PERSONALIZED HEALTH EDUCATION PROGRAMME USING ARTIFICIAL INTELLIGENCE AMONG ADULTS IN NIGERIA: A HUMAN-CENTRED PERSPECTIVE

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Abstract
The increasing application of Artificial Intelligence (AI) in healthcare has created new opportunities for improving health education through personalized and technology-driven interventions. In Nigeria, however, adults continue to face significant challenges in accessing accurate, timely, and relevant health information due to disparities in healthcare delivery, limited health literacy, inadequate healthcare personnel, and socioeconomic inequalities. These challenges call for innovative approaches that can improve the reach and effectiveness of health education while responding to the diverse needs of the population. This position paper argues that integrating AI into health education should be guided by a human-centred approach that places individuals and their lived experiences at the centre of technological innovation. This paper discussed the potential of AI, including intelligent chatbots, adaptive learning systems, predictive analytics, and multilingual digital platforms, to deliver personalized health education. It also highlighted the benefits of this approach in improving user engagement, health literacy, and informed decision-making, while examining barriers such as inadequate digital infrastructure, low digital literacy, unequal access to technology, and weak regulatory frameworks. Ethical concerns relating to data privacy, algorithmic bias, transparency, and equity are also discussed. The paper concluded that AI-enabled personalised health education programme has the potential to address some of the long-standing challenges of adult health literacy and preventive behaviour in Nigeria by delivering more relevant, timely, and accessible information and support. The paper further suggested that Governments, educational institutions, healthcare organizations, and community-based organizations should endeavour to implement continuous training to improve adults' ability to access, understand, evaluate, and utilize AI-supported health information effectively.

Keywords: *Artificial Intelligence, Digital Health, Health Literacy, Human-Centred Design, Personalized Health Education.*

Introduction
Personalized health education is increasingly recognized as a veritable strategy for improving public health outcomes, because adults do not all absorb, interpret, and act on health information in the same way. Standardized health information often assume that people share similar literacy levels, languages, cultural expectations, access to care, and digital resources, yet this assumption rarely holds in real life (World Health Organisation [WHO], 2024). The World Health Organisation (WHO) has indicated that Nigeria is currently grappling with a complex epidemiological profile characterised by a persistent burden of communicable diseases alongside a rapidly escalating prevalence of non-communicable diseases (NCDs) such as hypertension, diabetes, cancers, and cardiovascular conditions (WHO, 2024). In Nigeria, these differences are

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especially pronounced because adults live in highly varied social, geographic, and economic conditions. As a result, the United Nations Development Programme (UNDP) opined that a single health information delivered to the general public may be too broad for some groups, too technical for others, or too disconnected from everyday realities to produce meaningful change (Mohammed & Muhammad, 2025; UNDP, 2025).

Artificial Intelligence (AI) offers a way to bridge this gap by enabling health education systems to adapt content, timing, format, and tone to the needs of individual users. AI-based systems can process data on age, language, prior behaviour, health interest, and engagement patterns, then use that information to deliver targeted educational messages. Recent work on generative AI for personalized health messaging in Nigeria argues that tailored communication can improve understanding of public health issues and has the potential to support preventive health behaviour, especially in diverse and underserved populations (Mohammed & Muhammad, 2025).

However, the value of AI in health education does not depend only on technical capacity. It also depends on whether the system is usable, trusted, ethical, and locally relevant. A human-centred perspective is therefore indispensable. The National Information Technology Development Agency (NITDA) asserted that Human-centred design begins with the people who will use the programme and asks what they need, what they understand, what they trust, and what barriers they face (NITDA, 2024). This is particularly important in Nigeria, where internet access, digital literacy, language diversity, and trust in institutions vary widely across communities. Policy discussions around Nigeria's AI strategy have also emphasized fairness, accountability, and sectoral relevance, while noting that healthcare remains underdeveloped within the national AI policy framework (Nnaji, 2025). A human-centred AI health education programme should therefore be understood not as a technological novelty, but as a practical and ethical response to the realities of adult health communication in Nigeria.

