Digital Education for Self-Care Behavior to Prevent Respiratory Infections in Vulnerable Populations: A Review

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Digital education is increasingly recognised as powerful tool for addressing inequities in healthcare and education among vulnerable populations. Such populations, characterised by specific disadvantages, frequently encounter significant obstacles in accessing conventional educational and healthcare resources. The advent of the global pandemic, namely the Coronavirus disease 2019 (Covid-19), has further compounded the challenges confronting these populations, thereby necessitating the development of novel approaches to address their educational needs. Furthermore, health prevention strategies have been shown to improve general outcomes and protect communities. Digital technologies, including telehealth platforms, mobile health applications, and online learning systems, have emerged as useful solutions to overcome these challenges, offering scalable, flexible, and cost-effective ways to deliver tailored educational content while empowering users to take the respoabnbility to develop and mantein their health and wellbeing.

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1 Introduction

The adoption of digital technologies within healthcare education has allowed a higher access and interaction for individuals with health information (Dunn & Hazzard, 2019). Digital educational interventions not only improve access to healthcare information, but also empower citizens to actively engage themself in their care through personalized and interactive learning experiences (Harris et al., 2023).

Digital educational interventions are increasingly recognized as powerful tools for addressing inequities in healthcare and education among vulnerable populations. One critical area where digital education has demonstrated significant strength is in the prevention of respiratory infections, particularly among vulnerable populations (Goni et al., 2023). Respiratory infections, such as influenza-like illnesses and respiratory syncytial virus, pose a significant health burden on vulnerable populations, including the elderly, immunocompromised individuals, and those with underlying chronic conditions (Colosia et al., 2023).

1.1 Respiratory infections

Respiratory infections are among the most prevalent and impactful disease conditions worldwide, representing a substantial burden on global health systems and populations. Lower respiratory tract infections (LRTIs), including pneumonia, bronchitis, and influenza, are a leading cause of death, especially in low- and middle-income countries (LMICs) (Goni et al., 2023; Ii et al., 2014).

Preventive strategies have proven to be highly effective in mitigating the impact of these diseases, particularly in reducing transmission, hospitalizations, and mortality (Debbag et al., 2024). Vaccination programs are among the most impactful measures, with vaccines for influenza, pneumococcus, and Haemophilus influenzae type B (Hib) significantly reducing the incidence of severe respiratory conditions (Hanage & Schaffner, 2024). Other preventive measures, such as hand hygiene, the use of face masks, and avoiding crowded spaces, also play critical roles.

During the COVID-19 pandemic, the global adoption of mask-wearing and physical distancing significantly reduced the spread not only of SARS-CoV-2, but also of other respiratory infections like influenza (Damette & Huynh, 2023). However, despite this success, disparities in access to preventive care remain a significant challenge. Populations in LMICs and underserved areas are often excluded from vaccination campaigns due to logistical, financial, or infrastructural barriers (Kaddar et al., 2013). Additionally, the adoption of such measures is often hindered by various and interrelated factors that span individual, systemic, and societal levels. Expanding these efforts is essential for maximizing the impact of respiratory infection prevention on global health outcomes, along with increasing public awareness and education about preventive practices (Fokam et al., 2023). Cultural misconceptions further complicate the adoption of preventive measures. Similarly, social norms and stigma associated with certain preventive behaviours can discourage adherence.

1.2 The growth of digital education

The rapid evolution of digital technology has profoundly reshaped the way in which patients access and are engaged with health information.

Education has been recognized as a cornerstone of public health, playing a vital role in promoting awareness, fostering behavioral change, and equipping individuals with the knowledge needed to make informed decisions about their health (Kolbe, 2019). Traditional educational interventions in healthcare have relied on in-person methods, such as community workshops, printed materials, and public health campaigns delivered through mass media platforms like television and radio (Robinson et al., 2014). These approaches have been instrumental in disseminating critical health information and addressing public health emergencies, including vaccination programs and the management of infectious diseases (Hunt & Linos, 2022). Despite their success, these traditional methods often face challenges in scalability, accessibility, and personalization. Printed materials may not be adapted to diverse literacy levels, while in-person campaigns can be resource-intensive and difficult to implement in geographically dispersed or underserved areas (Wolf et al., 2018). Furthermore, traditional educational methods may lack the immediacy and interactivity needed to effectively engage contemporary audiences (Liman Kaban & Karadeniz, 2021).

