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Examining factors influencing intention to use M-Health applications for promoting healthier life among smartphone users in Tanzania

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ABSTRACT

Deaths related with Non-Communicable Diseases (NCDs) have recently increases, similarly, development of mobile technologies have paved a way in which Smartphone users can use m-health applications to address high level of sedentary behaviours that relates to negative health consequences. Therefore, this study was conducted to examine factors which may influence generation Y who are Smartphone users to adopt m-health applications in controlling NCDs in Tanzania. TAM theory was extended with awareness, trust and perceived cost to develop a research conceptual model of this study. Google form was used to developed online questionnaire which was distributed through social media platforms to respondents. Furthermore, other questionnaires were physically administered using snowball sampling through Drop-off / Pick-up method. A total of 396 valid and reliable questionnaires were received and used for data analysis. IBM-SPSS software was used to analyze the hypothesized relationships. Findings show that trust, perceived usefulness and perceived ease-of-use have significant influences on behaviour intention to adopt m-health applications in controlling NCDs. Nevertheless, awareness and perceived cost were found to have no significant effects on behaviour intention to adopt m-health applications. The study has provided theoretical and practical implications for researchers, m-health application owners and developers.

Keywords: M-health applications, NCDs, Awareness, Perceived Cost, Trust, Tanzania

INTRODUCTION

Information and Communication Technology (ICT) has imposed many positive effects in a provision of health services. The intervention of ICT through smartphones and wireless devices has been used as a means of gaining a better quality of life by making healthcare services and information more affordable, accessible, and available (Chiarini et al., 2013). The use of various technological tools seems to be an effective and promising approach that gives hope in adopting a quality lifestyle that reduces high levels of sedentary behaviours that relates to negative health consequences (Stephenson et al., 2017). Studies have shown that, Non-Communicable Diseases (NCDs) rate increases globally and so in the low and middle-income countries like Tanzania. NCDs pose serious health problems by contributing to a larger number of adult medical admissions and death cases of about 70% globally (WHO, 2018). On the other hand, World Health Organization reports show that, 90 % of the World's population has access to mobile phones and wireless technologies (WHO, 2016). Therefore, high penetration of mobile phone globally suggests changes for NCDs management, prevention, health promotion, and treatment (Feroz, Kadir & Saleem, 2018; Free et al., 2013). Mobile technologies features like affordability, accessibility, popularity, mobility, and technological capabilities make mobile health (m-health) applications appropriate tool for improving healthcare services (Free et al., 2013).

Currently, there are countless number of m-health applications developed and targeted to help individuals to manage sedentary behaviours (Saadatfard, 2016). These applications target to educate consumers about preventive healthcare services and chronic disease management through documentation, communications, information, analysis, recipe suggestion, reminders, and advisory/therapeutic support.

Some applications are developed to address general health and fitness issues while others aim to help patients with chronic diseases such as diabetes, chronic heart failure, and hypertension. Studies have shown that, readiness for adopting mobile health technology interventions for addressing NCDs in high-income countries is over 60% while in low and middle-income countries is 20% (Feroz, Kadir & Saleem, 2018; WHO, 2016). Altmann and Gries (2018) claimed that despite the countless number of advantages brought by m-health applications; still there is very low number of downloads of mobile health (m-health) applications and adoption particularly in low income countries. Siddharthan (2015) and Duncan et al. (2018) claimed that promoting the adoption and usage of m-health applications, awareness on availability and benefits of m-health applications should be more emphasized within the community. Furthermore, studies have shown that, financial resources is

one of the barriers for adoption and usage of m-health applications (Beratarrechea et al., 2016; Lee, 2018; Müller et al., 2016; Kang, 2014). Additional to that, trust has also been considered as important factor in adoption and usage of m-health applications, users of m-health application are interested to have secured and application with no privacy vulnerabilities (Zhao, Ni & Zhou, 2018).

Studies have shown that adoption of m-health applications in low-income countries is still very low (Alam, Hoque, Hu & Barua, 2020). Despite, several studies that have been conducted to examine the adoption and usage of m-health applications in controlling NCDs (Haluzá & Jungwirth, 2015; Opoku, Busse & Quentin, 2019); most of these studies have been administered in developed countries where technological usage in health sector is very high and behaviour of citizens in using technologies in managing health issues is very high. Due to technological differences and awareness levels between developed and developing countries, findings drawn from developed countries could not be suitable to address m-health application adoption and usage behaviour in developing countries like Tanzania. This means, there is lack of information on factors which determine the adoption of m-health applications in developing countries. This is a research gap, the current study intends to address. Therefore, this study adapts TAM model to examine factors which influence Smartphone users to adapt m-health applications in controlling NCDs.