Nigeria is Africa's most populous nation and is characterized by remarkable diversity in language, culture, educational attainment, income levels, geographical location, and access to digital technologies (World Bank, 2025). The National Bureau of Statistics (NBS) reported that adults residing in urban centres are generally more likely to possess smartphones, stable internet access, and digital literacy skills, whereas those in rural and underserved communities often depend on basic mobile phones, community health workers, radio broadcasts, and face-to-face communication for health information (WHO, 2024; NBS, 2024). Educational attainment also varies considerably across the population, influencing individuals' capacity to understand and apply health information. Such diversity makes it difficult for conventional mass communication strategies to effectively meet the health education needs of all adults.

Health literacy remains uneven across Nigeria. For instance, recent evidence indicates that many Nigerians experience significant challenges in accessing, evaluating, understanding, and applying health information necessary for disease prevention and health promotion (Akinyemi et al., 2025). Poor health literacy has been associated with delayed healthcare seeking, lower uptake of preventive services, poor treatment adherence, and poorer health outcomes. Furthermore, the rapid expansion of digital communication has transformed the way adults obtain health information. The United Nations Children's Fund (UNICEF) reported that many Nigerians now rely on WhatsApp, Facebook, YouTube, radio programmes, religious organizations, family members, and community networks as primary sources of health-related information (UNICEF, 2024). Consequently, the quality of public health education is increasingly influenced not only by formal healthcare institutions but also by the broader digital information ecosystem, where misinformation and inaccurate health claims may spread rapidly.

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Because of these conditions, personalized AI health education can be particularly valuable. It can reach adults in familiar digital spaces, adapt the level of explanation to literacy needs, and deliver information in smaller, more digestible pieces. The challenge, however, is that the same social and digital conditions that make AI promising also make it risky. If a programme assumes high literacy, stable connectivity, or universal trust in digital tools, it may end up serving only a subset of adults. That is why the literature repeatedly emphasizes contextual adaptation in Nigeria's AI and healthcare debates (NITDA, 2024).

AI and Personalized Health Education

AI has been rapidly transforming our world since its inception in the mid-twentieth century. AI encompasses a diverse range of technologies defined as self-learning and adaptive systems. It can be categorized based on technological purposes (like facial or image recognition), functions (such as language understanding and problem-solving), or types of agents (including robots and self-driving cars) (Russell & Norvig, 2021). It also includes various methods and disciplines such as computer vision, speech recognition, and robotics, which serve to enhance traditional human capabilities. Recent progress in AI has been driven by advancements in computing power and data processing techniques (United Nations, 2025).

AI can be understood as a family of computational techniques that enable machines to perform tasks like classification, prediction, pattern recognition, and natural language interaction that would normally require human intelligence (Topol, 2019). In health education, AI capabilities are typically embedded in digital platforms rather than appearing as visible "robots." Examples include algorithms that segment users into risk or interest groups; models that predict which content is most likely to be effective for a given user; and conversational agents that respond to user questions and learn from interactions over time (Okonkwo & Ibrahim, 2025).

Personalized health education refers to the process of tailoring health information, educational content, and behavioural support to individuals' unique characteristics, health needs, preferences, and social contexts rather than delivering standardized messages to the entire population (Kreps & Neuhauser, 2020). In practice, personalization may involve adapting educational content according to factors such as age, gender, pregnancy status, existing medical conditions, health literacy level, language preference, cultural beliefs, and socioeconomic circumstances. It may also include adjusting the timing, frequency, and delivery channels of health messages, including SMS, interactive voice response (IVR), WhatsApp, mobile applications, and web-based platforms, to align with users' communication preferences and levels of digital access (WHO, 2024). AI enhances this process by analyzing user-generated data, identifying behavioural patterns, predicting engagement levels, and continuously refining educational content to maximize relevance and effectiveness. Through machine learning algorithms and predictive analytics, AI systems can provide scalable, dynamic, and individualized health education that evolves with users' changing needs and behaviours (Okonkwo & Ibrahim, 2025).

Globally, AI-enabled digital health interventions have increasingly been implemented to support chronic disease prevention and management, mental health promotion, HIV care, maternal and child health services, and lifestyle behaviour modification. Recent systematic reviews indicate that AI-driven adaptive messaging, intelligent decision-support systems, and conversational health chatbots can improve medication adherence, health literacy, self-management behaviours, patient engagement, and preventive health practices, particularly when these technologies complement rather than replace healthcare professionals (Rajpurkar et al., 2022). In low and middle-income countries (LMICs), including Nigeria, AI applications are often embedded within mobile health (mHealth) platforms using rule-based systems, predictive analytics, and basic machine learning

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algorithms instead of more computationally intensive deep learning models. Nevertheless, these technologies enable more effective audience segmentation, personalized communication, and context-specific health education than conventional manual approaches, making them valuable tools for expanding access to health information in resource-constrained settings (UNICEF, 2024).

