intrinsic to the system, conferring potential to improve the quality of the services provided. Additionally, it is seen as a facilitating tool for communication directed to users, progressively expanding services, considering the speed and continuity of technological evolution (WORLD HEALTH ORGANIZATION, 2019).

mHealth can enable the provision of health services through the use of mobile devices, ranging from sending text and voice messages to the use of more complex resources, such as applications developed for smartphones, which incorporate mobile telecommunications services through internet access and Bluetooth technology. Thus, it is feasible to link this resource to knowledge related to health care in the control of NCDs,

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fostering the adoption of healthier practices and lifestyle transformations (KAY; SANTOS; TAKANE, 2011; GROS, 2016).

Applications designed for mobile devices are widely disseminated in society and, in this context, the implementation of this tool for guidance, prevention and monitoring of the health status of users acquires extreme relevance, especially in light of the effectiveness of these actions, duly proven by the specialized literature.

Therefore, the objective of this study was to carry out an integrative literature review with the purpose of identifying the main contributions of the use of artificial intelligence in promoting improvements in the control of NCDs and in the management of the population's health.

METHODOLOGY

This is an integrative bibliographic review of a scientific nature. The methodological procedure began with the precise definition of the object of study and, subsequent to that, a meticulous series of procedures followed (Mendes, Galvão, Silveira, 2008) in order to answer the following guiding question "How can the application of artificial intelligence in mobile devices improve the control and management of chronic non-communicable diseases (NCDs) and promote the health of the population?"

In this context, the following steps were adopted: the careful selection of the databases, the delimitation of the keywords in accordance with the Controlled Vocabulary in Health (DECS), the realization of a thorough bibliographic survey covering relevant electronic journals, the rigorous application of the inclusion and exclusion criteria, the thorough analysis of the selected articles, followed by a critical interpretation and an authoritative discussion, culminating, finally, in the conclusion of the study.

The sources of scientific information that supported this investigation included publications indexed in the National Center for Biotechnology Information (PubMed), Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrieval System Online (MEDLINE) and Latin American and Caribbean Literature on Health Sciences (LILACS).

The key expressions used for the careful search included the terms "Chronic Noncommunicable Diseases," "Health Promotion," and "Mobile Applications." The combination of these expressions was carried out strategically, resulting in the following

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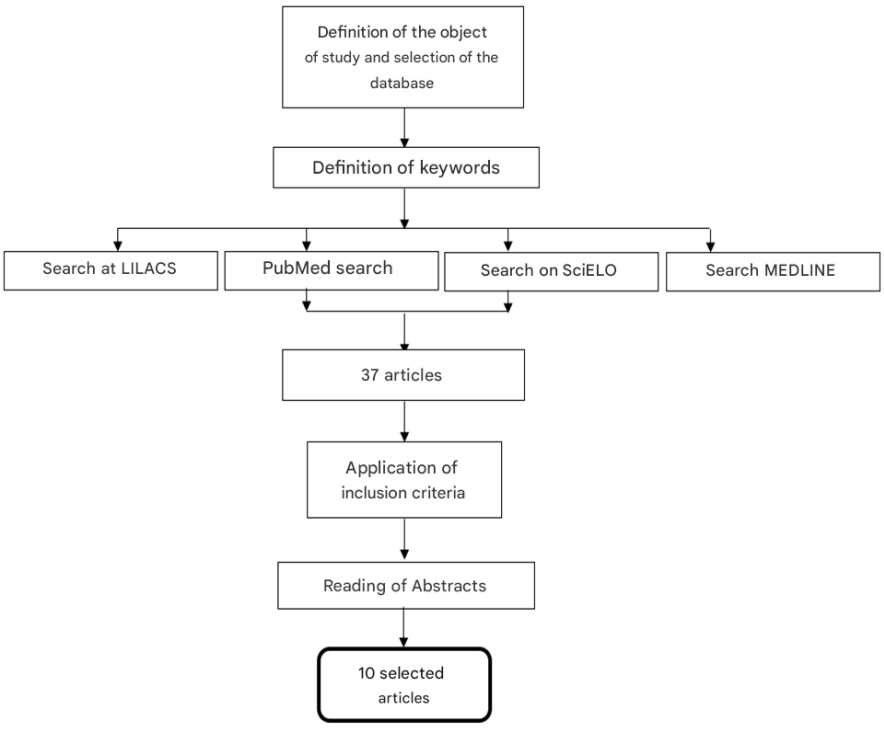
formulation: "Chronic Non-Communicable Diseases AND Health Promotion AND Mobile Applications".

