ARTIFICIAL INTELLIGENCE VOICE ASSISTANTS IN HEALTHCARE COMMUNICATION: A MULTILINGUAL APPROACH

Anayo Raphael Ngene
Communication Management, Unizik Business School,
Nnamdi Azikiwe Univerity, Awka, Anambra State

Chinwe Elizabeth Uzochukwu
Mass Communication Department,
Nnamdi Azikiwe University, Awka, Anambra State.

Abstract:
With the recent development in digital communication, especially with the launch of ChatGPT, the use of Artificial Intelligence across all sectors of life is increasing tremendously, particularly in the area of healthcare communication. This study examined how Multilingual AI Voice Assistants can help to bridge the communication gap in healthcare communication and provide easy access to healthcare delivery in Nigeria. Considering the role of AI Voice Assistants in providing real-time interaction between the healthcare providers and users through technology, the study was anchored on Technological Determinism Theory. Survey and interview were instruments used to collect data. The survey data was collected via Google Form and analyzed using Excel involving frequency distribution of responses while the interview data was analysed using thematic pattern. The study found out that Multilingual Voice Assistants can transform healthcare communication system by providing different platforms for real-time interaction between the healthcare provider and patients, translating medical languages to the patient's preferred language, and providing self-care services. The study recommends among other things that a Multilingual Voice Assistant that would be able to interact in the Nigerian languages should be developed and deployed to hospitals and health management organisations.

Keywords: Artificial Intelligence, Voice Assistants, Healthcare Communication, Multilingualism

Introduction

There has been an increase in the knowledge and application of Artificial Intelligence popularly known as AI. The application has crossed different fields of human endeavour and has continued to alter the landscape of how humans interact within their environment (Oyeleye & Admosu, 2021). AI in the form of neural networks and expert systems has applications in almost all human activities (Borana, 2016). It has become a modern technology that can be applied in healthcare, automobile, finance, social media communication, security and surveillance, education, space exploration, media, robotics and e-commerce.

Artificial Intelligence occurs when computers and machines mimic human cognition and are cable of understanding, reasoning and making decisions or taking actions (Bekker, 2023). Ding and Lu (2019) affirm that AI can imitate human intelligence at a different level. Generally, AI is a computing concept that helps a machine think and solve complex problems as humans do with their intelligence. Today, AI has been considered as a new means of addressing the needs of every sector such as healthcare, education, medical, etc. AI has a lot of potential with great anticipated impact in the healthcare sector. Gate (2023) believes that AI performs different functions in the healthcare sector such as administrative task. Further, Gate states that AI such as Abridge, Nuance, DAX, Nabla and Copilot can capture audio during appointment; write notes for the doctor to review. Apps like Glass Health can analyse a patient summary and suggest diagnosis. The use of Machine Language (ML) which is an aspect of AI based technology offers predictive and personalised medical services. ML uses a high level quantity of data such as medical

imagining to predict and analyse diagnosis. Applications such as PathAI, Tempus, Microsoft Project InnerEye, Watson AI technology and Pfizer use ML to predict medical condition and offer a personalised healthcare. The application of various aspects of Artificial Intelligence has created new opportunities in e-health system that makes healthcare accessible using technology. Mehta, Pandit and Shukla (2019 as cited in Ahanin, Sade & Tat, 2022) predict that the next decade of health system is moving towards medical solution using AI, Robotics and Virtual Assistants. This prediction is based on the success of AI in providing medical diagnosis and personalized services. According to Ahanin, Sade and Tat (2022) the application of AI has been centered on providing the medical platform for real-time and self-care service.

One aspect of AI which is fast developing is Voice Assistant (VA). Voice Assistants provide a platform where human beings can naturally talk to a computer and expect response in a human-like voice. Terzopolous and Satratezemi (2019 as cited in Ahanin et al., 2022) express that Voice Assistant is the use of technology to communicate with the user in a natural language. The use of Natural Language Processing (NLP) which is an aspect of AI, enables computers to comprehend text and voice data similar to human. Some popular voice assistants are Siri by Apple, Alexa by Amazon, Google Assistant, and Microsoft Cortana. These Voice Assistants provide a real-time interaction by using natural language, voice recognition and AI to identify the user's speech, filters out the background noise and respond to the user's request. The application of AI Voice Assistants in health communication is becoming popular and vital as it has the potential to transform healthcare communication. Communication is a core component of effective healthcare. Often times, communicating health information is taxing, however, with the increasing popularity of AI powered Voice Assistants the healthcare sector is undergoing a transformational shift (Sanda, 2023). This emerging technology used in healthcare communication is changing the way information is disseminated, patient engagement is fostered, and healthcare services are delivered. One of the ways to conceptualise AI in healthcare communication is to develop innovating health communication interventions that are more engaging, interactive and effective than the traditional approach (Sanda, 2023). Such intervention involves the use of virtual assistants in providing healthcare communication. Sanda believes that AI Voice Assistants provide personalised health information and advice to users in a timely and convenient manner and by leveraging on these Al agents, health communication can be tailored towards improving healthcare delivery.