In Nigeria, explicitly AI-driven health education interventions are still at an emerging stage, although digital health innovations and policy discussions surrounding artificial intelligence are gaining momentum. The Federal Ministry of Health and Social Welfare (FMoHS) reported that Mobile health (mHealth) programmes that utilize Short Message Service (SMS), voice calls, and mobile applications have demonstrated positive outcomes in promoting maternal and child health, increasing immunization uptake, improving antenatal care attendance, and enhancing adherence to health recommendations among different population groups (FMoHS), 2023). Tailored reminders and educational information delivered through mobile technologies have been shown to increase antenatal care utilization and improve childhood immunization coverage in several pilot interventions across Nigeria and other low- and middle-income countries (Jopir, 2025). Similarly, digital health literacy initiatives targeting older adults and individuals living with chronic diseases have employed customized educational content, behavioural coaching, and mobile-based support systems to strengthen health knowledge, digital competencies, and self-management practices (World Bank, 2025). Although the application of advanced AI technologies in health education remains limited within Nigeria, scholars increasingly recognize the potential of AI-powered chatbots, virtual health assistants, recommender systems, and predictive analytics to deliver targeted health messages, enhance health literacy, and encourage positive health behaviours (Okonkwo & Ibrahim, 2025).

Personalized health education refers to the delivery of health information, educational resources, and behavioural support that are specifically adapted to the characteristics, needs, and circumstances of an individual or identifiable subgroup rather than being uniformly distributed across an entire population (Kreps & Neuhauser, 2020). Personalization may be based on demographic characteristics such as age and gender, health literacy level, language preference, existing medical conditions, behavioural risk factors, cultural beliefs, previous health knowledge, and access to digital technologies. The primary objective is to improve the relevance, clarity, and usefulness of health information by ensuring that educational messages are meaningful and appropriate for the intended recipient. This approach recognizes that increasing knowledge alone does not necessarily result in behavioural change; rather, individuals are more likely to adopt healthy behaviours when health information is timely, understandable, culturally appropriate, and directly applicable to their everyday lives (Nutbeam & Lloyd, 2021).

AI significantly enhances personalized health education by enabling continuous adaptation of educational content based on users' interactions, preferences, and learning patterns. AI systems can analyze large volumes of user-generated data, identify behavioural trends, predict information needs, and automatically modify educational strategies to improve engagement and learning outcomes. For example, an AI-powered platform may detect that a user consistently ignores text-based educational materials and subsequently present the same information through audio messages, videos, infographics, or interactive conversations. Similarly, if assessment results indicate poor comprehension, the system may simplify explanations, provide additional examples, or recommend supplementary learning materials. AI can also recommend subsequent educational modules based on an individual's health status, previous engagement, or expressed concerns, thereby creating a dynamic and user-centred learning experience (Rajpurkar et al., 2022). Recent studies on generative AI for health communication in Nigeria further suggest that AI-driven personalized messaging can improve the relevance, precision, and cultural appropriateness of

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health education, particularly when messages are adapted to users' demographic characteristics, language preferences, and local contexts (Mohammed & Muhammad, 2025).

AI and Nigeria's Adult Health

Nigeria is a large, populous, multilingual country with wide differences in education, income, geography, and access to digital tools. Adults in cities may regularly use smartphones and data-based services, while adults in rural communities may depend more on basic phones, community health workers, or radio (NBS, 2024). Some adults have higher education and digital confidence; others may have limited literacy or little experience with interactive technology. This diversity makes it difficult for any single mass communication strategy to work equally well across all groups.

Health literacy remains uneven in Nigeria. For instance, research on the preventive health information practices of Nigerians shows that many people face difficulty accessing and interpreting health guidance, including advice related to disease prevention (Nutbeam & Lloyd, 2021). This has serious implications for adult education, because people who cannot understand health messages are less likely to take preventive action or seek care early. At the same time, informal and digital sources of health information have become increasingly important (Akinyemi et al., 2025). Adults frequently encounter health claims through WhatsApp, Facebook, radio, friends, religious groups, and community networks. This means that the quality of health education in Nigeria is shaped not just by formal health institutions, but by the wider information ecosystem. Because of these conditions, personalized AI health education can be particularly valuable. It can reach adults in familiar digital spaces, adapt the level of explanation to literacy needs, and deliver information in smaller, more digestible pieces (Nnaji, 2025). The challenge, however, is that the same social and digital conditions that make AI promising also make it risky.

