Challenges to Health Information Dissemination in Tanzania and the Opportunities Provided by Chatbot in Swahili Language

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Abstract

Context: To examine challenges to health-literacy with a focus on non-communicable diseases (NCDs) in Tanzania and to develop a Chatbot for NCDs in Swahili language.
Objective: To examine the challenges of health information dissemination in Tanzania; to analyse the opportunities offered by Chatbot to address the challenges of health information dissemination in Tanzania; to assess the readiness of users on the acceptance of an interactive Chatbot for NCDs in Swahili Language.
Method: Survey was conducted amongst a sample of 100 participants at Wazo ward, Dares-Salam; Chatbot was designed in Swahili and integrated into Facebook Messenger to eliminate the cost of the internet from the end-users.
Results: Challenges to health-literacy includes: inaccurate, inconsistent, untrustworthy, unreliable, untimely, contradictory, and confusing information; popular media such as TV programs and the Internet presents no opportunity for feedback, requests, or clarifications. Others are language barrier; high cost of internet, poor connectivity, the ratio of healthcare providers to patients, poverty, and traditional beliefs. There is a general acceptance of receiving health information through messaging apps.
Conclusions: Chatbot for NCDs in Swahili language 'afyaBot' could be strategic in affording Tanzanians access to adequate and timely information on NCDs, improve health-literacy, and promoting good health. Stakeholders and public policymakers in the health sector will find the study useful.

Keywords: Chatbot; Information Systems, Health-Literacy; Tanzania; NCDs, Non-Communicable Diseases

1. Introduction

Information access and retrieval are evolving through the utilization of novel tools and platforms supported by wireless technologies, cloud computing, AI, and machine learning. Hand-held devices such as wearable, smartphones, tablets, Personal Digital Assistants (PDAs), and laptops are providing individuals, organizations, firms, and communities' opportunities to be connected and have access to varieties of information, hence expanding the horizon for information literacy. The utilization of novel tools has resulted in the creation of new values and outcomes that provide immense opportunities in many works of life, rural and urban settings; radically changing how we store, process, retrieve, access, disseminate and share information.

An example of pleasantly new and emerging technology is the conversational Chatbot system. Examples of Chatbots in use across disciplines, fields, and workplaces abound,

these include education (Bii 2013; Holotescu 2016; Kane 2016; Roos & Lochan 2018) banking, marketing, and finance (Dole et al. 2015) customer service and technical support (Chakrabarti & Luger 2015) social health and well-being (Brixey et al. 2018; Fadhil & Villafiorita 2017; Kumar et al. 2017; Wilson et al. 2017a), etc. A chatbot is a computer program-controlled conversational agent; part of Natural Language Processing, a subcategory of AI that is created to enable and facilitate intelligent human language conversation through text or speech by interacting with users using natural language in a manner that approximates regular conversation between humans (Bii et al. 2013; Pereira & Juanan 2016; Shawar & Atwell 2007). The application can communicate with humans in their natural language and answer questions, perform required tasks, or provide information (Luger & Sellen 2016; Radziwill & Benton 2017). Chatbots have gained momentum usage, and famous Chatbots are Apple's Siri and Amazon's Alexa (Borana 2016; Dale 2019; Hoy 2018). Artificial

Intelligence (AI) technology has become a mega-trend, and it is expected to be an essential part of every large company routine, project, and business activities in the future (Wilson et al. 2017b).

AI and machine learning technologies have great potential to supplement many of the jobs we do today; many of the tasks in organizations and firms are now been automated. One area in which Chatbots technology is effectively trained to optimize varieties of functions is in healthcare. This domain is a subset of Mobile health or electronic health (eHealth) which incorporates the use of Wi-Fi-enabled mobile technologies such as smartphones and tablets; portable medical devices that are wearable in design and that can be synced to mobile phones or tablets, all of which may be used for functions such as remote patient monitoring, health data collection, health literacy programs, and the management of chronic diseases (Baum 2015; Brinkel et al. 2014; ECOSOC 2010). Chatbot systems have been proven to be efficient in many works of life and it has been applied to automate many human functions successfully. Chatbots are also deployed in self-health assessment functions, allowing users to check their health conditions and receive feedback in real-time. It could serve as a platform for patient assessment, education, and counseling. One interesting aspect of Chatbot is that it is task-specific or domain-centered. Besides, positive ratings attributed to Chatbots was as a result of the fact that they are cheaper, faster, affordable, and acceptable and are the preferred way of communication amongst many youngsters (Bii et al. 2013; Pereira and Juanan 2016; Radziwill & Benton 2017). Chatbot has the potential to track and manage customer progress, leading to increased customer satisfaction (Kowatsch et al. 2017) and are now been deployed as tools for online survey and data collections.