The parameters established as inclusion criteria covered studies published in the period covered by the last five years, that is, from 2019 to September 2023, which were written in English, Portuguese, or Spanish, and which focused on the analysis of the effectiveness of artificial intelligence in improving NCD control. It is noteworthy that redundant publications, as well as literature reviews, monographs, dissertations and theses, or even those that did not fit the scope of this study, were excluded.

During the screening process, 37 articles were found from the databases mentioned above. Subsequently, after applying the aforementioned criteria, 10 articles reached the condition of being included in this research, and were then submitted to a detailed and careful analysis, as illustrated in Figure 1.

Figure 1. Flowchart for searching and selecting articles



RESULTS

Chart 1 refers to the studies identified and categorized according to specific criteria, namely: authorship and year of publication, title, purpose and conclusions of each scientific production. This resource, by providing a detailed synthesis of the investigations eligible to

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compose this review article, enables a comparative analysis of the approaches employed and the findings obtained, thus contributing to a more comprehensive and in-depth understanding of the panorama of studies on the subject in question.

In this context, the careful establishment of analysis categories and the tabulation of information extracted from primary sources are common and necessary practices in the field of scientific research. This methodological approach provides a systematic organization of the data collected, which, in turn, facilitates the identification of patterns, trends and discrepancies in the investigations in question, contributing substantially to the development of scientific knowledge. Therefore, this framework plays a crucial role in consolidating knowledge and conducting more grounded and informed scientific research.

Table 1. Distribution of articles according to authorship/year, title, objectives and conclusion.

Author/year	Title	Goal	Conclusion
DENIZ-GARCIA *et al.* (2023)	Quality, Usability, and Effectiveness of mHealth Apps and the Role of Artificial Intelligence: Current Scenario and Challenges	Review guidelines for implementing healthcare applications and the challenges related to quality, usability, and user engagement and behavior change for NCD prevention.	It is concluded that the implementation of Artificial Intelligence applications in routine clinical practice and remote healthcare will not be feasible until it overcomes the main challenges related to data privacy and security.
AGACHI *et al.* (2023)	The Effect of Periodic Email Prompts on Participant Engagement With a Behavior Change mHealth App: Longitudinal Study	To analyze whether periodic email notices increased participants' engagement with the *mHealth* app and how this effect evolved over time.	Participants' engagement with an *mHealth* application for behavior change can be positively influenced by email prompts, albeit to a limited extent.
LIM *et al.* (2021)	A Smartphone App to Restore Optimal Weight (SPAROW) in Women With Recent Gestational Diabetes Mellitus: Randomized Controlled Trial.	To investigate the efficacy of a *smartphone* app in restoring ideal postpartum weight in women with gestational diabetes mellitus.	Although no significant increase in the number of women who reached their ideal weight was observed, this application remains promising, as women in the intervention group reported better health behaviors and lower caloric intake.
AZELTON *et al.* (2021)	Digital Health Coaching for Type 2 Diabetes: Randomized Controlled Trial of Healthy at Home	Analyze the impact of *Healthy at Home*, a phone- and SMS-based digital health coaching program, on insulin resistance.	The *Healthy at Home* app, characterized by digital coaching, was able to reduce the progression of insulin resistance in type 2 diabetes mellitus.
LINDQVIST *et al.* (2020)	User Perception of a Smartphone App to Promote Physical Activity Through Active Transportation: Inductive Qualitative	To assess the ability of a behavior change program delivered through a *smartphone* app to motivate participants to increase	The results showed that the application was well accepted by the participants. Self-monitoring and goal setting were the main motivators