The current study has two significances, firstly, the study will enhance scholars' knowledge on applicability of extended TAM model in examine adoption of m-health applications in controlling NCDs in developing countries like Tanzania. This is because, fewer studies have been conducted in how TAM can be applied in health sector particularly in developing countries.

Secondly, the study will provide usefully recommendations which will help m-health application owners and application developers to understand the major factors which will enhance adoption of their applications.

The remaining parts of this study are organized as follows; second section is literature review which is followed by conceptual research model and hypotheses. Then, the following sections include research methodology, data analysis and results, discussion, implication, conclusion, and recommended areas for future studies.

LITERATURE REVIEW

Mobile Health Application

The World Health Organisation defines mobile health applications as the devices like Smartphones, tablets, and their applications that are used to deliver health care and preventive health services (WHO, 2016). M-health applications are categorized for healthcare providers, disease management, applications for teaching, and applications for the public and patients. Those applications aiming for healthcare receivers can be merged with those for patient-centred applications that can either be for overall wellness or focus on disease management (Ning et al., 2018; Boulos et al., 2014). The utilization of Smartphone in accessing health services has extended to several advantages such as cost reduction, increase the possibility of self-independency, control body weight, proper diet intake, and other health self-management where the practice is between the patient and the mobile device, which saves the time needed from the healthcare givers (West et al., 2012; Rama et al., 2015; Agarwal et al., 2015; Luxton et al., 2011). Furthermore, m-health applications have become more convenient in enabling easier access to disease management and prevention information (Kane & Kane, 2015).

Digital Health System in Tanzania

According to WHO (2018), the health system in Tanzania is a pyramidal structure where primary health care services comprise of community-based health services, dispensaries, health centres, and district hospitals. The National Digital Health Strategy 2019–2024 aims to improve the health delivery process to all Tanzanians by increasing efficiency and quality of health care to support the effort imposed by the Government of Tanzania and stakeholders (URT, 2019).

Through encouraging the effective use of digital technologies, it is believed that health systems at all levels will be improved in terms of provision of high-quality health services, client experience, health systems strengthening, and health outcomes.

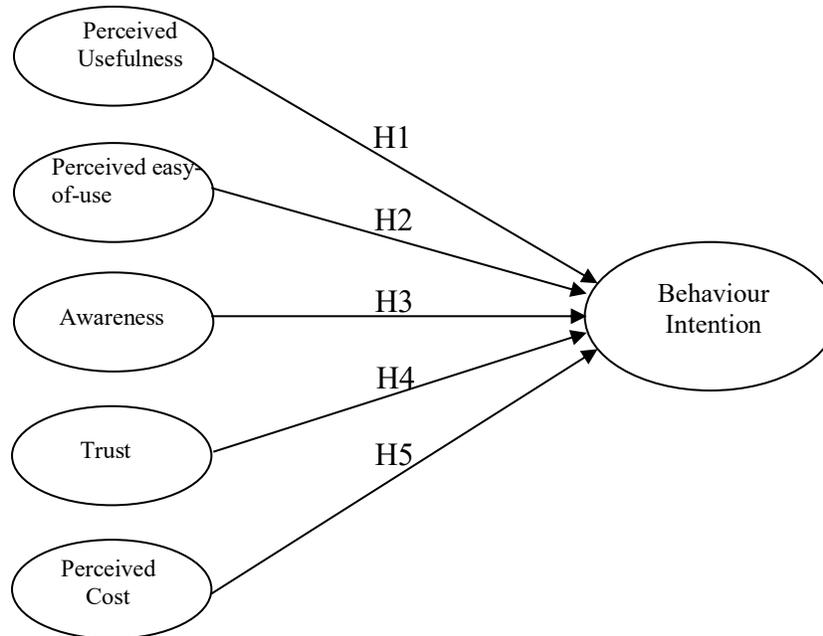
WHO (2018) continues to report about the current digital health situation that there are over 160 digital health or health-related systems in which some have national coverage while others are institution-based.