Health Education Challenges Among Adults in Nigeria

Adult health education in Nigeria unfolds within a context of constrained resources, structural inequalities, and cultural and linguistic diversity. Quantitative and qualitative studies consistently show that health literacy among Nigerian adults is low to moderate and unevenly distributed across socio-economic status, education, gender, and region (Okonkwo et al., 2025). In a tertiary hospital in South-South Nigeria, for instance, a 2023 study found that many hypertensive adults lacked adequate understanding of hypertension, target blood pressure levels, and the importance of self-monitoring, with low functional health literacy predicting poorer awareness and practice of self-monitoring of blood pressure (SMBP) (Umuerri et al., 2023). Similarly, focus groups on cancer in Ibadan revealed that while participants could name some risk factors, such as diet or heredity, they also expressed fatalistic beliefs, misconceptions about causes, and significant barriers to preventive action, including cost, stigma, and perceived low personal risk (Akinde et al., 2016).

Conventional health education approaches are poorly structured to address these complex and context-specific needs. Health education is commonly delivered through brief talks in outpatient clinics or wards, health talks during immunisation and antenatal clinics, community outreach activities, and mass media campaigns on radio and television (Soroye & Adebisi, 2020). These interventions typically use one-way communication, are not tailored to individual literacy levels or health conditions, and are often constrained by time pressures in overcrowded facilities, limiting opportunities for questions or dialogue.

Adult education literature reinforces this picture, indicating that many Nigerian adults lack foundational literacy and numeracy, and that adult education programmes are under-resourced and

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inconsistently integrated with health promotion efforts (Odo, 2024). Odo emphasised that adult education programmes often neglect health literacy components, missing opportunities to equip adults with critical skills for interpreting health information and navigating services. Structural factors compound these educational limitations. National reviews of health services highlight chronic underfunding of health promotion, inadequate human resources, and limited training for health workers in participatory communication techniques, all of which undermine effective adult health education (Federal Ministry of Health, 2015).

Nigeria's socio-cultural and linguistic heterogeneity adds further complexity. With more than 500 indigenous languages and diverse religious and cultural traditions, health beliefs and explanatory models vary widely, affecting how adults interpret symptoms, risk, and biomedical advice (Akinde et al., 2016). Messages crafted for a national audience may fail to resonate with or even be intelligible to many adults, particularly those in rural areas or with limited formal education (Egwudo et al., 2025). Gender norms, stigma, and power dynamics within households and communities also influence whether adults can act on health information, such as seeking screening or adhering to treatment (Soroye & Adebisi, 2020).

The digital environment is evolving but remains unequal. Nigeria has relatively high mobile phone penetration, and many adults, especially in urban areas, use phones for calls, SMS, and social media (Jopir, 2025). Recent digital health literacy initiatives among older adults in Lagos used community-based training and tailored digital content to significantly increase digital health literacy scores and engagement with digital health services, achieving an average 56% improvement in digital health literacy skills over the campaign period (WHO, 2024). Another study of digital health literacy programmes for urban adults with chronic diseases documented improved self-management and engagement after six months of tailored digital interventions (Egwudo et al., 2025).

AI for Health Education

Several AI technologies are relevant to personalized health education for adults in Nigeria.

The first is the conversational chatbot. Chatbots can answer common questions, explain health concepts, guide users through basic decision trees, and deliver reminders. Their appeal lies in immediacy and accessibility. A user can ask a question at any time without waiting for a clinician or traveling to a facility (Rajpurkar et al., 2022). In low-resource settings, this can significantly expand access to basic health information. At the same time, chatbots must be carefully designed to avoid overclaiming expertise or giving unsafe advice.

The second is the recommender system. Recommender systems suggest content based on previous interactions or known characteristics. In health education, this might mean recommending the next lesson after a user completes one topic, or offering a more advanced explanation when the system detects comprehension (Ricci et al., 2022). This is useful because adults often learn best in stages. Rather than overwhelm users with long and complex messages, the system can sequence content gradually.