Health literacy is concerned with the motivation and ability of individuals to gain access to, understand, and use information in ways that promote and maintain good health (Dodson et al. 2015). Low health literacy is a major barrier to delivering preventive healthcare. Health literacy is also linked to economic development; as such individuals with low health literacy find it hard to engage effectively in socio-economic activities. Therefore, it is necessary to promote health literacy to achieve a society of healthy individuals. Communities and businesses across Africa and other developing countries are gradually expanding the integration of e-health with their healthcare systems to expand opportunities for health literacy. As a case study, medical informatics is growing without bounds in Tanzania where many e-health projects have been successfully implemented with positive feedbacks from end-users and stakeholders. There are reports of many e-health projects currently undergoing pilot phases and to be implemented across the nation. Apart from Mobile Apps that are specifically designed for different health purposes, there currently exists information systems designed for District health. Notable examples of m-health in Tanzania include the use of mobile text messages to disseminate health information like 'Wazazi nipendeni' project for

family planning. Others include m-health for malaria, diabetics, and cancers. An App developed for medical records such as registration of new-borns (developed by RITA - The Registration Insolvency and Trusteeship Agency) is a good example of m-health in practice (Kanani 2016).

So far, eHealth in Tanzania continues to expand opportunities for health care service providers and it is believed that technology like Chatbot could complement to stimulate and improve health literacy in Tanzania. Therefore, this research discusses the challenges of health information dissemination in Tanzania and makes a case for the design and development of a Chatbot that could facilitate health information dissemination, access, and retrieval. We investigate the drawback posed by lack of adequate information and awareness on non-communicable diseases [NCDs] in Tanzania and how technology like Chatbot could be useful.

1.1.   Objectives of the study

The general objective of this study is to examine the challenges of health information dissemination in Tanzania and discuss the opportunities provided by Chatbot technology to address these challenges. The specific objectives are as follows:

i.   To examine the challenges of health information dissemination in Tanzania.
ii.   To analyze the opportunities offered by Chatbot to address the challenges of health information dissemination in Tanzania.
iii.   To assess the readiness of users on the acceptance of an interactive Chatbot for NCDs in Swahili Language.

2.   Materials and Methodologies

This study employed a cross-sectional research design approach. This approach helps the researchers in collecting data from different respondents in a short period. The non-probability sampling technique was employed in this study; participants were selected based on their knowledge, experience, roles in health care service, involvement, and willingness to provide necessary information on NCDs. Therefore, the sampling method was purposive sampling. This enables the researchers to select key informants to get detailed information about non-communicable disease dissemination methods currently in place and to understand the challenges. The sample size of 100 for this study was obtained by using the Yamane formula (Neuman 2014) of sample size calculation from the population of 90, 825. Hence, a total of 100 participants were involved in the study. Out of this sample size, 95 participants belong to the category of the general public, while 5 participants were categorized as key informants. Two (2) health practitioners from Chanika area and three (3) health practitioners from Tegeta-Nyuki area were purposefully selected to participate in the study as key informants based on their knowledge, experience, and participation in disseminating health information about non-communicable diseases.

2.1. Data Collection and Analysis

Data was collected through Surveys: A self-administered Questionnaire and Face-to-Face Interview. The questionnaire comprised of both closed and opened-ended questions. Before administering the questionnaire to the general public it was pre-tested by administering to a few respondents from Wazo ward to check for reliability, validity, and errors. The questionnaire was pre-tested with a sample of 4 respondents from Wazo ward to check if the respondents would have any difficulty understanding the questions. The questionnaire was also translated into Swahili language for ease of understanding. Respondents were informed about the purpose of the research before data collection. Data collections were carried out after participants consented to take a full part in the study. The data collected was treated as confidential and would be used for academic purposes only. The data were managed and analyzed using SPSS software version 20. Descriptive statistics such as frequency distribution were used to describe and summarize the data, while graphs and charts were produced to visualize data and results.

3.   Results

3.1. Demographic Information of Respondents

The demographic information of respondents is very important in understanding the characteristics of respondents. The gender of respondents was considered to ensure that we have equal participation of both men and women in the study. 42% of participants are within the age group 18 – 27 years; 38% of participants within the age group 28 – 37 years while only 4% of participants are considered to be within the elderly group. This indicates that the majority of the participants are young folks, while many middle-aged individuals also participated in the study. This is very important since young people have been observed to enjoy information retrieval through modern technological devices like smartphones and tablets. These are also the categories of people who are likely to engage more in online health information activities. The level of education might affect individual knowledge-seeking behaviour and awareness of NCDs. The educational level might also affect the pattern of responses given by study participants. Results show that the majority (70.5 percent) of the respondents are graduates. All the participants have a minimum educational qualification relevant to this study. All the participants are literate and it is believed that they provided vital information required for the study.