Adoption of e-Health in Tanzania

The Tanzania government, through the Ministry of Health and Social Welfare, understands the potentiality of ICT in the provision of health services in a society. ICT plays a role in transforming the lives of Tanzanians through the innovation of various technologies. Despite challenges faced, substantial efforts have been imposed by the Government of Tanzania through public and private healthcare services providers to use technological means in delivery of primary health services to citizens (URT, 2018). Among the most innovative technological solutions used to provide fast and cost-effective health services is mobile health (Alam, Hoque, Hu & Barua, 2020). The utilization of mobile phones is impressively growing very fast in Tanzania, this means m-health applications are considered as alternative powerful channel for increased efficiency and ensure quality health services in Tanzania society (Mangu, 2018; Sundin, Callan and Mehta, 2016; Mtenzi, Chachage and Ngumbuke, 2008). Due to the high influx of mobile phones, the m-health system becomes promising in providing improved healthcare services in developing countries such that the implementation of m-health projects should be encouraged (Beratarrechea et al., 2016). Despite strong financial, logistical, and clinical support from Non-Governmental Organizations (NGOs), government ministries, and private sectors, most of the m-health projects implemented in developing countries fail to scale up from pilot stages to sustainable projects which lead to ‘pilotitis’ (Bloomfield et al., 2014). This shows that, there is a knowledge gap which is not yet address to make implemented m-health projects successfully.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

This study (Rogers, 2003). adapts TAM model to develop research conceptual model, TAM was adopted because, the theory has been proved to be suitable when explaining the willingness of consumers to accept technologies than other theories. This argument has been also supported by Harryanto, Muchran, and Ahmar, (2018), Mathieson, (1991) and Sezgin, Children and Yildirim, (2017). Studies have shown that, TAM’s main factors which are perceived usefulness and perceived easy-of-use are considered to be good in explaining technology adoption (Kalayou, Endehabtu & Tilahun, 2020). Furthermore, to address the main challenges identified in utilization of m-health applications in developing countries, this study extends TAM model with awareness, trust and cost. Extending the acceptance model with other variables increases the explanatory power and acceptance of the technology (McFarland & Hamilton, 2006). Figure 1 shows the research conceptual model of this study.

Figure 1. Research Conceptual Model

Perceived Usefulness and Perceived Ease-of-Use

TAM has two factors that influence user's attitude namely perceived usefulness and perceived ease of use (Tarhini et al., 2015). Perceived Usefulness (PU) is defined as the degree to which a person believes that using a particular system would enhance his/her job performance while Perceived ease of use is considered as the degree to which an individual believes that using a particular system would be free of a physical and mental effort' (Davis, 1986). Several studies have concluded that perceived usefulness and perceived ease-of-use have positive and significant impact in technologies adoption (Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014). Most of the consumers of the technology tend to use technological product when they perceived that using the product will be advantageous to them as well as the technological its self is simple to use. Similarly, if users of m-health applications perceive the application to be easy to use and with relative advantages, their likelihood to adopt m-health applications will be high. Based on the previous studies, this study also postulates that:

H1: Perceived usefulness positively influences the behaviour intention to adopt m-health applications.

H2: Perceived ease-of-use positively influences the behaviour intention to adopt m-health applications.

Awareness

When an individual is well informed about the existence and the benefits of the technology, that person can easily be influenced to adopt and use the technology (Rogers, 1995). This means the degree to which an individual is conscious of services, products, or innovation associated with tends to draw a perception of what it involves (Kayyali et al., 2017; Krebs and Duncan, 2020). Past studies have concluded that awareness has positive and significant effect on intention to adopt several technologies (Iglesias et. al., 2011; Mandari, Chong & Wye, 2017). Likewise, when Smartphone users who are interested with controlling NCDs are aware of the existence of m-health applications which can provides a lot of advantages to them; their likelihood to adopt the applications will be very high. Based on previous findings, this study hypothesizes that:

H3: Awareness on existence and advantages of m-health applications has a positive and significance influence on behaviour intention to adopt m-health applications.

Trust

When patients make face-to-face contact with medical experts, it increases self-explanatory confidence compared to when using technological means. This indicates that the privacy and security of health data shared are of high concerned. This means, when technology is used, privacy and security attributes should be given high priority in order for the users to get confidence with the technology (Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014). Several previous studies have been conducted to evaluate the effects of trust on technology adoption, findings reveal that trust have significant positive impact on behaviour intention to adopt and use of any technology (Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014). Similarly, if Smartphone users of m-health applications trust that using the application could be

secure in terms of their privacy, confidentiality and security, their likelihood to adopt m-health applications will be very high. Based on the above explanation, this study hypothesizes that:

H4: Trust has a positive influence on behaviour intention to adopt m-health applications.