The third is generative AI. Generative systems can draft messages, summarize medical concepts, simplify language, translate content, and create conversational responses. In Nigeria, this is especially useful because health messages may need to be delivered in multiple languages and at multiple reading levels. The study by Mohammed and Muhammad (2025) argued that generative AI could transform personalized health messaging by improving public understanding and supporting health awareness. A generalist conversational AI review in a public health context also highlights the promise of AI-driven messaging platforms for scalable and personalized health

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communication, while stressing challenges such as misinformation, bias, privacy, and the need for oversight (Nadarzynski et al., 2023).

The fourth relevant technology is learning analytics. These tools monitor user behaviour and engagement, helping the system infer whether the user is confused, disengaged, or ready for more content (Siemens & Baker, 2012). If a user repeatedly gets answers wrong or abandons a module early, the platform can intervene with simpler or alternative content. This makes the educational process adaptive rather than static.

The fifth is speech and translation technologies. Text-to-speech, speech-to-text, and automatic translation can make health education more inclusive for people who prefer audio or have low literacy (WHO, 2024). In Nigeria, this is not optional. Voice-based interfaces may be essential for reaching older adults, rural users, and people who are comfortable speaking but less comfortable reading. A human-centred AI system should therefore not assume that text is the default mode of communication.

A Human-Centred Perspective

Human-centred design (HCD) offers a conceptual and practical framework for shaping AI-enabled health education in ways that align with users' needs, capacities, and rights. In global health, HCD is defined by its emphasis on deep engagement with end-users and stakeholders, iterative prototyping and testing, and the pursuit of solutions that are usable, acceptable, and contextually appropriate, rather than technologically impressive but misaligned with reality (Bazzano et al., 2017). Bazzano et al. (2017) further argued that HCD can promote global health equity by illuminating and addressing barriers faced by marginalised populations in interacting with health systems and interventions.

Applying HCD to AI-enabled adult health education in Nigeria requires, first, rigorous formative research into adults' health information needs, decision points, and digital practices. Evidence from digital health literacy campaigns and chronic disease programmes underscore the importance of understanding baseline digital skills, preferred communication channels, and barriers to engagement (UNICEF, 2024). This may involve surveys, in-depth interviews, focus groups, and ethnographic observations in diverse settings such as in rural communities, urban slums, markets, transport hubs among others, to capture the lived realities of different adult groups (Odo, 2024).

Second, HCD entails co-creation of content and interaction modalities. Rather than health professionals and developers alone determining the language, tone, and structure of AI-mediated messages, adults from target communities should be involved in drafting, testing, and refining messages and dialogue flows (Bazzano et al., 2017). Given Nigeria's linguistic diversity and high prevalence of low literacy, this may mean prioritising audio content, pictorial cues, and simple branching dialogues over dense text; supporting multiple local languages; and incorporating culturally resonant metaphors and narratives (UNICEF, 2024).

Third, a human-centred approach recognises and seeks to redress power imbalances between different actors such as the government agencies, donors, private technology companies, health workers, and communities. Digital health projects in LMICs often reflect the priorities of funders and technologists more than those of end-users (Bazzano et al., 2017; Federal Ministry of Health, 2015). To counter this, governance mechanisms such as community advisory boards, user councils, and participatory oversight committees can give adult users and community leaders meaningful roles in shaping AI-enabled programmes and monitoring their impacts (Olawade et al., 2025).

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Fourth, HCD in this context must be explicitly equity-oriented. This implies deliberately prioritising the needs of adults most at risk of exclusion from digital health innovations: low-income and rural residents, women with limited phone ownership or privacy, older adults, people with disabilities, and speakers of minority languages (WHO, 2024). For example, Egwudo et al., (2025) demonstrated that older adults can achieve substantial gains in digital health literacy when interventions are tailored to their baseline skills and delivered through accessible, community-based formats. Likewise, digital health literacy programmes for urban chronic disease patients show that carefully designed interventions can improve self-management even among individuals with low baseline digital skills.

Finally, HCD emphasises iterative learning and adaptation. AI-enabled programmes should not be static; they must incorporate feedback mechanisms like user ratings, complaint channels, usage analytics and governance processes that translate this feedback into concrete changes in algorithms, content, and delivery strategies (Topol, 2019). This iterative orientation is particularly important for AI systems, where biases, misclassifications, or unintended consequences may only become visible during real-world deployment (Nnaji, 2025).