To foster inclusion in healthcare communication, it is important to introduce the Multilingual AI Voice Assistants. "Multilingual Voice Assistants are cutting-edge technology that allows users to interact with their devices using natural language commands in multiple languages" (Pavitra, Ganeshan, Pavithran & Rajamurugan 2023, p. 287). This is against the monolingual voice assistants, which are limited to one language. Practically, the multilingual voice assistants can understand and respond to commands in different languages. This makes them a vital tool for polyglots. One way to actualise the benefits of Multilingual AI Voice Assistants in healthcare communication in Nigeria is to consider its immense benefit as a means of reaching the teeming population in their various languages or language of preference. Sanda, (2023) validates AI Voice Assistants potential in transforming healthcare communication in Nigeria by improving access to healthcare, providing self-care services, translating medical language into local languages, providing a platform for interaction in local languages, identifying and applying the best communication channels for each patient. Undoubtedly, Multilingual Voice Assistants can help to bridge the communication gap in healthcare communication and provide easy access to healthcare delivery. It is in furtherance of this, that this study examined how multilingual AI Voice Assistants can be applied in healthcare communication in Nigeria in order to foster a more inclusive and efficient health communication to the diverse groups in Nigeria.

Statement of the Problem

Nigeria has a fast-growing technology sector mainly driven by financial services and telecommunications. The technology ecosystem has experienced impressive growth and is evolving rapidly. In spite of advancement

in technology, the healthcare sector is yet to experience exponential technological growth, especially in the area of communication. One of the most significant problems to effective healthcare communication in Nigeria is the information gap between the healthcare providers and the users. The communication between doctors and patients has always been facial interaction and in-phone service. In addition, communication between healthcare providers is often not a real-time experience as obtained with the use of Voice Assistant which is spontaneous and conversational. Nigeria healthcare system with its many problems has a very poor doctor-patient ratio with 1 doctor per 5,000 patients. This makes it difficult to have effective healthcare communication with the patients. It is important to highlight that accessibility to healthcare in Nigeria is nearly impossible. According to 2021 survey by the National Population Commission only 38.4% of Nigerians have access to healthcare services (National Population Commission, 2021). Another problem facing the healthcare communication is the multilingual nature of Nigeria with many Nigerians having limited literacy skill which makes it difficult for them to understand and communicate health information in English language.

On the contrary, AI Voice Assistants provide real-time interaction. With AI Voice Assistants patients can monitor their medical conditions, have real-time interaction, and get immediate responses to questions about symptoms of various illnesses, available therapeutic advice via voice command. With over 400 indigenous languages in Nigeria and a growing population, the application of Multilingual Voice Assistants would provide real-time interaction to many Nigerians in their native languages thereby bridging the communication gap. Given the exponential impact of Multilingual AI Voice Assistants on healthcare communication, it is important to examine its application in healthcare communication in bridging the communication gap via providing real-time communication and providing healthcare delivery and access.

Objectives: The broad objective of this study is to examine how the Multilingual AI Voice Assistant can help in healthcare communication across the diverse linguistic groups in Nigeria. The specific objectives are to:

1) Examine the level of awareness Nigerians have regarding the use of AI Voice Assistants in healthcare communication.
2) Evaluate the perceptions of individuals regarding the use of AI Voice Assistants for healthcare communication.
3) Investigate the level of usability of Multilingual AI Voice Assistants among healthcare providers and users.
4) Assess the level of importance of Multilingual AI Voice Assistants in healthcare communication in Nigeria.
5) Evaluate the extent Multilingual AI Voice Assistants can help in bridging healthcare communication gap among the different linguistic groups in Nigeria.

Conceptual Clarification of Terms

Artificial Intelligence, Voice Assistants and Healthcare Communication

The term artificial intelligence is coined from two words “artificial” meaning man made and “intelligence” meaning the ability to learn and think (Pati, 2021). Consequently, Pavitra et al., (2023) define AI as the ability of a machine or computer program to perform tasks that normally require human intelligence, such as learning, problem solving, reasoning and decision making. With the help of algorithm that tests the data provided, AI is able to perform various human simulation activities. Generally, Artificial Intelligence is a field of computer that helps a machine think and solve a complex problems as human beings do. Pati (2021) confirms that artificial intelligence is a field of computer science which makes a computer system mimics human intelligence.

Voice Assistant (VA) is a sub-field of artificial intelligence. Mohapatra (2022) defines voice assistant as a virtual assistance software that returns information or performs certain actions according to certain voice commands provided by the user. This software uses certain technologies such as speech recognition, language processing algorithms, and voice synthesis in order to perform any assigned tasks. Koli (2020) agrees that VA is a virtual software which recognizes human speech and respond using a synthesized voice i.e. artificial

production of human voice. They use language processing algorithm to listen to specific voice command. Contributing to the study of voice assistants, Mani (2022) views voice assistant as voice enabled artificial intelligence which uses voice recognition technology to respond to specific commands and to provide the user with relevant information.