Perceived Cost

Cost is considered as one of the major factors which limit adoption and usage of innovative technologies (Ramlugun & Issuree, 2014). Studies have shown that adoption of technology in high-income society is high as compared to lower-income society where majority tends to adopt technology very late (Rogers, 2003). This is attributed by having adequate financial lucidity (Rogers, 2003).

A study conducted by Lin and Hsieh (2011) showed that, cost tends to generate negative impact on adoption and usage of technologies.

This means users of mobile applications are cost-conscious, the higher the cost, the lower the rate of adoption and usage of the technologies. Therefore, for any m-health application to have significant number of users, owner should consider providing the m-health application at reduced cost. Based on the previous studies, this study postulates that:

H5: Perceived costs has negative influencing on behaviour intention to adopt m-health applications.

RESEARCH METHODOLOGY

Development of Research Instrument

The questionnaire used in this study contains three main sections namely introduction, demographic details and measurement items. The Introduction section provides clearly information to respondents on the main aim of the research as well as providing assurance on the confidentiality of the data to be collected. Demographic detail section collects information which is used to describe the characteristics of the sample respondents used in this study. The last section contains measurement items for all variables used to develop the conceptual

research model for this study. The items for perceived usefulness and perceived ease-of-use were borrowed from Davis (1989), items for awareness were borrowed from Kayyali et al. (2017), items for trust were borrowed from Silic, Barlow and Back (2018) and items for perceived-cost were taken from Cruz (2010).

All measurement items were the pre-validated items from previous studies and they were slightly customized to suite the current study. All measurement items were measured using 5-point Likert scale which range from 1 – Strongly Disagree to 5 – Strongly Agree.

In order to improve the quality of the questionnaire, the designed questionnaire was sent to 10 research and m-health experts for identify mistakes, unclear issues and determine the content validity of the measurement scales. Item Content Validity Index (I-CVIs) was used to determine the validity of each item (Davis, 1992). All I-CVIs values produced were above 79% as proposed by Davis (1992), therefore all items were considered as appropriate for this study. Researchers and m-health experts provided additional opinions which were also used to improve the quality of the final questionnaire.

Furthermore, pre-testing survey was conducted using few Smartphone users to examine if designed questionnaire was clearly understood. Issues observed from pre-testing were addressed to improve the quality of the final questionnaire used on the main survey.

Respondents, Sample Size and Sampling

The population of this study is Generation Y Smartphone users who are living in Dar es Salaam City in Tanzania. Generation Y was considered as targeted respondents because they are considered to be using technologies more than any age segments (Alam, et. al, 2019). Unfortunately, Generation Y is considered to be vulnerable to risk factors contributing to Non-Communicable Diseases because of their life style (Alam, et. al, 2019; Ghorai et al., 2014). Since total population of generation Y Smartphone users who are using m-health applications is unknown, therefore, Cochran's formula was used to estimate the sample size used in this study. Using 95% confidence interval, a sample size of 384 is considered as adequate for providing valid and reliable findings (Cochran, 1977).

Google form was used to create electronic questionnaire which was distributed through WhatsApp social media application. The designed questionnaire contained filter question to eliminated respondents who are not living in Dar es Salaam, neither using Smartphone in case the questionnaire is channeled through other electronic means. Furthermore, physical questionnaire was also distributed through

drop-off/pick-up method (Steele et al., 2001). For those which were distributed manually, snowball sampling techniques was used to identify potential required respondents. In addition, using drop-off/pick up method enabled research assistants who are collecting data to screen potential respondents before administering the questionnaire (Waight & Bath, 2014).

DATA ANALYSIS AND RESULTS

A total of 402 responses were received, 6 questionnaires received were dropped due to large number (more than 20%) of missing data and strait lining as suspicious pattern. Furthermore, analysis was conducted to evaluate the impact of missing values found on responses with minor missing data using MCAR method.

The findings show that, all remaining missing values have non-significant effect ($\chi^2 (134) = 189, p = 0.623$); therefore all values were replaced by using *Expectation-Maximization (EM)* algorithm (Pigott, 2001). Therefore, a total of 396 responses were considered as valid and reliable responses for data analysis. Table 1 show that 57.6% of the respondents were male while 42.4% were female.