Benefits of the Human-Centred Approach

One anticipated benefit is improved relevance, comprehension, and engagement. Tailored content that reflects adults' specific conditions e.g., hypertension, diabetes, life stages, and cultural contexts is more likely to be perceived as useful and to be acted upon (Topol, 2019). Nigerian evidence supports this logic: digital health literacy campaigns among older adults in Lagos achieved marked improvements in digital health skills and knowledge through tailored, context-sensitive content and coaching (UNICEF, 2024). Similarly, chronic disease self-management programmes that provided personalised digital education for urban Nigerian adults reported improved self-management behaviours and health outcomes over six months. AI-driven personalisation could deepen these gains by dynamically responding to user behaviours. For instance, increasing explanatory content when users repeatedly indicate confusion, or adjusting message timing to align with observed patterns of receptivity (Okonkwo & Ibrahim, 2025).

A second potential benefit is enhanced preventive behaviours and self-management. International studies show that reminder systems and adaptive educational sequences can improve adherence to medications, attendance at appointments, and maintenance of lifestyle changes in chronic disease and maternal health contexts (Topol, 2019). In Nigeria, SMS-based health education and reminder programmes have increased antenatal care attendance and immunisation coverage significantly, suggesting that timely prompts and clear information can shift behaviours (Jopir, 2025). When augmented with AI-enabled risk stratification and engagement-based adaptation, similar systems could provide more intensive support to adults at higher risk of non-adherence or poor control, potentially improving long-term outcomes in conditions such as hypertension and diabetes (Umuerri et al., 2023).

Third, AI-enabled personalisation may create new opportunities to advance equity, if inclusively designed. Low-tech channels such as SMS, USSD, and IVR can reach adults with basic phones and low literacy, including rural residents and older adults who are often marginalised in digital health initiatives (WHO, 2024). By tailoring language, modality (voice vs text), and interaction complexity, programmes can accommodate diverse capacities and preferences. AI models could also be used to identify individuals or groups with low engagement or poor outcomes and trigger additional human follow-up, thus focusing limited human resources on those most in need (Okonkwo & Ibrahim, 2025).

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From a health system perspective, AI-supported education can improve efficiency and resource allocation. Nigerian health workers frequently report heavy workloads and limited time for counselling, particularly in public facilities (Soroye & Adebisi, 2020). Automating routine educational functions such as basic disease information, medication reminders, and simple behaviour change tips could allow health workers to concentrate on complex counselling, clinical decision-making, and relationship-building, provided that AI tools are integrated into workflows and accompanied by adequate training and supervision (Federal Ministry of Health, 2015).

Barriers to Implementation of AI-enabled Personalised Health Education

Infrastructure and access constraints remain among the most fundamental. The Nigerian Communications Commission (NCC) argued that although mobile penetration is relatively high, network coverage is patchy in many rural and peri-urban areas, electricity supply is unreliable, and data costs are high relative to income, particularly for low-income adults (NCC, 2024). These factors limit the feasibility of data-intensive or smartphone-only solutions and can disrupt sustained engagement even with simpler tools. AI-enabled systems that depend on continuous connectivity or high-bandwidth features may therefore exacerbate existing digital divides unless alternative, low-bandwidth, and offline-capable designs are prioritised (Nnaji, 2025).

Digital literacy and skills gaps pose another major barrier. Evidence from Lagos shows that older adults start with limited digital skills and require structured, supportive training to use digital health services effectively; while such training can significantly improve digital health literacy, it is not currently available at scale (UNICEF, 2024). Digital health literacy programmes for urban chronic disease patients highlight that users may initially struggle with basic functions such as navigating apps, interpreting notifications, or managing data privacy settings. On the provider side, Olawade et al. (2025) reported that ethics committee members in Nigerian teaching hospitals have limited knowledge about AI technologies, their functioning, and their implications, suggesting that many health professionals and regulators may lack the skills needed to oversee AI systems or explain them to patients.