Healthcare Communication

Healthcare communication or health communication as popularly used by scholars of health communication is a multi-faceted domain and an interdisciplinary concept because of the intersection between health and communication, thus, leading to different scholarly views about the two concepts. For the purpose of this study, the concepts health and communication are considered as one concept. Kreuter and Kreuter (2009 as cited in Sanda, 2023), define health communication as "the study of and use of communication strategies to inform and influence individual and community decisions that enhance health (p.160)." Uzochukwu, Onyenekwe and Chinedi-Okeke (2020) consider health communication as "the study and use of communication strategies to inform and influence individual and community decisions that enhance health (p.498)". Further Uzochukwu et al. assert that health communication is the study of how to generate and disseminate heath information and how the information affects the people, community and public policy on health.

In summary, health communication provides the communication platforms for the health practitioners to interact with patients, general public and healthcare policy makers.

Literature Review

There is a substantial existing literature on artificial intelligence, voice assistants, and healthcare communication. Primarily these subject matters have been exclusive of one domain that needs an extensive study i.e. Multilingual AI Voice Assistants in the area of healthcare communication, particularly in developing countries like Nigeria. Consequently, the existing literature on artificial intelligence, voice assistants and healthcare communication are reviewed in this study to assent the importance of AI Voice Assistants in healthcare communication.

Effective communication is a fundamental element of quality healthcare delivery. Golan Reddy, and Ramasmy (2024) state that the medical informatics have witnessed a significant surge in interest especially regarding the diverse capabilities of AI and Language Learning Models (LLMs). Golan et al. believe that the surge is not limited to transforming physician-patient communication but extend to various other aspects of healthcare, such as diagnostic, treatment, planning and healthcare management. Continuing on the need for simplified health communication, Golan et al. assert that patients who comprehend their medical conditions and adhere to the recommended treatment are more likely to be less complaint, thus leading to better health outcomes. In addition, a patient's understanding does not only bolster their autonomy but also improves the physician-patient relationship. Contributing to the significance of effective communication, Ndukauba, NgoziOhuba, and Nduka (2021) assert that the practice of good communication helps in building trust in relationship between healthcare providers and patients and enables better understanding of the patient's medical problems. Oketunmbi (2014) adds that health problem effectively communicated is a health problem effectively positioned for solution. These assertions are indicators that effective communication between the healthcare providers and patients is important to the patients' satisfaction of healthcare system.

Emerging technologies such as AI and Voice Assistants are transforming the healthcare communication rapidly. According to Sanda (2023), AI has the ability to transform the health communication by improving healthcare access, tailoring healthcare message to the individual and enhancing patient engagement. She states that AI-powered chatbots and virtual assistants have facilitated real-time interaction, enabling individuals to access personalised medical guidance and support irrespective of geographical location. Virtual assistants provide real-time interaction between the healthcare providers and users. Sanda acknowledges that AI can be used to bridge the information gap and tailor health communication messages to the needs of the people. Ahanin et al. (2022) while examining applications of artificial intelligence and voice assistants in healthcare, note that in this era of

AI, the focus is on providing medical platforms, real-time interaction and outcome-based care, however, in the next decade, the focus will be moving towards medical solutions by AI, robotics, virtual and augmented reality with the intention of delivery intelligent solutions (Mehita et al., 2019 as cited in Ahanin et al., 2022). Ahanin et al. identify that voice assistant which is an aspect of AI helps patients get answers to critical questions and provides personalised health information and advice to users in a timely and convenient manner using voice recognition to communicate in natural language.

Another emerging technology useful for healthcare communication is multilingual voice assistant. Discussing the need for multilingual voice assistants, Pavitra et.al (2023, p.287) state:

> Multilingual voice assistants are cutting-edge technology that allows users to interact with their devices using natural language commands in multiple languages. Unlike traditional voice assistants, which are limited to one language, multilingual voice assistants can understand and respond to commands in multiple languages, making them a valuable tool for users who speak different languages or who travel frequently.

Although, Pavitra et al. mainly focused on the general multilingual voice assistant, these voice assistants are helpful in translating spoken words in real time, allowing users to communicate seamlessly with machines and get immediate feedback. Multilingual voice assistants translate medical terms to the patients' preferred language, thereby, bringing inclusion in healthcare delivery and patients' knowledge of health issues and satisfaction. Relating multilingual voice assistants to health communication, Adeniji and Odeyemi (2022) acknowledge that AI-powered multilingual health education resources can increase health knowledge and awareness among people with limited literacy skills.

As digital communication continue to evolve, there is tendency to witness more innovative and effective digital means of communicating health issues.

Theoretical Framework

Technological determinism is the theoretical framework used for this study. The term was coined by an American sociologist, Thorstein Veblen (1857-1929). Thorstein formulated the casual link between technology and society. However, Marshall Mcluhan in 1962 propounded the theory. The central focus of this theory is that technology is the principal initiator of the society's transformation (Hauer, 2017). The proponents of technological determinism believe that society is influenced and shaped by technological development. This theory considers technology as part of a large spectrum of human activity i.e. technology is the basis for all human activities. Winner (1975) in Hess (2015) argues that the core assumptions of technological determinism:

1. Social changes are controlled by the technology, technological development, communication technology and media i.e. changes in technology are primary and most important source that leads to change in society.