Also, 50.2% of the total number of respondents aged between 26 to 35 years, and the majority of respondents had a university education that constitutes 88.1% of all respondents.

Table 1. Demographic Details

| Variable | Description | Frequency | Percentage |
|-----------------|-----------------------|-----------|------------|
| Gender | Male | 228 | 57.6% |
| | Female | 168 | 42.4% |
| Age | 18 to 25 | 26 | 6.6% |
| | 26 to 35 | 199 | 50.2% |
| | 36 to 40 | 171 | 43.1% |
| Education Level | Informal Education | 3 | 0.8% |
| | Primary Education | 7 | 1.8% |
| | Secondary Education | 14 | 3.5% |
| | Certificate Education | 23 | 5.8% |
| | University Education | 349 | 88.1% |

Normality Assessment

Since the findings from this study need to be generalized to the population under investigation, then the sample data used for analysis should be normally distributed. Hair et al. (2010) and Kline (2011) suggested that for the data to be normally distributed, then absolute value for skewness and kurtosis should be 2 and 3 respectively. Normal distribution test for this study shows that the absolute value for skewness and kurtosis are 1.8 and 2.4 respectively which are within the suggested thresholds. Based on this finding, it is appropriate to conclude that, the data are normally distributed and therefore suitable for further analysis.

Reliability Analysis

To examine the extent to which measurement items are consistency in measuring their corresponding variables, reliability analysis was conducted. Cronbach's alpha test was used to examine reliability of the scale. Lance, Butts and Michels (2006) denoted that, if Cronbach's alpha tests produces threshold value greater than or equal to 0.7 then the scale are reliable in measuring the respective variables. Reliability results of this study shows that, four items namely AWR5, AWR6, PU6, and PCST4 have produced low loading values below threshold value which is 0.6 (Hair et al., 2010). Therefore, all items with loading values below recommended thresholds were deleted because they have effects on Cronbach's alpha values produced for their respective variable. Table 2 shows the reliability analysis for each variable after deletion of items with low factor loading.

Table 2. Reliability Results

| Variable | Items | Loading value | Cronbach's Alpha |
|-----------------------|-------|---------------|------------------|
| Awareness | AW1 | .840 | 0.835 |
| | AW2 | .772 | |
| | AW3 | .757 | |
| | AW4 | .787 | |
| Perceived Usefulness | PU1 | .872 | 0.885 |
| | PU2 | .873 | |
| | PU3 | .848 | |
| | PU4 | .858 | |
| | PU5 | .849 | |
| Perceived Ease-of-Use | PEOU1 | .887 | 0.909 |
| | PEOU2 | .881 | |
| | PEOU3 | .905 | |
| | PEOU4 | .876 | |
| | PEOU5 | .880 | |
| | PEOU6 | .922 | |
| Trust | TRS1 | .905 | 0.922 |
| | TRS2 | .904 | |
| | TRS3 | .890 | |
| | TRS4 | .894 | |
| Perceived Cost | PCT1 | .806 | 0.806 |
| | PCT2 | .853 | |
| | PCT3 | .812 | |
| Intention to Use | ITU1 | .835 | 0.860 |
| | ITU2 | .814 | |
| | ITU3 | .817 | |
| | ITU4 | .873 | |
| | ITU5 | .808 | |

In order to examine the hypothesized relationships shown in conceptual research model of this study, multiple regression analysis was conducted using IBM-SPSS version 22. Awareness, perceived usefulness, perceived ease-of-use, trust and perceived cost was regressed against behavioural intention. Findings from Table 3 shows that the independent variables shown in the research model of this study are

statistically significant to explain the dependent variable ($F(5,208) = 106.662, p < 0.001$).

This means the regression model produced good fit of the data used in this study. Therefore, the significant relationships between dependent and independent variables from this study may be used for policy makers. Furthermore, Table 4 shows that perceived usefulness ($\beta=0.213, p < 0.005$), perceived ease-of-use ($\beta=0.182, p < 0.05$) and trust ($\beta=0.352, p < 0.001$) have positive and significant effects on behavioural intention to adopt m-health applications in controlling NCDs. Surprisingly, two hypothesized relationships related with awareness and perceived cost were not found to have significant effects on behaviour intention to adopt m-health application. All positive and significant variables are found to explain behaviour intention to adopt m-health application by 71% as shown in Table 5.