Health system and organizational barriers also hinder the implementation of AI-enabled personalized health education in Nigeria. The country's health system continues to face shortages of skilled health workers, inadequate funding, weak health information systems, and limited digital infrastructure, particularly within primary healthcare facilities (Egwudo et al., 2025). In addition, many digital health initiatives have been implemented as donor-funded pilot projects with limited integration into routine healthcare delivery and national digital health systems (Egwudo et al., 2025). Without effective integration into Electronic Medical Record (EMR) systems and primary healthcare processes, AI-enabled health education programme risk increasing fragmentation rather than strengthening a coordinated national digital health ecosystem (Nnaji, 2025).

Financial sustainability represents another major challenge to the successful implementation of AI-driven personalized health education. Developing, localizing, deploying, maintaining, and continuously updating AI applications require substantial investments in technological infrastructure, skilled personnel, cybersecurity, internet connectivity, and user training. Evidence from digital health programmes in Nigeria indicates that many innovations continue to rely heavily on donor funding and international development partners, with limited provision for long-term domestic financing or integration into government health budgets (World Bank, 2025). This dependence raises concerns regarding continuity once external funding ends. Furthermore, Nnaji (2025) argued that without comprehensive legal, regulatory, and sustainable financing frameworks, AI initiatives may either fail to progress beyond pilot implementation or evolve in ways that prioritize commercial objectives over public health needs, equity,

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transparency, and accountability. Establishing robust governance mechanisms, sustainable financing models, and strong public-sector leadership is therefore essential for ensuring the long-term effectiveness and equitable deployment of AI-enabled health education programme in Nigeria (WHO, 2024).

Suggestions

1. AI-powered health promotion interventions should be developed through active engagement with intended users, including adults from diverse socio-economic, cultural, and linguistic backgrounds, to ensure relevance, usability, and acceptability.
2. Educational content should be available in major indigenous languages and delivered through multiple formats such as text, audio, video, and interactive voice response to accommodate varying literacy levels and communication preferences.
3. Governments, educational institutions, healthcare organizations, and community-based organizations should endeavour to implement continuous training to improve adults' ability to access, understand, evaluate, and utilize AI-supported health information effectively.
4. Expanding broadband connectivity, improving electricity supply, and increasing affordable internet access, particularly in rural and underserved communities will enhance equitable access to AI-enabled health promotion services.
5. AI tools should serve as decision-support and health education resources while maintaining healthcare professionals' central role in clinical decision-making, counselling, and patient management.
6. Training programmes should focus on the effective use of AI systems, digital health communication, ethical considerations, and responsible integration of AI into routine health promotion activities.
7. Robust legal and technical safeguards should be implemented to protect users' personal health information and enhance public confidence in AI-based health education systems.
8. Collaboration among government agencies, universities, technology companies, telecommunications providers, healthcare institutions, and development partners can facilitate the development, deployment, and sustainability of locally relevant AI health promotion innovations.
9. Religious leaders, traditional rulers, community health workers, civil society organizations, and local associations should endeavour to participate in designing and promoting AI-enabled health education programme to improve trust, cultural appropriateness, and community acceptance.

Conclusion

AI-enabled personalised health education programme has the potential to address some of the long-standing challenges of adult health literacy and preventive behaviour in Nigeria by delivering more relevant, timely, and accessible information and support. Evidence from digital health literacy campaigns and chronic disease self-management programmes shows that adult Nigerians can benefit substantially from well-designed digital interventions, with improvements in digital health literacy, disease knowledge, and self-management behaviours documented among older adults and urban adults with chronic conditions. However, research on adult health literacy, digital health implementation, and AI ethics in Nigeria also reveals significant infrastructural, institutional, ethical, and social challenges that must be addressed for AI-enabled education to be

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beneficial and equitable. A human-centred perspective offers a principled approach to navigating these tensions. By grounding AI-enabled health education in adult Nigerians' lived realities, involving them in co-design and governance, prioritising those at greatest risk of exclusion, and embedding robust data protection and fairness safeguards, policymakers and practitioners can configure AI systems to support rather than undermine health equity. This requires integrated policy frameworks, multi-stakeholder regulatory bodies, investments in capacity building, and sustainable financing arrangements aligned with Nigeria's broader digital health strategy.

Ultimately, AI is a means rather than an end. The critical question for Nigeria is not whether AI will enter the health education space because this is already happening globally but under what conditions, with whose participation, and to what effect on adults' health and rights. A deliberate, collaborative, and accountable approach today can help ensure that personalised AI-enabled health education strengthens, rather than compromises, health literacy, dignity, and justice for adults across Nigeria.

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