3.2. Awareness of Non-Communicable Diseases

The findings from the survey of this study suggest that majority of the respondents (94%) are aware of non-communicable diseases and different types of NCDs. Although, according to key informants, the general public is not fully aware of non-communicable diseases since they are not taking full precautions to prevent themselves from the diseases. Awareness is the state or ability to perceive, feel, or be conscious of events, objects, or sensory patterns. However, health literacy is beyond awareness, health literacy is the ability to locate medical facilities, schedule and keeps appointments, describe, monitor, and measure symptoms, follow prescribed medication or treatment

regimens, adjust medications or treatment as needed, seek care when appropriate, determine risk and take preventive actions (Dodson et al. 2015; ECOSOC 2010; Mnzava & Katabalwa 2017; Oyibocha et al. 2014; Timothy et al. 2014). This implies that the population sample at Wazo ward in Dar es Salaam are aware of these diseases, but cannot be considered to be a community of health literates because they do not comply with measures to prevent and manage these diseases. Information gathered from this study suggests that the majority of respondents do not practice or comply with health instructions and guidelines. The key informants revealed that there are still traditional beliefs amongst members of the community that diseases or sickness is associated with witchcraft or punishment for sins. Only about 31% of respondents accepted that they practice, obey, and follow strictly health information received through different mediums. A similar finding was reported by Buguzi (2018) who noted that some patients would rather visit traditional healers than report to hospitals whenever they have any symptoms of NCDs. Implementing a Chatbot that will educate people about NCDs and their impacts will help to raise awareness amongst individuals and this knowledge could spread to the larger community.

3.3. Medium Used to Receive Health Information

Results from the study indicate that 57% of respondents obtain health information about non-communicable diseases through TV programs and health information websites. Using the website as a medium to obtain information suggests that respondents are specifically looking for answers or solutions. Although web health information search has become a common practice amongst internet users, however, web health information search has its drawback because it could take some time for a user to obtain accurate information from his/her requests.
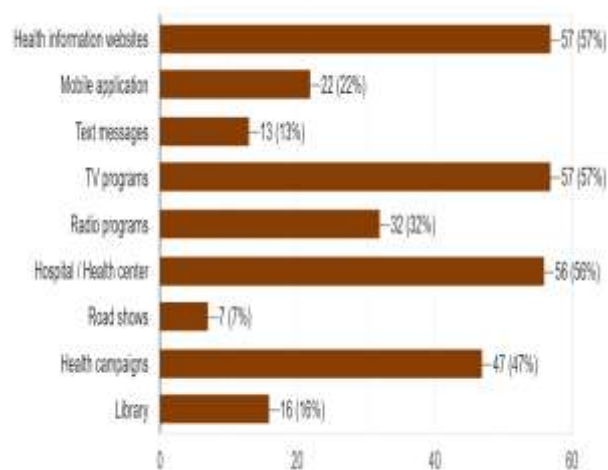

Figure 1. The medium used to receive health information about NCDs

Besides, most users accept the first page results produced by their search engine which might not produce the most relevant or accurate information on a particular health topic. Studies also show that users are more likely to click

the first link provided by a search engine which most often misses out on detailed information or answers on many health topics. Hence developing a Chatbot with direct and specific health information will save time and lives.

3.4 The Most Inquired Non-Communicable Diseases
Results from this study show that cancer is the most inquired disease by 71% compared to other non-communicable disease followed by diabetes at 66%.
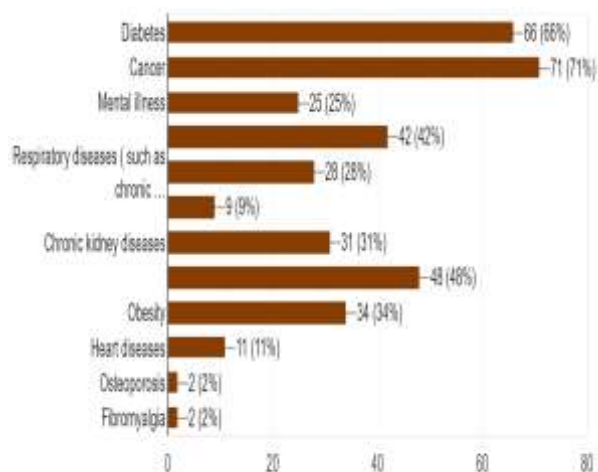

Figure 2. The most inquired NCDs

This shows that most people are curious about cancer and they want to know more about it. This is not surprising since the Tanzanian government through the Ministry of Health and Social Welfare has acknowledged that cancer is a major public health problem in Tanzania (Kapinga 2017). During the World Cancer Day on 4th February 2018, the minister of Health and Social Welfare Tanzania cited data from WHO showing that there is an estimated 50,000 cancer cases in Tanzania each year (Baguzi 2018).