Table 3. ANOVA Table

| ANOVA ^a | | | | | | |
|--------------------|------------|----------------|-----|-------------|---------|-------------------|
| | Model | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 154.612 | 5 | 30.922 | 102.662 | .000 ^b |
| | Residual | 62.651 | 208 | 0.301 | | |
| | Total | 217.263 | 213 | | | |

a. **Dependent Variable:** Behavior Intention to Use

b. **Predictors:** (Constant), Perceived Cost, Trust, Awareness, Perceived Ease-of-Use, Perceived Usefulness

Table 4. Multiple Regression Analysis

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Remarks |
|-----------------------|-----------------------------|------------|---------------------------|-------|------|-----------------|
| | B | Std. Error | Beta | | | |
| (Constant) | .588 | .145 | | 4.046 | .000 | |
| Awareness | .007 | .070 | .008 | .1023 | .918 | Not Significant |
| Perceived Usefulness | .213 | .072 | .198 | 2.969 | .003 | Significant |
| Perceived Ease-of-Use | .182 | .070 | .203 | 2.591 | .010 | Significant |
| Trust | .352 | .054 | .459 | 6.469 | .000 | Significant |
| Perceived Cost | .066 | .037 | .073 | 1.754 | .081 | Not Significant |

Table 5: Model Summary

| Model Summary | | | | |
|---------------|--------------------|----------|-------------------|----------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | 0.848 ^a | 0.712 | 0.705 | 0.54245 |

a. Predictors: (Constant), Perceived Cost, Perceived Usefulness, Awareness, Trust, Perceived Ease-of-Use

DISCUSSION

The main objective of this study was to examine factors that influence Smartphone users to adopt m-health applications in controlling Non-Communicable Diseases in Tanzania. Based on the literature, this study adopted TAM model and extended the theory by adding three variables namely awareness, trust and perceived cost to develop a research model of this study.

The finding shows that trust has positive and direct influence on adoption of m-health applications among Smartphone users in Tanzania. Trust was also found to be a strong predictor ($\beta=0.352$) as compared to other significant variables. This

means m-health application developers and application owners should concentrated more on improving trust attributes in their applications. As young generation smartphone users trust certainly m-health application increases, the possibility of using that m-health application also increases. Smartphone users are very much concerned with privacy and security of their data shared through the m-health applications. Confidentiality of their data should be guarantee when using m-health application. The finding of this study is consistent with previous studies which have shown that trust has strong influence on intention to adopt m-health application (Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014).

Furthermore, perceived usefulness was also found to have significant and direct influence on adoption of m-health application. This means functional utilities related with controlling NCDs provided within the m-health applications are more important to Smartphone users and will tend to influence them to adopt the m-health applications in controlling NCDs.

This means m-health application owners and application developers should concentrate much on adding more usefully attributes related with controlling of NCDs. This finding is also supported by previous findings which have also denoted that perceived usefulness is a key determinant of intention to use m-health application (Alam, et. al, 2019; Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014).

Additionally, the relationship between perceived ease-of-use and behaviour intention to use m-health application was also found to be significant. This means, Smartphone users who are intended to use m-health application are very concerned with simplicity of the m-health applications. The m-health applications developed should be easy to use, easy to navigate and easy to find help, this will tend to influence Smartphone users to adopt the application in controlling NCDs. Similarly, previous studies have also proved that, perceived ease of use have huge influence on adoption of m-health application (Barutçu, Barutçu & Ünal Adıgüzel, 2018; El-Wajeeh, Galal-Edeen & Mokhtar, 2014).

With regards to awareness, the finding shows that awareness has no significant influence on behaviour intention to adopt m-health application in controlling NCDs. This could be attributed by the fact that most of the Smartphone users tend to receive so many information regarding various mobile applications; therefore, awareness on m-health applications for them is not an issue. This finding has also been supported by previous studies which have shown that awareness has no significant influence on behaviour intention to adopt mobile technologies (Elhajjar & Ouaida, 2019; Makanyeza, 2017).

Moreover, perceived cost was also found to have no significant influence on behaviour intention to adopt m-government services. This finding is in line with other previous studies which have also shown that cost has no significant influence on behaviour intention to adopt m-health applications and other technologies (Alam, et. al, 2019; Petrova & Yu, 2010; Ramlugun & Issuree, 2014). The post explanation could be due the importance of using m-health applications in controlling NCDs. Smartphone users outweigh the cost-benefit of using m-health applications and possibly found that benefits of using m-health applications in controlling NCDs are many as compared to cost incurred, therefore they have less concerned to issues related with cost of using m-health applications in controlling NCDs.