2. The technology of a given society is a fundamental influencer of the various ways in which a society exists.

These assumptions imply that technology influences the various choices human beings make. Hence a changed society can be traced back to change in technologies.

One of the applications of AI changing the communication system globally is the voice assistants which facilitate human-computer interaction. With the operational and functionality of AI, the AI Voice Assistants can leverage on the technological determinism principles to bring change in healthcare communication by providing self-care services and improving the healthcare providers-patients real time interaction through the use of machines.

Methodology

This exploratory study examined how Multilingual Voice Assistants can be used to bridge the gap in healthcare communication in Nigeria. It is a mixed design that employed survey and interview instruments. Both instruments were used to gather in-depth knowledge, awareness, and perception on AI Voice Assistants and applicability of Multilingual AI Voice Assistants in healthcare

communication. The survey method was implemented using ordinal scale questionnaire distributed online via email, WhatsApp, and Facebook. The population of the study comprised healthcare providers: doctors, nurses, and other healthcare professionals working in various healthcare settings in Nigeria, and healthcare users: individuals seeking healthcare services across different regions and demographics in Nigeria.The snow-ball sampling method was used to ensure representation from diverse regions, languages, and healthcare settings. The participants were recruited from the six geo-political zones and each participant was asked to send the survey to their colleagues, friends and families. The survey had 194 respondents spread across the states in Nigeria, however some states didn't get respondents but the three major languages spread across the six geographical zones were represented. It comprised responses from health professionals, civil servants, teachers, students, businessmen/women and other occupations. The data were collected and analyzed using Excel involving frequency distribution of responses for categorical variables and presented in charts

For the in-depth interview, participants were recruited within the South-east region of Nigeria. Three participants who were interviewed are between the ages of 29 to 35 years, graduates and are all working class with access to healthcare facilities. The interview was conducted at the offices of the participants and each session lasted for a minimum of 20 minutes. Before the recording of the interview, the participants' consents were obtained and the confidentiality of their responses were assured to them. The interview was moderated by the researcher using open-ended questions to extract data for qualitative design. Firstly, interview guide was prepared based on the study topic. The data was transcribed using Cockatoo App after which it was coded based on the study objectives. Thematic analysis was used to analysed the qualitative data.

Reliability of the Instrument: Inter-rater reliability was used to determine the extent to which the results obtained by two raters agree. To ensure reliability of the coding process, two raters were used and items were classified into 5 categories addressing the objectives of the study using Cohen's Kappa formula:

$$\kappa = \frac{p_0 - p_e}{1 - p_e},$$

Cohen's Kappa is calculated using the formula:

$$\kappa = \frac{p_0 - p_e}{1 - p_e},$$

Where
Po: is the observed agreement among raters.

Pe: is the expected agreement among raters.

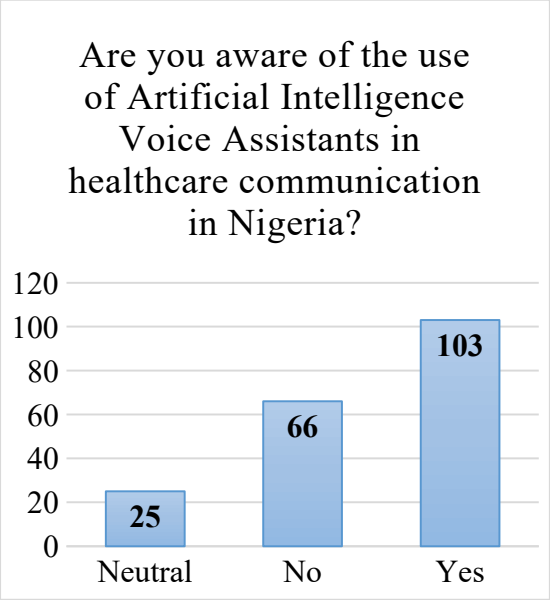
A Cohen's Kappa value of 0.4974 was computed, and indicates substantial agreement between the two raters according to the commonly used scale for interpreting Kappa values.

For the interview (qualitative data), inter-coder reliability test involving split coding was used to ensure reliability of the data and validity of the codebook.

Data Presentation and Analysis
This is presented in two stages comprising the quantitative data (survey) and qualitative data (in-depth interview).

Quantitative Data Analysis

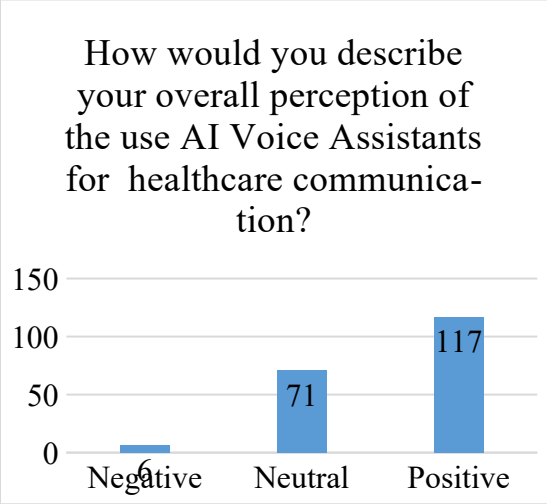
Research Question 1: What level of awareness do Nigerians have regarding the use of AI Voice Assistants in healthcare communication?