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	Content Analysis Within the Smart City Active Mobile Phone Intervention (SCAMPI) Study.	physical activity levels through active transportation.	for practicing more active transportation.
GARRIDO; DELAY (2019)	Use of social networks as a strategy to promote healthy food in adolescents	To analyze the use of social networks as a healthy eating strategy in adolescents, using the support of the messages of the Food-Based Food Guides (GABAS).	It was concluded that there is a significant learning with the messages sent. In addition, the recommendations of the GABAS messages were put into practice, evidenced by the recording of messages, videos and photographs sent by adolescents.
KABIR; SCHULMAN; ABDULLAH (2019)	Promoting Relational Agent for Health Behavior Change in Low and Middle - Income Countries (LMICs): Issues and Approaches.	To analyze the growing application of mobile devices in behavior change interventions in high-income countries and to describe the potential of their use in low- and middle-income countries.	Mobile devices have great potential to address the shortage of human resources for health in low- and middle-income countries by facilitating the delivery of health services.
KHARBANDA *et al.* (2019)	mOral Health in India: Current Scenario and Future Perspectives	To analyze the effectiveness of mobile health in relation to the oral health of young people.	It was concluded that the mobile application has not only contributed to a greater motivation of young people to take care of their teeth more effectively, but also has enormous potential as a way to convey crucial messages and information about oral health.
VERBIEST *et al.* (2019)	Using codesign to develop a culturally tailored, behavior change mHealth intervention for indigenous and other priority communities: A case study in New Zealand	Provide insight To identify whether they are able to adapt to different cultural and behavioral needs.	*Codesign* allowed and empowered users to adapt the intervention to their cultural needs, through the use of *mHealth.*
MURALIDHARAN *et al.* (2019)	Engagement and Weight Loss: Results from the Mobile Health and Diabetes Trial	Achieve 5% weight loss and see if there is an association with the degree of involvement with the *mDiab app*.	The result of this article suggests that the use of an *mHealth* intervention may help with moderate weight loss in a high-risk population.

Source: survey data (2024)

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DISCUSSION

In contemporary times, the substantial increase in the adoption of technologies, especially smartphones, by society is undeniable. Through these devices, a variety of activities can be carried out, such as shopping, entertainment, obtaining information, and even gaming. In this way, mobile applications emerge as a facilitating option for the dissemination of knowledge related to health care.

In this context of practical application, AI assumes a multifaceted role in the control of NCDs. For example, AI algorithms have the ability to analyze electronic health records, identifying patients at risk of developing NCDs based on their medical history and lifestyle. Such an approach allows for early and personalized interventions, including the prescription of behavioral and lifestyle modifications, as well as the administration of medications when necessary.

Thus, it is essential to search for studies that investigate the adherence of individuals to the use of health applications and, equally relevant, the evaluation of the effectiveness of these technological interventions. It is believed that this is an effective and accessible tool to improve the health conditions of the population, representing a crucial health promotion strategy. This is particularly relevant in underdeveloped countries, where scarcity of resources and information often leads to less healthy habits.

In this scenario, the study conducted by Kabir, Schulman, and Abdullah (2019) plays a prominent role, as it seeks to evaluate the effectiveness of technology in modifying health-related behaviors, both in high-income countries and in middle- and low-income countries. The authors argue that mobile devices have the ability to positively influence user behavior and can also play a key role in mitigating the shortage of human resources for health in low- and middle-income nations, contributing to the provision of health services to the population.

Additionally, these devices have the flexibility to adapt to different cultures, as identified by Verbiest *et al. (2019),* who employed a co-design methodology in their study to meet the varied needs of different cultural groups. This approach contributes significantly to lifestyle changes being better accepted and adopted by the population, taking into account cultural diversity.

Deniz-Garcia et al. (2023) corroborate the idea that healthy behaviors can be improved through mobile health apps, addressing issues such as diet, physical activity, reducing tobacco consumption, alcohol, and sun exposure. However, the authors highlight

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the need for measures to improve the privacy and security of patient and health care data to improve the effectiveness of these tools.

Lindqvist et al. (2020) identified a change in lifestyle, specifically an increase in physical activity levels, through technology. In their study, they explored the perceptions of healthy adults regarding the use of a smartphone app designed to promote the use of active transportation. They concluded that positive changes were motivated by self-monitoring, goal setting and receiving reminder messages.

The use of reminder messages was also evaluated by Agachi et al. (2023), who examined whether periodic email prompts increased participants' engagement with the mHealth app and how this effect evolved over time. Email reminders were found to improve attendee engagement, albeit in a limited way. However, given the favorable cost-benefit ratio associated with sending emails and its wide reach, this feature can be considered a cost-effective strategy to increase participant engagement and the effectiveness of lifestyle change programs.

A low-cost strategy adopted to involve the population, especially adolescents, in the use of technology in favor of health, is the use of reminders via WhatsApp. As in the studies mentioned above, Garrido and Mora identified that sending messages proved to be an effective strategy to improve the adherence and education of the young population in relation to lifestyle change guidelines, aiming at health promotion and prevention of NCDs. For the authors, information technologies are ahead of traditional learning approaches, due to the speed and constant increase in their use.