IMPLICATION OF THE STUDY

Recently, deaths caused by NCDs have increases, but thanks to development of mobile technologies which can be used to control NCDs. It is clearly acceptable that, effective usage of m-health applications in controlling NCDs can reduce death risk and provide substantive health status Smartphone users. Therefore, this study contributes to literature in the following areas; firstly, the study has extended TAM model with awareness, trust and cost to examine the influence of Smartphone users in using m-health application to control NCDs. Fewer studies have been conducted in this area particularly in developing countries in which technology is less applicable in health sector. Therefore, this study enhances scholar's knowledge on applicability of TAM model and other extended variables in studying the adoption of m-health applications in controlling NCDs in developing countries.

Furthermore, the study has provided implications to m-health service providers and m-health application developers. The study has identified three main factors which could influence Smartphone users to adopt m-health applications in controlling NCDs. The study suggest that emphases should be considered in trust, usefulness and easy- of use. Trust should be highly considered because most of the m-health application users are much concerned with privacy and security of the data collected through m-health application. This means, should consider using light weight data confidentiality protocols to safeguard mobile app's users health information. Furthermore, m-health applications owners should consider adding more functional utilities in the application and making m-health application more user friendly to allow young generation to use the application easily.

CONCLUSION AND FUTURE STUDY

This study has examined factors that could influence generation Y Smartphone users to adopt m-health applications in controlling NCDs in Tanzania. The study has extended TAM model with awareness, trust and perceived cost to develop a research model for this study. The findings of the study show that trust, perceived usefulness and perceived ease-of-use have significant effect on behaviour intention to adopt m-health application in controlling NCDs. This means m-health owners and application developers should make necessary effort to concentrate on the above mentioned factors in order for their m-health applications to be adopted.

This study have concentrated in generation Y and respondents from Dar es Salaam city only, therefore, findings generated from this study may have generalization limitations. This means, further studies which include respondents from different age segments and from various regions of Tanzania should be conducted. Only three variables were found to be significant and have produced 71% which is the proportion of variance of independent variable to explain the dependent variable. Therefore, future studies may extend the developed research model with additional variables to produce more explanatory variables.

REFERENCES

- Alam, M. Z., Hoque, M. R., Hu, W., & Barua, Z. (2020). *Factors influencing the adoption of mHealth services in a developing country: A patient-centric study*. *International journal of information management*, 50, 128-143.
- Alam, M. Z., Hu, W., Hoque, M. R., & Kaium, M. A. (2019). Adoption intention and usage behavior of mHealth services in Bangladesh and China: A cross-country analysis. *International Journal of Pharmaceutical and Healthcare Marketing*.
- Altmann, V., & Gries, M. (2018). *Factors influencing the usage intention of mHealth apps: An empirical study on the example of Sweden*.
- Barutçu, S., Barutçu, E., & Ünal Adıgüzel, D. (2018). *A technology acceptance analysis for mhealth apps: the case of Turkey*.
- Beratarrechea, A., Diez-Canseco, F., Irazola, V., Miranda, J., Ramirez-Zea, M., & Rubinstein, A. (2016). *Use of m-health technology for preventive interventions to tackle cardiometabolic conditions and other non-communicable diseases in Latin America-challenges and opportunities*. *Progress in cardiovascular diseases*, 58(6), 661-673.

