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IMPLEMENTATION OF GENERATIVE AI IN e-HEALTH FOR NEGLECTED TROPICAL DISEASES IN REGIONS WITH LIMITED RESOURCES

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Abstract

Neglected tropical diseases (NTDs) continue to pose significant public health challenges in low-resource settings, including Nigeria. The integration of Generative Artificial Intelligence (AI) in eHealth offers a promising avenue for improving disease detection, diagnosis, and management. This study explores the role of Generative AI in enhancing NTD-related healthcare interventions. The data sourced from Benue and Ondo States, Nigeria respectively implemented leveraging AI-driven tools, healthcare professionals can bridge gaps in surveillance, treatment accessibility, and patient education. Using an extensive review of existing literature and practical implementation analysis, this paper evaluates the effectiveness of AI applications in tackling NTDs in resource-limited regions.

Keywords: Generative AI, e-Health, Neglected Tropical Diseases (NTDs), Limited resource.

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1.0 Introduction

Neglected tropical diseases (NTDs) impact more than one billion individuals globally, significantly burdening regions in sub-Saharan Africa, including Nigeria (Hotez & Kamath, 2009). Despite ongoing efforts, the battle against NTDs is frequently obstructed by poor healthcare infrastructure, a lack of diagnostic tools, and a shortage of medical professionals (Molyneux, 2014). Innovations in digital health, especially those powered by AI, are increasingly acknowledged as game changers for tackling healthcare inequalities (Jacobsen & Aguirre, 2019).

Generative AI has shown considerable promise in enhancing disease surveillance, improving patient diagnostics, and facilitating automated medical consultations, especially in regions that lack adequate healthcare resources (Petric et al., 2020). AI models can produce diagnostic frameworks from available medical data, allowing for prompt and cost-effective disease identification (Ogundele & Adeyemi, 2021). This research explores the incorporation of Generative AI into eHealth systems for neglected tropical diseases (NTDs) and underscores its potential to improve both healthcare access and quality.

2.0 Challenges of NTD Management in Nigeria

Nigeria remains one of the countries with the highest burden of NTDs (Fitzpatrick et al., 2018). Key challenges include:

i. **Limited access to medical diagnostics**: Many rural communities in Benue and Ondo States lack basic laboratory facilities, making early detection difficult (Bockarie & Kelly-Hope, 2010).

ii. **Insufficient healthcare workforce**: The shortage of trained medical personnel exacerbates the burden of disease management (Moon et al., 2017).

iii. **Lack of real-time surveillance**: Traditional methods of NTD tracking rely on manual reporting, leading to delays in response (Keenen et al., 2019).

iv. **Social stigma and misinformation**: Communities affected by NTDs often experience discrimination, reducing healthcare-seeking behaviors (Chami et al., 2019).

3.0 The Role of Generative AI in eHealth for NTDs

The application of AI in eHealth is being acknowledged as a transformative force for managing neglected tropical diseases (NTDs). Tools powered by AI facilitate disease identification, boost patient involvement, and optimize the distribution of treatments (Shiferaw & Brooks, 2020). Notable uses encompass:

i. **AI-Driven Disease Surveillance and Prediction**

   i. Generative AI can process large datasets from electronic health records to predict outbreaks and monitor disease trends in real time (Brady et al., 2016).

   ii. In Benue and Ondo States, AI-based tools can generate alerts based on symptoms reported through mobile health applications, improving early intervention (WHO, 2020).

ii. **Automated Diagnostic Support**

i. AI models trained on NTD-specific datasets can assist clinicians in diagnosing conditions such as trachoma, schistosomiasis, and lymphatic filariasis with high accuracy (Idowu & Olanrewaju, 2017).

ii. In areas with few specialists, AI chatbots can provide preliminary consultations, reducing the burden on healthcare facilities (Petric et al., 2020).

iii. **Enhancing Drug Distribution and Treatment Compliance**

i. AI-based logistics systems can optimize drug distribution, ensuring medication reaches affected communities efficiently (Fitzpatrick et al., 2018).

ii. Machine learning algorithms can track treatment adherence and send reminders to patients, improving health outcomes (Ogundele & Adeyemi, 2021).

3.1 Implementation of AI based Diagnostic system

A pilot implementation utilized AI-enhanced eHealth platforms to tackle NTD challenges. Key strategies included:

i. **Deploying AI-powered web-based applications** to facilitate remote consultations and symptom analysis. It performs the following functions:

i. **AI Diagnosis:**The AI diagnosis system utilizes a model trained on a diverse range of symptoms to interact with patients in a quick and intuitive manner. Through an interactive interface, the AI conducts an initial assessment, providing a preliminary diagnosis subject to further medical testing. This allows for efficient triaging of patients and ensures that they receive timely medical attention. Based on the AI's findings, patients are accurately referred to registered clinics for in-depth evaluation and treatment, streamlining the diagnostic process and improving healthcare accessibility in resource-limited regions.