These limitations have facilitated the integration of digital technologies, which can enhance and revolutionize the delivery of healthcare education; in fact, digital platforms have emerged as essential tools in delivering educational content and health services. However, this rapid shift also revealed persistent inequities in digital access, known as the digital divide. Vulnerable populations often lacked the infrastructure, skills, or devices needed to engage fully with these technologies, exacerbating existing disparities (Eruchalu et al., 2021; Gordon, 2020).

1.3 Vulnerability among population

Vulnerability in healthcare refers to a population's increased susceptibility to adverse health outcomes due to a combination of individual, social, and systemic factors. According to Gordon (2020), vulnerability arises from intersecting determinants such as socio-economic status, age, underlying health conditions, geographic location, and access to healthcare services. These factors not only amplify the risk of diseases like respiratory infections but also limit the capacity of affected populations to engage in preventive and treatment measures.

Socio-economic status plays a central role in health vulnerability. Individuals in low-income households often experience barriers to healthcare access, including the inability to afford vaccines, limited transportation to healthcare facilities, and inadequate access to digital tools necessary for health education (Gordon, 2020).

Age is another critical determinant of vulnerability. Older adults, for instance, are disproportionately affected by respiratory infections such as influenza, pneumonia, and respiratory syncytial virus (RSV) due to weakened immune systems and coexisting chronic conditions (Colosia et al., 2023). Children under five years old are similarly vulnerable, particularly to conditions like pneumonia, which is responsible for significant morbidity and mortality in this age group.

Individuals with chronic health conditions, such as diabetes, cardiovascular disease, or chronic obstructive pulmonary disease (COPD), are at elevated risk for severe outcomes from respiratory infections.

Geographic location further exacerbates vulnerability. Rural and remote communities often lack healthcare infrastructure, making it challenging to access preventive measures such as vaccines and timely treatment.

Many individuals experience overlapping vulnerabilities. For example, an elderly person with diabetes living in a low-income, rural area faces compounded risks due to their age, chronic condition, and geographic isolation. Gordon (2020) emphasizes that addressing such intersecting vulnerabilities requires holistic and tailored interventions that consider the diverse needs of at-risk populations.

To mitigate these vulnerabilities, it is critical to implement strategies that enhance healthcare access, provide targeted education, and address systemic inequities.

1.4 Aim of the study

This review explores the current digital education tools for respiratory infection prevention, with a focus on its application in vulnerable populations.

2 Research methodology

This narrative review (Chiappinotto et al., 2023) has synthesized findings from diverse sources, including PubMed, Scopus, and grey literature (e.g., policy reports, government documents).

The search strategy employed a combination of Medical Subject Headings (MeSH) terms and keywords, such as "Health Education," "Self-Care," "Respiratory Tract Infections," "Digital Health," and "Vulnerable Populations."

Studies were selected based on their relevance to digital interventions, self-care promotion, and their applicability to at-risk groups, with a particular focus on interventions aimed at addressing health disparities. Inclusion criteria emphasized articles published within the last decade, practical applications in public health, and evidence-based findings. Gray literature sources, such as global health reports and non-governmental organization documents, were included to capture real-world insights and policy implications.

The methodology ensures a comprehensive narrative synthesis, integrating evidence from a wide range of academic and practical perspectives.

3 Results and Discussion

3.1 Digital Health Education for vulnerable populations

Defined as the ability to access, understand, and apply health information, health literacy influences an individual's capacity to make informed decisions, adhere to treatment regimens, and engage in preventive care. Digital educational tools are central to advancing health literacy, including mobile health applications, telehealth platforms, e-learning systems, and hospital-based technologies, in particular for vulnerable populations. These groups often encounter significant barriers to accessing traditional health education and care (Blount et al., 2023). Digital education interventions offer scalable, flexible, and cost-effective ways to deliver tailored educational content, while empowering users to take charge of their health and wellbeing (Kaihlanen et al., 2022). Digital tools operate by disseminating accurate health information, fostering active user engagement, and offering decision-making support. Real-time feedback, gamification, and tailored content increase user motivation and adherence to recommended behaviours (Eysenbach, 2011).

Mobile health applications, for instance, are increasingly used to support chronic disease management. These tools offer features such as personalized reminders, educational modules, and progress tracking, all of which foster greater engagement and adherence to treatment plans. Studies have demonstrated their effectiveness in improving outcomes for chronic conditions like diabetes, hypertension, and asthma. For example, patients using a diabetes management app reported better glycaemic control and a deeper understanding of their condition (Harris et al., 2023).

Digital platforms have demonstrated efficacy in delivering structured, interactive, and personalized educational content that enhances comprehension and facilitates behavior change (Kaihlanen et al., 2022).