In this context, Kharbanda et al. (2019) agree that sending messages is effective in improving the population's understanding of health information, with the aim of preventing NCDs. Therefore, the authors emphasize the importance of using this technology to carry out oral health promotion interventions, since most health apps focus on chronic diseases, especially in the control of diabetes mellitus.

This statement is in line with the present study, which addressed three articles among the ten used related to diabetes mellitus. Lim et al. (2021) investigated the effectiveness of the Nutritionist Buddy app in restoring ideal postpartum weight in women with a history of gestational diabetes mellitus. The study sought to evaluate whether the use of the app was effective in achieving ideal weight four months after delivery, taking into account the restoration of the weight of the first trimester, if the body mass index (BMI) in this period was ≤23 kg/m2, or the weight loss of at least 5% of the weight of the first

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trimester, if the BMI was >23 kg/m2. Although there was no statistically significant difference, the study recorded a high rate of resource utilization during the intervention (60%) and improvements in health-related behaviors, such as the self-reported reduction in caloric intake by postpartum women, thus promoting a healthier lifestyle for this population.

Muralidharan et al. (2019) also investigated the effectiveness of an app (mDiab) in changing the behavior of individuals with diabetes mellitus, setting the goal of a 5% reduction in body weight. Although the results were mixed, the study identified that the technology used was able to promote moderate weight loss in a high-risk population. The authors emphasize, however, that more comprehensive approaches are needed for the prevention of diabetes mellitus, in addition to weight loss.

On the other hand, Azelton et al. (2021) identified in their study that most of the goals of diabetic patients were related to nutrition and, consequently, to the reduction of body weight. Medication adherence, stress reduction, and functional aspects were also reported, although to a lesser extent. The authors concluded that a health app, characterized by digital coaching, was able to reduce the progression of insulin resistance in type 2 diabetes mellitus. Thus, this resource is considered effective in promoting motivation and overcoming barriers typically faced by the population.

In addition, it is important to highlight that Artificial Intelligence (AI) plays a crucial role in medical research, accelerating the discovery of new treatments and therapies for NCDs through the analysis of large volumes of genomic, molecular, and clinical data. The integration of AI in the control of chronic non-communicable diseases represents a significant advance in the field of healthcare. With the proper application of AI, it is possible to improve the prevention, diagnosis, and treatment of NCDs, providing a more personalized and effective approach to the health care of the population.

However, it is essential to continue investing in research and development in this area, ensuring that AI is accessible to all strata of society. This will contribute to a significant improvement in the quality of life and longevity of people affected by NCDs, thus consolidating the relevance and promising perspective of information and communication technologies in health promotion and prevention of these chronic diseases of great global impact.

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STUDY LIMITATIONS

The discussions presented in this integrative literature review provided a comprehensive and insightful overview of the role of mobile technologies and AI in health promotion and NCD control. However, it is critical to recognize some limitations that may guide future research in this field of study.

First, it is worth noting that most of the studies analyzed in this review focused on high-income countries, where access to technology and mobile devices is more widespread. Therefore, a notable limitation lies in the lack of representation of low- and middle-income countries, where economic and infrastructural barriers can affect the accessibility and effectiveness of technology-based interventions

Another relevant limitation is the lack of long-term studies that assess the sustained impact of technological interventions on behavior change and long-term health improvement. Many of the studies reviewed are based on short-term assessments, which does not allow for a full understanding of the long-term effects of these interventions. Therefore, future research should include longitudinal studies that follow participants over time to determine the durability of effects.

Additionally, the privacy and security of users' health data are key concerns in the use of health apps and mobile technologies. While some studies have mentioned this issue, there is still a need for further investigation into how to ensure the protection of users' personal data and how to increase confidence in the security of mobile health technologies. This is a crucial area for future research, especially in light of growing data privacy concerns.

Another point to be considered is the need for research that more comprehensively explores the effectiveness of different types of health apps, considering the specificities of NCDs. This includes evaluating how these technologies can be tailored to meet the specific needs of patients with different health conditions, such as diabetes, cardiovascular disease, cancer, and chronic respiratory diseases.

Finally, it is important to highlight that the existing literature still lacks a deeper understanding of the cultural and social barriers that can affect user adherence and engagement in health apps. Adapting these technologies to different cultural and social groups is an important challenge that requires further investigation. These considerations are crucial to promote significant advances in the field and to maximize the potential of health technologies in the prevention and control of NCDs.