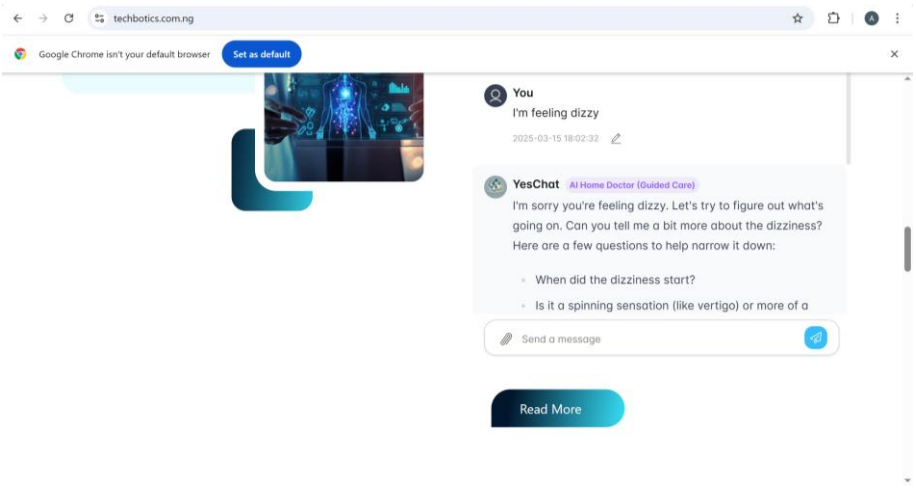


Figure 3.1: Interactive AI doctor Diagnosis session

ii. **Isolation center Inclusion:** If the detected disease is an infectious condition, such as Lassa fever, the system prioritizes containment measures by referring the patient to the nearest designated isolation center. The AI-driven platform ensures that relevant health authorities are immediately alerted, enabling a swift and coordinated response. This approach helps prevent further transmission by facilitating timely medical intervention, resource allocation, and patient management. Additionally, the system provides real-time updates to healthcare workers, ensuring that isolation centers are prepared to receive and treat incoming cases efficiently.

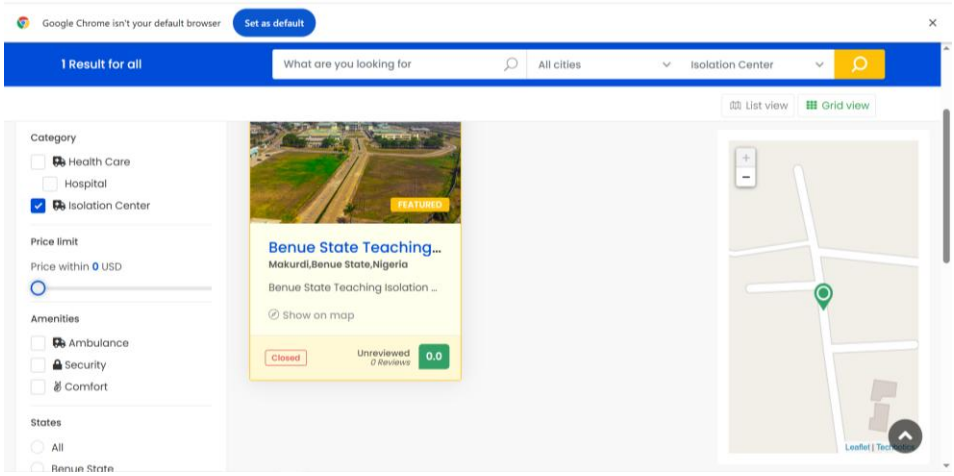


Figure 3.2: Live locations of Isolation centers

iii. **Establishing an AI-driven telemedicine network:**

Connecting rural clinics with specialists for real-time diagnostic assistance. For none infectious diseases once a person is diagnosed by the AI doctor, they are navigated to the location of the nearest registered clinic based on their geographical coordinates. This ensures that patients receive timely medical attention without the burden of searching for healthcare centers independently. The AI system integrates with mapping services to provide clear directions, enhancing accessibility for individuals in remote areas. Additionally, referral data can be shared with healthcare providers in advance, allowing clinics to prepare for incoming cases and optimize patient management.