Telehealth platforms represent another critical innovation, particularly for populations with limited mobility or geographic barriers. By enabling remote consultations and virtual health education sessions, telehealth reduces the need for

physical travel, making healthcare more accessible for older adults and those in rural areas. Meanwhile, e-learning platforms played a critical role in disseminating evidence-based information about infection prevention, vaccination, and public health measures (Monaghesh & Hajizadeh, 2020; Torres et al., 2021). Older adults with chronic conditions have especially benefited from telehealth interventions, which provide convenient access to healthcare professionals and educational resources, improving self-efficacy and reducing hospitalizations among aging populations reducing (Blount et al., 2023).

E-learning modules also play a significant role: online platforms that deliver tailored educational content have proven effective in addressing knowledge gaps and promoting self-care behaviours. These modules are often designed to cater to specific populations, incorporating multimedia elements like videos, infographics, and interactive quizzes to enhance engagement and comprehension (Kaihlanen et al., 2022).

3.2 Limitation of Digital Educational Interventions

Despite their potential, digital education interventions face numerous barriers that limit their effectiveness and accessibility. The first one is the digital divide, which encompasses disparities in access to technology, internet connectivity, and digital literacy. Socioeconomically disadvantaged populations are disproportionately affected, often lacking the financial means to purchase devices or pay for internet services. Rural areas also face infrastructural challenges, with unreliable connectivity further restricting access (Eruchalu et al., 2021).

Digital literacy is another significant barrier, particularly among older adults who may not be familiar with modern technologies. Complex user interfaces and insufficient training exacerbate these difficulties, leading to frustration and disengagement. Older users often require additional support to navigate digital platforms effectively, highlighting the need for user-friendly designs and targeted training programs (Bertolazzi et al., 2024).

Medical vulnerability further complicates the use of digital tools, particularly among older adults and individuals with disabilities. Age-related declines in cognitive and physical function, coupled with limited experience with technology, often hinder

older adults' ability to navigate digital platforms. Inclusive design is important to address these challenges, recommending features such as large fonts, voice-guided navigation, and compatibility with assistive devices (Bertolazzi et al., 2024). Similarly, individuals with disabilities require specialized accessibility features, such as screen readers, tactile interfaces, or captioned videos, to ensure equitable engagement.

Cultural and linguistic barriers also play a critical role in shaping the effectiveness of digital education. Programs that fail to account for cultural norms, language preferences, or social contexts may alienate their target audiences, reducing engagement and impact. Involving community stakeholders is pivotal in the design process to ensure that digital tools are culturally relevant and resonate with users (Tutt et al., 2022). For instance, multilingual support and culturally adaptive content have been shown to improve vaccination uptake among immigrant communities, demonstrating the value of inclusive approaches (Torres et al., 2021). Programs that fail to account for cultural norms, language differences, or specific community needs often struggle to engage users. Therefore, educational programs aimed at preparing the next generation should provide strategies to overcome these challenges (Szara & Klukow, 2023).

4 Conclusion

This review has explored the role of digital education interventions in addressing these challenges.

Digital educational interventions represent a transformative opportunity to enhance health equity and empower vulnerable populations. By leveraging technology to deliver tailored, accessible, and scalable educational content, these tools have the potential to bridge critical gaps in healthcare delivery. However, realizing this potential requires addressing persistent barriers such as the digital divide, low digital literacy, and cultural insensitivity.

The integration of hybrid models, investments in digital infrastructure, and the adoption of user-centric designs are essential steps toward creating inclusive and effective interventions. Hybrid educational models, which combine digital tools with in-person support, offer a promising solution to many of these challenges, as scalability and flexibility of digital platforms with the personalized engagement of

face-to-face interactions. They also help build trust and rapport, which are essential for engaging vulnerable populations.

Furthermore, innovations in Artificial Intelligence and adaptive learning systems can enhance the customization and impact of these tools. Policymakers, healthcare providers, and technology developers must collaborate to ensure that digital education interventions are sustainable, culturally competent, and accessible to all. Digital literacy training should be prioritized, with programs tailored to the needs of specific populations. As the digital world continues to evolve, the potential for these interventions to promote health literacy, empower self-care, and improve health outcomes rests immense. With a concerted effort to address existing challenges, digital educational tools can play a pivotal role in shaping a more equitable and informed society. Future efforts should focus on creating inclusive, user-centric digital tools that align with the diverse needs of vulnerable populations. Investments in infrastructure, training, and emerging technologies will further enhance the capacity of digital education to meet the challenges of modern healthcare. As digital tools continue to evolve, their potential to promote health equity and improve patient outcomes will only grow, fostering a healthier and more informed society.