To ascertain the level of awareness Nigerians have on the use of AI Voice Assistants in

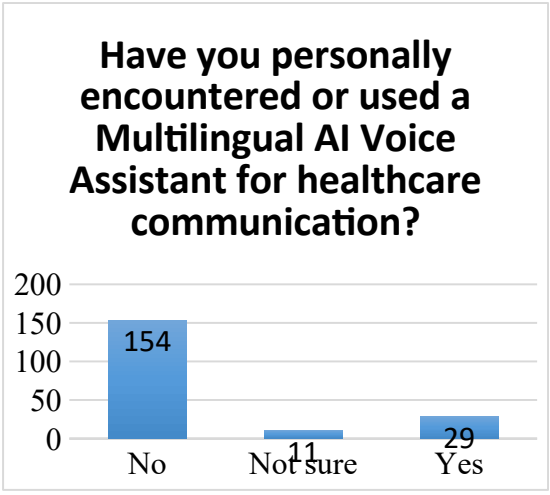
healthcare communication, the research question was rephrased to get each individual's input to the study. The data in the chart shows that the level of awareness of the use of AI Voice Assistants in healthcare communication is above average. Out of 194 respondents, 103 were aware of the use of Artificial Intelligence Voice Assistants in healthcare communication, 66 had no idea, and 25 were neutral on the awareness of AI Voice Assistant for healthcare communication in Nigeria.

Research Question 2: How do individuals perceive the use of AI Voice Assistants for healthcare communication?



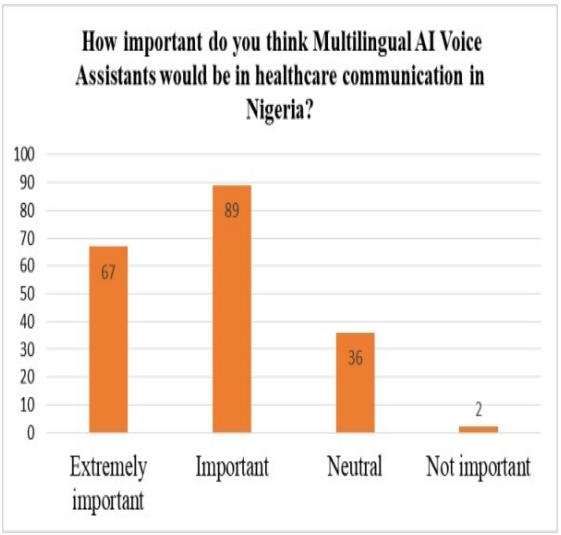
This question was aimed at examining how individuals view the use of AI Voice Assistants for healthcare communication. Out of 194 respondents, 117 had a positive view about the use of AI Voice Assistants for healthcare communication, 71 were neutral while 6 had negative view. On the general perception, the 117 positive perception indicates the relationship between awareness and perception of AI. The people that were aware of the use in the healthcare communication had positive view of it. This buttresses the technological determinism assumption that technology influences the various choices human beings make. The choice of positive mindset is dependent on the awareness of AI technology.

Research Question 3: What is the level of usability of Multilingual AI Voice Assistants among healthcare providers and users?



The survey questionnaire was personalized in order to obtain data that would address the research Question 3. In terms of usage, a lot of people have not used Multilingual AI Voice Assistants even though people were aware of it and have positive attitude towards it. From the chart, out of 194 respondents, 154 have not used or experienced the usage for healthcare communication, 29 had used it while 11 were not sure if they had used it.

Research Question 4: How important is the use of Multilingual AI Voice Assistants in healthcare communication in Nigeria?

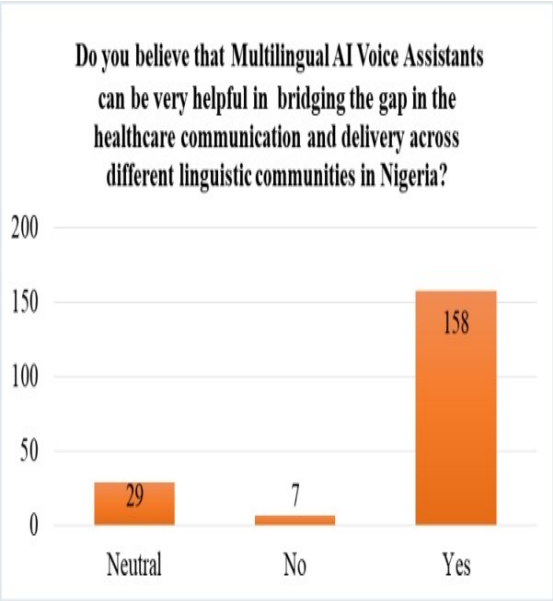


On the importance of the use of Multilingual AI Voice Assistants, out of 194 respondents, 89 of the respondents acknowledged the importance of the Multilingual AI Voice Assistants for healthcare communication, 67 acknowledged that they are extremely important, 36 were neutral, while 2 acknowledged that they are not important. With 89 and 67 respectively as important, extremely important, the sum of 156

of the respondents acknowledged the importance of

Multilingual AI Voice Assistants as effective means of health communication.