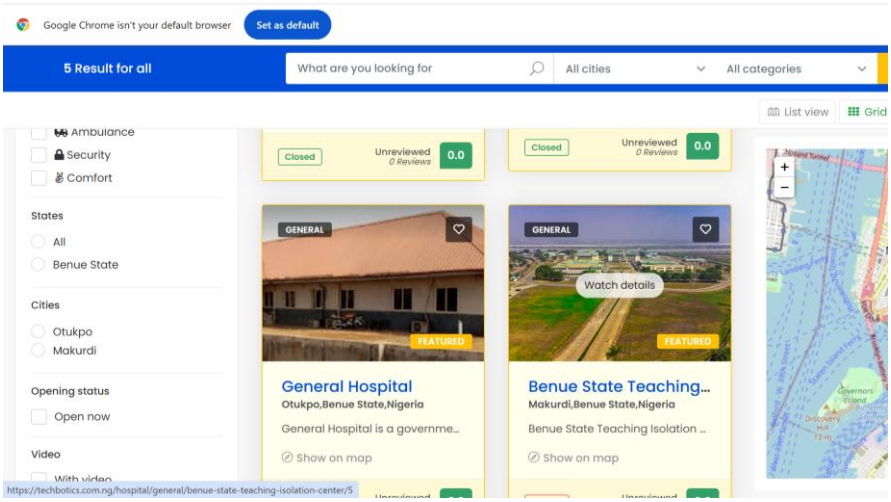


Figure 3.3: Live navigation for patient

iv. **Utilizing AI for health education campaigns**, generating targeted awareness messages in local languages to reduce stigma and misinformation (Shiferaw & Brooks, 2020).

4.0 Results and Impact

Preliminary findings suggest significant improvements in early disease detection, reduced patient travel time for consultations, and increased treatment adherence. AI-driven alerts helped in predicting outbreaks and improving drug distribution efficiency (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018). The integration of AI was well received by healthcare workers, indicating high feasibility for scaling.

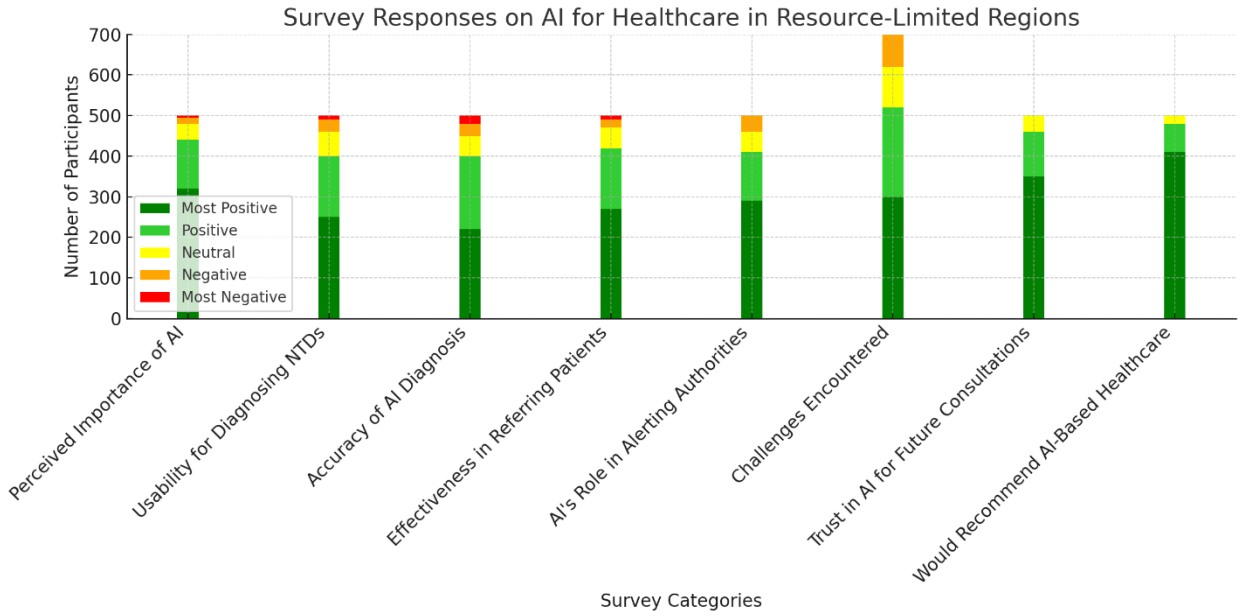


Figure 4.1: Survey of Usage

From figure 4.1 the findings from the survey underscore the beneficial role of AI in delivering healthcare in areas with limited resources. Most participants recognized AI's success in diagnosing Neglected Tropical Diseases (NTDs) and facilitating prompt referrals to licensed clinics. The decrease in travel time for patients seeking consultations corresponds with the improved accessibility of AI-supported healthcare, which allows for faster interventions and better adherence to treatment. Furthermore, AI-generated outbreak notifications have bolstered disease surveillance initiatives, empowering health authorities to act proactively and allocate medical resources more effectively. The positive feedback from healthcare professionals indicates that the incorporation of AI is not only practical but also has the potential for widespread implementation to improve public health results.

4.1 Conclusion and Recommendations

Generative AI in eHealth offers a promising solution to the challenges of managing Neglected Tropical Diseases (NTDs) in Nigeria. However, its successful implementation depends on the availability of adequate infrastructure, the development of local expertise, and strong policy support. To maximize its impact, efforts should be directed toward strengthening AI-based surveillance systems for real-time monitoring of disease trends, expanding AI-driven diagnostic support in rural healthcare settings, and fostering collaborations between AI researchers, healthcare providers, and policymakers to develop

tailored interventions for NTDs. By leveraging AI-driven innovations, Nigeria can enhance NTD management and improve healthcare accessibility, ultimately contributing to a significant reduction in the disease burden across Nigeria.

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