References

Bertolazzi, A., Quaglia, V., & Bongelli, R. (2024). Barriers and facilitators to health technology adoption by older adults with chronic diseases: An integrative systematic review. *BMC Public Health*, *24*(1), 506. https://doi.org/10.1186/s12889-024-18036-5

Blount, M. A., Douglas, M. D., Li, C., Walston, D. T., Nelms, P. L., Hughes, C. L., Gaglioti, A. H., & Mack, D. H. (2023). Opportunities and Challenges to Advance Health Equity Using Digital Health Tools in Underserved Communities in Southeast US: A Mixed Methods Study. *Journal of Primary Care & Community Health*, *14*, 21501319231184789. https://doi.org/10.1177/21501319231184789

Chiappinotto, S., Bassi, E., & Palese, A. (2023). LA REVISIONE NARRATIVA DELLA LETTERATURA: ASPETTI METODOLOGICI. *L'Infermiere on line - sessione scienze infermieristiche*, 131–141. https://doi.org/10.57659/SSI.2023.012

Colosia, A., Costello, J., McQuarrie, K., Kato, K., & Bertzos, K. (2023). Systematic literature review of the signs and symptoms of respiratory syncytial virus. *Influenza and Other Respiratory Viruses*, *17*(2), e13100. https://doi.org/10.1111/irv.13100

Damette, O., & Huynh, T. L. D. (2023). Face mask is an efficient tool to fight the Covid-19 pandemic and some factors increase the probability of its adoption. *Scientific Reports*, *13*(1), 9218. https://doi.org/10.1038/s41598-023-34776-7

Debbag, R., Rudin, D., Ceddia, F., & Watkins, J. (2024). The Impact of Vaccination on COVID-19, Influenza, and Respiratory Syncytial Virus-Related Outcomes: A Narrative Review. *Infectious Diseases and Therapy*. https://doi.org/10.1007/s40121-024-01079-x

Dunn, P., & Hazzard, E. (2019). Technology approaches to digital health literacy. *International Journal of Cardiology*, *293*, 294–296. https://doi.org/10.1016/j.ijcard.2019.06.039

Eruchalu, C. N., Pichardo, M. S., Bharadwaj, M., Rodriguez, C. B., Rodriguez, J. A., Bergmark, R. W., Bates, D. W., & Ortega, G. (2021). The Expanding Digital Divide: Digital Health Access Inequities during the COVID-19 Pandemic in New York City. *Journal of Urban Health*, *98*(2), 183–186. https://doi.org/10.1007/s11524-020-00508-9

Eysenbach, G. (2011). Infodemiology and Infoveillance: Tracking Online Health Information and Cyberbehavior for Public Health. *American Journal of Preventive Medicine*, *40*(5), S154–S158. https://doi.org/10.1016/j.amepre.2011.02.006

Fokam, J., Nka, A. D., Gabisa, J. E., Nwosu, K., Wanda, F., Mama, L., Ka'e, A. C., Bouba, Y., Semengue, E. N. J., Tchouaket, M. C. T., Takou, D., Ngueko, A. minelle K., Pabo, W., Sosso, S. M., Keiser, O., Perno, C.-F., Colizzi, V., Ekane, E.-G. H., Otokoye, J. O., … Ciaffi, L. (2023). COVID-19 preventive social-behavioural practices and exposure to SARS-CoV-2 among residents in the city of Yaounde: Lessons from the early phase of the pandemic in Cameroon. *PLOS Global Public Health*, *3*(8), e0002331. https://doi.org/10.1371/journal.pgph.0002331

Goni, M. D., Hasan, H., Naing, N. N., Wan-Arfah, N., Deris, Z. Z., Arifin, W. N., & Baaba, A. A. (2023). Impact of a Health Education Intervention on the Incidence of Influenza-Like Illnesses (ILI) During Hajj via Smartphone Application. *Journal of Immigrant and Minority Health*, *25*(4), 870–881. https://doi.org/10.1007/s10903-022-01443-4

Gordon, B. G. (2020). Vulnerability in Research: Basic Ethical Concepts and General Approach to Review. *Ochsner Journal*, *20*(1), 34–38. https://doi.org/10.31486/toj.19.0079

Hanage, W. P., & Schaffner, W. (2024). Burden of Acute Respiratory Infections Caused by Influenza Virus, Respiratory Syncytial Virus, and SARS-CoV-2 with Consideration of Older Adults: A Narrative Review. *Infectious Diseases and Therapy*. https://doi.org/10.1007/s40121-024-01080-4