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CLINICAL APPLICATIONS OF THE FINDINGS

Based on the analyses presented in this integrative literature review study, highly promising prospects emerge for future clinical applications in the domain of digital health and AI in the control of NCDs. The conclusions and insights presented in this article have the potential to guide the design of innovative strategies and interventions to improve the provision of health care and the management of NCDs.

One of the immediate clinical applications that emerges from the results of this study is the adaptation of technology-supported interventions for specific health contexts. This process encompasses the design of highly customized mobile applications and AI systems, aimed at meeting the individual needs of patients affected by different chronic pathologies, such as diabetes, cardiovascular diseases, cancer and respiratory diseases. Such apps can provide ongoing support to patients, including the ability to monitor symptoms and health indicators in real time, as well as provide medication administration reminders, personalized lifestyle guidance, and access to pertinent educational information.

Another clinical application of considerable relevance is the integration of AI systems in medical decision-making. In this context, AI algorithms can be properly trained to perform the analysis of clinical data, electronic health records, and patient-specific information, providing assistance to healthcare professionals in the early identification of risk factors associated with NCDs, as well as in the personalization of treatment plans. This can culminate in more effective and targeted therapeutic interventions, resulting in a reduction in the burden imposed by NCDs, both for patients and for the health system as a whole.

The interconnection of these clinical applications and the continuous advancement of research in this area constitute a fundamental pillar for the transformation of the approach to NCDs, with the potential to substantially improve the management and prevention of these chronic diseases. As digital health and AI continue to evolve, new discoveries and innovations are expected to translate into tangible improvements in the quality of life and overall health of the population affected by NCDs. Therefore, the future promises increasingly effective and personalized solutions for the control and treatment of these diseases.

FUTURE SUGGESTIONS

Prospective research can additionally explore the feasibility of using mobile technology and AI for the purpose of optimizing patient adherence to therapeutic protocols

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and self-care practices. Health apps, in this context, can integrate gamification elements, reward systems, and social interaction mechanisms to encourage and encourage patients to maintain healthy behaviors and comply with prescribed treatment plans. In addition, AI can play a crucial role in personalizing interventions, meticulously considering individual preferences and the intrinsic characteristics of each patient.

Another research domain of notable relevance is the analysis of the long-term effectiveness of technology-anchored interventions. Longitudinal investigations have the ability to monitor patients over extended periods, which makes it possible to elucidate the ongoing effects of the use of healthcare applications and AI systems on the trajectory of NCDs, improved quality of life, and overall health outcomes. Such investigations would provide valuable knowledge about the persistence of the effects of interventions and their long-term influence on the health of the population.

In addition, it is essential to consider the application of AI in the field of medical research. AI has the potential to streamline the analysis of vast genomic, molecular, and clinical datasets, which allows for a deeper understanding of the origins and underlying mechanisms of NCDs. This advance can lead to the identification of new therapeutic targets and the development of more effective therapeutic modalities.

In summary, the clinical implications arising from the findings of this study awaken new perspectives to improve health care and the management of NCDs through mobile technology and AI. Future research may focus on tailoring interventions in line with individual patient needs, integrating AI into clinical decisions, strengthening patient compliance, in-depth assessment of effects over time, and applying AI in the context of medical research. These approaches have the potential to substantially reshape the way in which NCDs are prevented, diagnosed, and treated, thus resulting in a substantial improvement in the quality of life and health of the community in general.

FINAL CONSIDERATIONS

The increasing incorporation of technology into society has been a notorious trend in recent decades. The conduct of this review led to the finding that this resource plays a significant role as a primary ally for professionals in the planning and execution of strategies aimed at health promotion, with a focus on the mitigation of Chronic Non-Communicable Diseases (NCDs). The results of this study show that this approach is effective in optimizing

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the control of diseases, particularly diabetes mellitus, covering the entire population, transcendently from different socioeconomic strata and cultural diversities.

The population's adherence to mobile applications that encourage the practice of physical activity and/or the improvement of eating habits is configured as a strategy of excellence for the transformation of lifestyle and, consequently, for the attenuation of risk factors inherent to the development or worsening of NCDs. In view of this panorama, it is urgent to highlight the indispensability of implementing public policies that promote the engagement of individuals in programs aimed at reformulating their lifestyles, with the aim of safeguarding and promoting their health.

In this context, it is essential to emphasize the need for additional studies to deepen the understanding of the implications of technology in health promotion and NCD management, considering various aspects, such as the long-term effectiveness of digital interventions, the personalization of health strategies based on individual characteristics, and the challenges inherent in the widespread adoption of such technologies by the population. Continuous analysis and interdisciplinary research are crucial to drive future innovations and public health policies aimed at the prevention and effective control of NCDs, thus contributing to the improvement of the quality of life and well-being of the population on a global scale.