Research Question 5: What extent can Multilingual AI Voice Assistants help in bridging healthcare communication gap among the different linguistic groups in Nigeria?



Out of 194 respondents, 158 believed that Multilingual AI Voice Assistants can be helpful in bridging the gap in healthcare communication across the linguistic communities in Nigeria, 29 were neutral and 7 believed that they would not be useful. The 158 of this finding correlates with 153 of respondents who considered Multilingual AI Voice Assistant an important tool for healthcare communication.

Qualitative Data (Interview)

Research Question 1: What level of awareness do Nigerians have regarding the use of AI Voice Assistants in healthcare communication?

Participants' awareness regarding the use of AI Voice Assistants in healthcare communication was examined through different open-ended and prompt questions. First, the interviewees referred to as respondents were asked, if they were aware of any AI Voice Assistant used in healthcare communication in Nigerian. Initially, the first respondent was not aware of anyone but when the concept of how AI tools are used in the hospital was explained, he acknowledged of been aware of the use in the developed countries. The second respondent claimed to be aware of it been used in the developed countries but not in Nigeria. He went further to explain how it is being used in the healthcare sector. The third respondent like the first respondent was not aware of AI Voice Assistants been used in Nigerian healthcare sector but when the context of AI within the health sector was explained, he responded that he has only heard about it but have not seen it in used in Nigeria.

Research Question 2: How do individuals perceive the use of AI Voice Assistants for healthcare communication?

To obtain an in-depth response, the participants were asked how they perceive the use of AI Voice Assistants for healthcare communication. The first respondent viewed the AI Voice Assistant as a good innovation that is not meant to take away people's job. The second respondent viewed it as laudable and commendable initiative but has some reservations on its accuracy and reliability. When prompted further, he responded, "I place my perception on not perfect. It is not perfect. Good functional, not perfect. It is not, it doesn't have discretion."

Research Question 3: What is the level of usability of Multilingual AI Voice Assistants among healthcare providers and users?

To address this study objective, the respondents were asked if they had ever interacted with a multilingual AI Voice Assistants and how they would describe the experience. The first respondent acknowledged that he has used multilingual Voice Assistants outside the healthcare and described the experience as awesome. To obtain more information about the usage, the second respondent was asked how comfortable he would be interacting with healthcare multilingual AI Voice Assistants. He responded that he would be comfortable to release basic information but not rely on it for decision making. The third respondent acknowledged that he has used Multilingual AI outside the healthcare sector.

Research Question 4: **How important is the use of Multilingual AI Voice Assistants in healthcare communication in Nigeria?**

The respondents believed that with a Multilingual AI Voice Assistants deployed in the hospitals, communication would be easier not complex and patients would be able to get feedback and diagnosis immediately.

Research Question 5: What extent can Multilingual AI Voice Assistants help in bridging healthcare communication gap among the different linguistic groups in Nigeria?

The respondents were asked if the application of Multilingual AI Voice Assistants can enhance healthcare communication in Nigeria among the diverse linguistic and ethnic groups in Nigeria. The first respondent narrated an experience he encountered in the government hospital within his area where some women needed to speak to the doctor but the doctor couldn't speak their native language. He acknowledged that the deployment of multilingual AI Voice Assistants in the hospitals would be useful in bridging the communication gap. The second respondent believed that a multilingual AI Voice Assistants would provide a real-time interaction and makes the healthcare available to patients all the time. The third respondent acknowledged that with multilingual Voice Assistants communication would be made easier especially in a multi-ethnic groups. He acknowledged that such AI would help to translate languages to the user's language. Further, he believed that it would lead to cooperation and inclusion.

Discussion of Findings

The data on AI Voice Assistants indicate that respondents are knowledgeable about Artificial Intelligence Voice Assistants especially in the area of healthcare communication. Obviously, this knowledge may be as a result of exposure of the respondents to technology. Although, many respondents do not have practical knowledge of the use of Artificial Intelligence Voice Assistants in healthcare communication, they have positive mindset towards the technology. This relates to technological determinism theory that technology is the principal driver of society's transformation. With the awareness of AI Voice Assistants, the mindset of the respondents are already transformed, even though the application of the technology is not yet been practised in Nigeria.

In addition, the data on the Multilingual AI Voice Assistants in healthcare communication indicate a glaring gap in terms of usage, 154 out of 194 of the respondents have not used such Multilingual AI Voice Assistant in healthcare communication. According to WHO (2022), many Nigerians are denied access to effective healthcare due to limited literacy skills in spite of the language diversity. 158 of the respondents believed that Multilingual AI Voice Assistants would be useful for healthcare communication. This is because Multilingual VA comes in handy and can translate medical terms to the language the patient understands. Sometimes, medical terms may be incomprehensible to the patient. The findings affirm the position of this study that the use of Multilingual AI Voice Assistants would be useful in bridging the communication gap in healthcare communication especially in a multilingual nation like Nigeria where many citizens have limited literacy skills. In addition, the findings were in line with the postulation made by Sanda (2023) that AI can be used to translate medical language into local languages.