Harris, K. M., Mayo Gamble, T., Yoo, M. G., Spell, L. A., Minor, T. N., Jones, H., & Lynch, D. (2023). Leveraging mHealth to Mitigate the Impact of COVID-19 in Black American Communities: Qualitative Analysis. *JMIR Human Factors*, *10*, e47294. https://doi.org/10.2196/47294

Hunt, I. de V., & Linos, E. (2022). Social Media for Public Health: Framework for Social Media–Based Public Health Campaigns. *Journal of Medical Internet Research*, *24*(12), e42179. https://doi.org/10.2196/42179

Ii, W. A. F., Gong, M., Bhagwanjee, S., & Sevransky, J. (2014). Global Burden of Influenza as a Cause of Cardiopulmonary Morbidity and Mortality. *Global Heart*, *9*(3). https://doi.org/10.1016/j.gheart.2014.08.004

Kaddar, M., Schmitt, S., Makinen, M., & Milstien, J. (2013). Global support for new vaccine implementation in middle-income countries. *Vaccine*, *31*, B81–B96. https://doi.org/10.1016/j.vaccine.2012.11.085

Kaihlanen, A.-M., Virtanen, L., Buchert, U., Safarov, N., Valkonen, P., Hietapakka, L., Hörhammer, I., Kujala, S., Kouvonen, A., & Heponiemi, T. (2022). Towards digital health equity—A qualitative study of the challenges experienced by vulnerable groups in using digital health services in the COVID-19 era. *BMC Health Services Research*, *22*(1), 188. https://doi.org/10.1186/s12913-022-07584-4

Kolbe, L. J. (2019). School Health as a Strategy to Improve Both Public Health and Education. *Annual Review of Public Health*, *40*(Volume 40, 2019), 443–463. https://doi.org/10.1146/annurev-publhealth-040218-043727

Liman Kaban, A., & Karadeniz, S. (2021). Children's Reading Comprehension and Motivation on Screen Versus on Paper. *Sage Open*, *11*(1), 2158244020988849. https://doi.org/10.1177/2158244020988849

Monaghesh, E., & Hajizadeh, A. (2020). The role of telehealth during COVID-19 outbreak: A systematic review based on current evidence. *BMC Public Health*, *20*(1), 1193. https://doi.org/10.1186/s12889-020-09301-4

Robinson, M. N., Tansil, K. A., Elder, R. W., Soler, R. E., Labre, M. P., Mercer, S. L., Eroglu, D., Baur, C., Lyon-Daniel, K., Fridinger, F., Sokler, L. A., Green, L. W., Miller, T., Dearing, J. W., Evans, W. D., Snyder, L. B., Viswanath, K. K., Beistle, D. M., Chervin, D. D., … Rimer,

B. K. (2014). Mass Media Health Communication Campaigns Combined with Health-Related Product Distribution: A Community Guide Systematic Review. *American Journal of Preventive Medicine*, *47*(3), 360–371. https://doi.org/10.1016/j.amepre.2014.05.034

Szara, M., & Klukow, J. W. (2023). New technologies used in the education of nurses and midwives. *Pielegniarstwo XXI Wieku / Nursing in the 21st Century*, *22*(3), 181–194. https://doi.org/10.2478/pielxxiw-2023-0026

Torres, C., Ogbu-Nwobodo, L., Alsan, M., Stanford, F. C., Banerjee, A., Breza, E., Chandrasekhar, A. G., Eichmeyer, S., Karnani, M., Loisel, T., Goldsmith-Pinkham, P., Olken, B. A., Vautrey, P.-L., Warner, E., Duflo, E., COVID-19 Working Group, Balinda, I. G., Bido-Medina, R., Brandt, A., Velez, C. (2021). Effect of Physician-Delivered COVID-19 Public Health Messages and Messages Acknowledging Racial Inequity on Black and White Adults' Knowledge, Beliefs, and Practices Related to COVID-19: A Randomized Clinical Trial. *JAMA Network Open*, *4*(7), e2117115. https://doi.org/10.1001/jamanetworkopen.2021.17115

Wolf, S., Turner, E. L., Jukes, M. C. H., & Dubeck, M. M. (2018). Changing literacy instruction in Kenyan classrooms: Assessing pathways of influence to improved early literacy outcomes in the HALI intervention. *International Journal of Educational Development*, *62*, 27–34. https://doi.org/10.1016/j.ijedudev.2018.02.004

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