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REFERENCES

1. Aqui está a formatação das referências fornecidas no estilo APA (7ª edição), organizada alfabeticamente e ajustada para consistência com as diretrizes da APA:

2. Agachi, E., et al. (2023). The effect of periodic email prompts on participant engagement with a behavior change mHealth app: Longitudinal study. JMIR mHealth and uHealth, 11, e43033. https://doi.org/10.2196/43033

3. Arnett, D. K., et al. (2019). 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation, 140(11), e596–e646. https://doi.org/10.1161/CIR.0000000000000678

4. Azelton, K. R., et al. (2021). Digital health coaching for type 2 diabetes: Randomized controlled trial of Healthy at Home. Frontiers in Digital Health, 3, 764735. https://doi.org/10.3389/fdgth.2021.764735

5. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não Transmissíveis. (2021). Vigitel Brasil 2021. Ministério da Saúde. http://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2021.pdf

6. Deniz-Garcia, A., et al. (2023). Quality, usability, and effectiveness of mHealth apps and the role of artificial intelligence: Current scenario and challenges. Journal of Medical Internet Research, 25, e44030. https://doi.org/10.2196/44030

7. Garrido, M. O., & Mora, E. C. (2019). Uso de las redes sociales como estrategia de promoción de alimentación saludable en adolescentes. Revista Cubana de Informática Médica, 11(1), 113–124. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1684-18242019000100113

8. Gros, B. (2016). The design of smart educational environments. Smart Learning Environments, 3, 1–11. https bundles://doi.org/10.1186/s40561-016-0037-8

9. Guideline, W. H. O. (2019). Recommendations on digital interventions for health system strengthening. World Health Organization. https://www.who.int/publications/i/item/9789241550505

10. Kabir, M. F., Schulman, D., & Abdullah, A. S. (2019). Promoting relational agent for health behavior change in low and middle-income countries (LMICs): Issues and approaches. Journal of Medical Systems, 43(7), 227. https://doi.org/10.1007/s10916-019-1362-1

11. Kay, M., Santos, J., & Takane, M. (2011). mHealth: New horizons for health through mobile technologies. World Health Organization, 64(7), 66–71. https://www.who.int/publications/m/item/mhealth-new-horizons-for-health-through-mobile-technologies

Revista ARACÊ
ISSN: 2358-2472

12. Kharbanda, O. P., et al. (2019). mOral health in India: Current scenario and future perspectives. Contemporary Clinical Dentistry, 10(4), 586–589. https://doi.org/10.4103/ccd.ccd_104_20

13. Lim, K., et al. (2021). A smartphone app to restore optimal weight (SPAROW) in women with recent gestational diabetes mellitus: Randomized controlled trial. JMIR mHealth and uHealth, 9(3), e22147. https://doi.org/10.2196/22147

14. Lindqvist, A.-K., et al. (2020). User perception of a smartphone app to promote physical activity through active transportation: Inductive qualitative content analysis within the Smart City Active Mobile Phone Intervention (SCAMPI) study. JMIR mHealth and uHealth, 8(8), e19380. https://doi.org/10.2196/19380

15. Mendes, K. D. S., Silveira, R. C. C. P., & Galvão, C. M. (2008). Revisão integrativa: Método de pesquisa para a incorporação de evidências na saúde e na enfermagem. Texto & Contexto - Enfermagem, 17(4), 758–764. https://doi.org/10.1590/S0104-07072008000400018

16. Moretti, F. A., Oliveira, V. E., & Silva, E. M. K. (2012). Acesso a informações de saúde na internet: Uma questão de saúde pública? Revista da Associação Médica Brasileira, 58(6), 650–658. https://doi.org/10.1590/S0104-42302012000600007

17. Muralidharan, S., et al. (2019). Engagement and weight loss: Results from the Mobile Health and Diabetes trial. Diabetes Technology & Therapeutics, 21(9), 507–513. https://doi.org/10.1089/dia.2019.0134

18. Verbiest, M. E. A., et al. (2019). Using codesign to develop a culturally tailored, behavior change mHealth intervention for indigenous and other priority communities: A case study in New Zealand. Translational Behavioral Medicine, 9(4), 720–736. https://doi.org/10.1093/tbm/iby093