3.5 Challenges of Current Health Dissemination Methods
The study seeks to examine whether there are challenges with the current health information dissemination methods on non-communicable diseases. 31% of the respondents considered the 'high cost of the internet' to be a challenge since they tend to seek online information on NCDs.
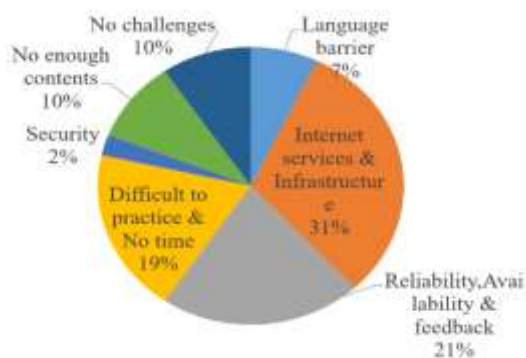

Figure 3. Challenges of current health information dissemination methods on NCDs

Although, internet penetration in Tanzania is increasing with approximately 23 million subscribers in 2018 (Ng'wanakilala 2018), however, it is still difficult for many people to get access to online health information content because of high internet costs, poor and unreliable connectivity. Service providers in Tanzania offer free access to Social Media platforms like Facebook, therefore, implementing an interactive health Chatbot system that can work in compatibility with Facebook would go along to aid user's information-seeking behaviour. Also, 21% of respondents believe that the information they seek is not always available and most often they do not trust the information they receive to be reliable. Respondents reported having received contradictory health information on the internet which leads to confusion and indecision. Lots of researchers have reported similar results with regards to online health information (Delesha & Carpenter 2016). Participants also revealed that most often health information is not readily and timely available especially for those who rely on TV programs (dedicated to health and diseases awareness) for health information. Another drawback of the TV programs dedicated to health and disease awareness is that viewers have no opportunity to receive feedback in case they have questions or clarification on some vital issues. The aforementioned problems could be solved by implementing a Chatbot system since it saves time and provides quick answers to most questions that might be asked. Besides, 7% of the respondents identified the language barrier to be a challenge for them, since the majority of Tanzanians speaks Swahili and not all health information are available in Swahili language. Most online health information contents are not available in Swahili language that every citizen of Tanzania understands. Meanwhile, the IT sector in Tanzania has been developing several initiatives to address language barrier to technology adoption by promoting the use of Swahili language in online services. The 2016 ICT policy of Tanzania put in place an effective mechanism to promote the use of Kiswahili in electronic and online services for the transformation of Tanzania into a knowledge society. Developing and implementing a Chatbot in Swahili language that is accessible from the palm of the user's hands would be a catalyst in addressing the language barrier, hence increasing health literacy and awareness in Tanzania.

Furthermore, the ratio of health specialists to patients is a big problem in Tanzania; illiteracy and poverty affected people to pay attention to health information; religion and witchcraft beliefs have also hindered the acceptance of modern health-care practices. Campaigns, rallies, posters, and verbal communication at hospitals are some of the methods adopted by health care providers to create awareness. However, key informants in this study revealed that they rarely receive responses or feedback from the populace after conducting health awareness programs. This implies that many people don't follow up after receiving health information.