The data on the importance of the use of Multilingual AI Voice Assistants have 156 of 194 respondents comprising 89 respondents who acknowledged them as important and 67 who acknowledged VAs as extremely important and effective means of health communication. When health communication is effective, drug adherence and other medical habits can be observed (Golan et al., 2024). This finding relates to the assertion of Oketunmbi (2014) that health problem effectively communicated is a health problem effectively positioned for solution and Ndukauba et al. (2021) that the practice of good communication helps in building trust in relationship between healthcare providers and patients and enables better understanding of the patient's medical problems.

The qualitative data analysis indicates that the respondents were aware of AI Voice Assistants-driven healthcare technology in developed countries. They perceived AI Voice Assistants technology as a good innovation. Two of the three respondents acknowledged that AI Voice Assistant is a good innovation

while one acknowledged it as commendable with reservation that it lacks discretion. On the importance, they believed that Voice Assistants would provide real-time interaction, spontaneous feedback and self-care services. This affirms the cardinal principle of the theoretical framework of this study, technological determinism which states that technology is part of human society. Implicitly, this means that technology is the basis for human activities. Consequently the application of Multilingual Voice Assistants aspect of AI technology would revolutionize healthcare communication system by providing different platforms for real-time interaction between the healthcare provider and patients, translating medical languages to the patient's preferred language and providing self-care services.

Conclusion

Assessing the application of Multilingual AI Voice Assistants in healthcare communication, from this study's perspective, it can be deduced that the Multilingual Voice Assistant has potential to bridge healthcare communication gap in Nigeria. This Voice Assistant has the potential to transform healthcare accessibility even in remote areas, patient engagement especially real-time interaction with the healthcare provider, self-care services as well as fostering a more inclusive and sustainable healthcare system. By leveraging on Multilingual AI Voice Assistants in Nigerian healthcare communication, the numerous multifaceted healthcare challenges could be addressed and healthcare information message could be tailored to the language of the patient as well as efficient and effective healthcare communication could be achieved.

Recommendations

In line with the outcome of this study and the need to create a more inclusive healthcare communication, it is important to consider the following recommendations:

1. Since Nigeria is a large and viable market for tech business, efforts should be made by the government and health policy makers to have at least three main Nigerian languages programmed in the major Voice Assistants such as Siri, Alexa, Cortana etc. with access to healthcare.

2. Tech companies should be sponsored by the government to develop a Voice Assistant App that would be able to interact in the Nigerian languages.

3. Healthcare providers and Health Management Organisations should deploy the use of Multilingual AI Voice Assistants multimedia and apps in the hospitals and offices.

4. Future studies should look into the architecture, functionalities, challenges, ethical and legal framework of Multilingual Voice Assistants (MVA) for healthcare communication.

References

Adeniji, A.O. & Odeyemi, J.O. (2022). The Role of Artificial Intelligence in improving healthcare access in Afric1a. *Journal of Global Health,* 12(1),e22074. doi:10.7189/jogh.22.22074

Ahanin, E., Sade,A., & Tat, H. (2022). Applications of Artificial Intelligence and Voice Assistant in Healthcare. *Internal Journal of Academic Research in Business & Social Sciences.* http://dx.doi.org/10.6007/IJARBSS/v12-i12/16048 DOI:10.6007/IJARBSS/v12-i12/16048

Babel, A., Taneja, R., Malvestiti F., Monaco, A., & Donde, S. (2021). Artificial Intelligence Solutions to increase Medication Adherence in Patients with Non-communicable Diseases. *Frontier in Digital Health*.une 2021 | Volume 3 | Article 669869. Doi: 10.3389/fdgth.2021.669869

Bekker, E. (2023).The Importance of Artificial Intelligence (AI) in the Healthcare

Sector. Journal of Healthcare Communication. 8(04 8034),1-2,

https://doi.org/ 10.36846/2472-1654-8.4.8034

Borana, J. (2016). "Applications of Artificial Intelligence & Associated Technologies." Proceeding of International Conference on Emerging Technologies in Engineering, Biomedical, Management and Science [ETEBMS-2016], 5-6 March 2016

Congressional Research Service (2023). Artificial Intelligence: Overview, Recent Advances, and Considerations for the 118th Congress. Available at:https://sgp.fas.org/crs/misc/R47644.pdf. [Accessed 5 March, 2024].

Ding, J & Lu, Y. (2019). Application of Artificial Intelligence in Healthcare: Advantages and Challenges. A Descriptive Literature Review LAMK

Gates, B. (2023). THE FUTURE OF AGENTS AI is about to completely change how you use computers and upend the software industry.