3.6 The Use of Messaging App

Findings from this study suggest that nearly all respondents make use of messaging apps (97%). The use of messaging apps is growing exponentially because they offer a cheap alternative to operator-based text messaging via SMS; they also offer more features such as group chats, the exchange of graphics, video and even audio messages as well as stickers or emoticons. Instant messaging is a type of online chat that offers real-time text transmission via the internet. Since the appearance of smartphones which is becoming more affordable by the day, we have experienced an explosion in mobile apps, and free instant chat platforms (Pallavi et al. 2018). The four major instant messaging applications in the world are Facebook Messenger, WhatsApp Messenger, WeChat, and Viber (Lua 2018). The majority (69%) of respondents in this study prefer to use WhatsApp messenger, 26% prefer Facebook Messenger, while some prefer WeChat (3%) and Viber (2%) for health information.
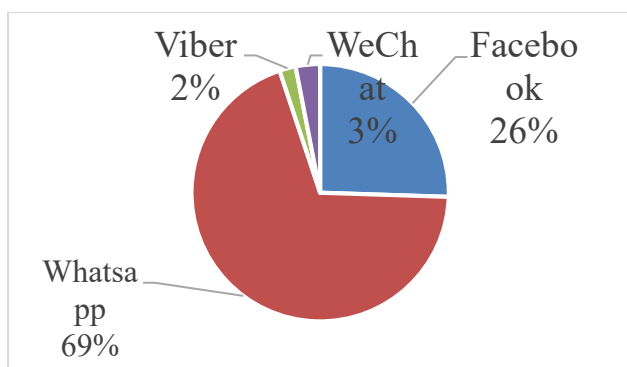

Figure 4. Preferred messaging app for receiving health information

Although most messaging apps designed for smartphones and tablets enable users to send text messages, make voice or video calls using the internet (Wi-Fi or cellular data networks), and allow group conversations (Snigdha 2019). however, WhatsApp is the most preferred messenger app today because it is free, flexible, easy to learn, easy to use, offers an ad-free experience, end-to-end encryption, thus making it a very secure user-friendly messenger app (Kim 2018). We also observed that the majority (92.6%) of the respondents mostly used smartphones and Laptops (27.4%), tablets/iPad (7.4%), or Desktop (6.3%) when seeking health information. We found that the majority of respondents own mobile phones (smartphones) that enable them to access the internet through the palm. Also, it was reported that the increase of internet users in Tanzania is brought by mobile phone users (Ng' wanakilala 2018). Therefore, implementing a Chatbot on mobile devices would be convenient for lots of health information seekers.

3.7 Messaging App for Comprehensive Health Information

Our findings indicate that 92% of respondents would love to receive health information through messaging applications, while 3% of the respondents were not sure if they want to receive information through a messaging app.

Pallavi (2018) discussed that interacting with users directly through messaging apps is much more effective than asking the user to exit and open another standalone app. Mobile app developers are giving up their standalone apps or skip app stores to write Chatbots on mobile messaging platforms (Wilson et al. 2017a). In essence, implementing a Chatbot for NCDs inside messaging apps is a strategy in the right direction for health information literacy. Internet statistics show that messaging apps have become the most preferred choice for users than social networks.

Thus, we have discussed the current challenges of effective health information dissemination which hinders health literacy and healthcare practices. Therefore, we designed and developed a Chatbot 'afyaBot' for NCDs in Swahili language that has the potential to overcome many of the aforementioned challenges. The Chatbot was integrated with Facebook to eliminate the cost of the internet since mobile network providers in Tanzania allow users to access Facebook content for free. The knowledge base of the Chatbot was trained in Swahili language so that citizens of Tanzania can access health information on non-communicable diseases in their local language for ease of understanding.

4.   Discussion

The outcome of this study leads to the design and development of an interactive health Chatbot 'afyaBot' for NCDs in Swahili language. Findings from this study were instrumental in understanding and implementing the functional and non-functional requirements of the Chatbot. The study will aid to raise awareness about the dangers of NCDs and spur research efforts and renewed strategies to create awareness, prevent, control, and treat this disease. This Chatbot can facilitate the collection of timely health data, monitoring, planning, and evidence-based intervention amongst health service providers. Statistics and conversation data from the Chatbot can be analysed; reports can be generated for decision making and policy formulation. This study leads to the implementation of a Chatbot for NCDs in Swahili language that has the potential to improve education on NCDs in Tanzania. The study will be significant in improving knowledge and ideas on the application of Chatbot systems in different domains and how it could be deployed in other social systems for efficiency, effectiveness, and sustainability.

5.   Conclusion

We have presented the report of a study on the challenges of health information dissemination by identifying factors that affect adequate health literacy and good healthcare practice in Tanzania. Chatbot for NCDs in Swahili language afyaBot' could be strategic in affording Tanzanians access to adequate and timely information on NCDs, improve health-literacy and promotion of good health. Stakeholders and public policymakers in the health sector will find the study useful. In general, Chatbot for NCDs will improve health literacy, education, and the general wellbeing of society. M-health is one of the emerging components of eHealth in Tanzania. A significant number of Tanzanians have access to hand-held

gadgets such as mobile phones and tablets. If the Chatbot platform is exploited effectively, it has the potential of benefiting a lot of people especially in the event of a health pandemic like COVID -19 which could result in lockdown and restrictions of movement.

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