GatesNote, The Blog of Bill Gates. https://www.gatesnotes.com/AI Accessed [2 March 2024]

Golan, R., Reddy, R., and Ramasmy, R. (2024).The Rise of Artificial Intelligence-driven health communication. *Translational Andrology and Urology. Available at:*https://dx.doi.org/10.21037/tau-23-556 Accessed [5 March 2024]

Hauer, T. (2017). Technological determinism and new media. I*nternational Journal of English, Literature and Social Science (IJELS). 2*, (2),. Available at: https://ijels.com/detail/technological-determinism-and-new-media/, [Accessed 10 April, 2024].

Hess, D. J. (2015). Power, Ideology, and Technological Determinism. *Engaging Science, Technology, & Society*, 1, 121-125. https://doi.org/10.17351/ests2015.010

Koli, M. (2022). The Voice Assistants in your Pocket. In Sundari, S., Garg, R., Hoque, S., & Verma, R. (Ed). *Artificial Intelligence & Voice Assistants*. Royal Book Publishing: New Delhi.

Mani, A. (2022). Talking to Machines-Voice Assistants. In Sundari, S., Garg, R., Hoque, S., & Verma, R. (Ed). *Artificial Intelligence & Voice Assistants*. Royal Book Publishing: New Delhi.

Mohapatra, A. (2022). The World Of Voice Assistants. In Sundari, S., Garg, R., Hoque, S., & Verma, R. (Ed). *Artificial Intelligence & Voice Assistants*. Royal Book Publishing: New Delhi.

National Population Commission (2021). Nigeria demographic and health survey 2018.National Population Commission. doi: 10,4321/s11377-021-00466-0

Ndukauba, K., NgoziOhuba, A. & Nduka, I. (2021). Communication barriers in healthcare delivery in Nigeria. IOSR Journal of Humanities and Social Science (IOSR-JHSS) Volume 26, Issue 4, Series 1 (April. 2021) 15-22 e-ISSN: 2279-0837, p-ISSN: 2279-0845. *www.iosrjournals.org*

Ngene, A. (2023). Integration of National Languages into Development Communication Policy. In Emeka-Nwobia N., Umezurike, G., Aliede, J., Udeze, S.,Mojaye,, E., & Ogbodo, J. (Eds), *Media and Technology for a better society a festschrift for Professor Ifeyinwa Nsude.*(pp..158-178). Rhycee Kerex Publisher: Enugu

Oketunmbi, F.O. (2014). Communication Barriers to Healthcare Delivery in Nigeria since 1914 Amalgamation. International Journal of Communication: An Interdisciplinary Journal of Communication Studies. Number fifteen. June 2014.

Onah, C. Azuogu, B, Ochie, C., Akpa, C. Okeke.K., Okpunwa, A., Bello, H., & Ugwu, G. (2022). Physician emigration from Nigeria and the associated factors: the implications to safeguarding the Nigeria health system. *Human Resources for Health.* https://doi.org/10.1186/s12960-022-00788-z

Oyeleye, S. & Ademosu, I. (2021). Communication Made Easy? Patterns of AI-Voice Activated Virtual Assistants Usage on Mobile Devices among Young People in Adebayo & Ifedolapo (eds.), *Knowledge Societies: Artificial Intelligence and the Media* (p. 134-161). UNESCO

Pandey, B., Chakraborty, S., & Kumar, V. (2022). Role of artificial intelligence in health communication: With special reference to smartwatch technology. *International Journal of Health Sciences*, *6*(S1), 11872–11892. https://doi.org/10.53730/ijhs.v6nS1.7952

Pati, S. (2021). The Difference Between Artificial Intelligence and Machine Learning, [online]. Available at: *https://www.analyticsinsight.net/the-difference-between-artificial-intelligence-and-machine-learning/*, [Accessed 5 March, 2024].

Pavitra, A.R, Ganeshan, M., Pavithran, P., Rajamurugan, G. (2023). A Review of Intelligent Voice Assistant with Multilingual Support using Artificial Intelligence. *Journal of Emerging Technologies and Innovative Research (JETIR)*.Vol.10, Issue 4, April, 2023.

Uzochukwu, C., Onyenekwe, O. & Chinedi-Okeke, C. (2020). Health Communication: Concepts and Strategies in Okunna. S (Ed), *Communication and Media Studies Multiple Perspectives (*pp 491-531). Enugu: New Generation Educare Ltd.

Sanda, H. (2023). Role of Artificial Intelligence in Health Communication in Nigeria. In Emeka-Nwobia N., Umezurike, G., Aliede, J., Udeze, S.,Mojaye,, E., & Ogbodo, J. (Eds), *Media and Technology for a better society a festschrift for Professor Ifeyinwa Nsude.*(pp..158-178). Rhycee Kerex Publisher: Enugu

World Health Organisation. (2022). World health statistics 2022: Monitoring health for the SDGs, sustainable development goals (1st ed.). World Health Organisation. doi:10.9789/9789240050069

World Health Organisation. (2023). Regulatory considerations on Artificial Intelligence for health. Available at: https://creativecommons.org/licenses/by-nc-sa/3.0/igo.