- Bloomfield, G. S., Vedanthan, R., Vasudevan, L., Kithei, A., Were, M., & Velazquez, E. J. (2014). *Mobile health for non-communicable diseases in Sub-Saharan Africa: a systematic review of the literature and strategic framework for research*. *Globalization and health*, 10(1), 1-9.
- Boulos, M. N. K., Brewer, A. C., Karimkhani, C., Buller, D. B., & Dellavalle, R. P. (2014). *Mobile medical and health apps: state of the art, concerns, regulatory control and certification*. *Online journal of public health informatics*, 5(3), 229.
- Chiarini, G., Ray, P., Akter, S., Masella, C., & Ganz, A. (2013). *mHealth technologies for chronic diseases and elders: a systematic review*. *IEEE Journal on Selected Areas in Communications*, 31(9), 6-18.
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). New York: Wiley.
- Cruz, P., Neto, L. B. F., Muñoz-Gallego, P., & Laukkanen, T. (2010). *Mobile banking rollout in emerging markets: evidence from Brazil*. *International Journal of bank marketing*.
- Davis, F.D. (1989). *Perceived usefulness, perceived ease of use and user acceptance of information technology*. *MIS Quarterly*, 13(3), 319-339.
- Davis, L. L. (1992). *Instrument review: Getting the most from a panel of experts*. *Applied nursing research*, 5(4), 194-197.
- Duncan, M. J., Brown, W. J., Burrows, T. L., Collins, C. E., Fenton, S., Glozier, N., ... & Vandelanotte, C. (2018). *Examining the efficacy of a multicomponent m-Health physical activity, diet and sleep intervention for weight loss in overweight and obese adults: Randomised controlled trial protocol*. *BMJ open*, 8(10), e026179.
- Duncan, M. J. et al. (2018) 'Examining the efficacy of a multicomponent m-Health physical activity, diet and sleep intervention for weight loss in overweight and obese adults: Randomised controlled trial protocol', *BMJ Open*, 8(10), pp. 1–14
- Elhajjar, S., & Ouaida, F. (2019). An analysis of factors affecting mobile banking adoption. *International Journal of Bank Marketing*.
- El-Wajeih, M., Galal-Edeen, G., & Mokhtar, H. (2014). *Technology acceptance model for mobile health systems*. *IOSR Journal of Mobile Computing and Acceptance*, 1(1), 21-33.
- Feroz, A., Kadir, M. M., & Saleem, S. (2018). *Health systems readiness for adopting mhealth interventions for addressing non-communicable diseases in low-and middle-income countries: a current debate*. *Global health action*, 11(1), 1496887.

Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., ... & Haines, A. (2013). *The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis*. PLoS Med, 10(1), e1001363.

Ghorai, K., Jahan, S., Ray, P. and Chylinski, M. (2014), "mHealth for behaviour change: role of a smartphonebased multi-intervention service for hypertension and diabetes in Bangladesh", *International Journal of Biomedical Engineering and Technology*, Vol. 16 No. 2, pp. 135-155.

Hair, J., Black, W. C., Babin, B. J. & Anderson, R. E. (2010) *Multivariate data analysis* (7th ed.). Upper Saddle River, New Jersey: Pearson Educational International.

Haluza, D. and Jungwirth, D. (2015) 'ICT and the future of health care: Aspects of health promotion', *International Journal of Medical Informatics*. Elsevier Ireland Ltd, 84(1), pp. 48–57

Iglesias, O., Singh, J. J., Casabayó, M., Alamro, A., & Rowley, J. (2011). *Antecedents of brand preference for mobile telecommunications services*. Journal of Product & Brand Management.

Kalayou, M. H., Endehabtu, B. F., & Tilahun, B. (2020). *The Applicability of the Modified Technology Acceptance Model (TAM) on the Sustainable Adoption of eHealth Systems in Resource-Limited Settings*. Journal of Multidisciplinary Healthcare, 13, 1827.

Kayyali, R., Peletidi, A., Ismail, M., Hashim, Z., Bandeira, P., & Bonnah, J. (2017). *Awareness and use of mHealth apps: a study from England*. Pharmacy, 5(2), 33.

Kline, R.B. (2011). *Principles and practice of structural equation modeling* (5th ed., pp. 3-427). New York: The Guilford Press

Lance, C. E., Butts, M. M., & Michels, L. C. (2006). *The sources of four commonly reported cutoff criteria: What did they really say?* Organizational Research Methods, 9(2), 202–220.

Makanyeza, C. (2017). Determinants of consumers' intention to adopt mobile banking services in Zimbabwe. *International Journal of Bank Marketing*.

Mangu, V. P. (2018) 'Mobile Health Care', *Consumer-Driven Technologies in Healthcare*, pp. 1–14.

McFarland, D. J., & Hamilton, D. (2006). *Adding contextual specificity to the technology acceptance model*. Computers in human behavior, 22(3), 427-447.

- Mtenzi, F. J., Chachage, B. L., & Ngumbuke, F. (2008). *The growth of Tanzanian mobile phone sector: triumph of quantity, failure of quality?*.
- Opoku, D., Busse, R., & Quentin, W. (2019). *Achieving sustainability and scale-up of mobile health noncommunicable disease interventions in Sub-Saharan Africa: views of policy makers in Ghana*. *JMIR mHealth and uHealth*, 7(5), e11497.
- Petrova, K. & Yu, S. (2010). *Sms banking: An exploratory investigation of the factors influencing future use*. *International journal of E-Services and mobile alications*, 2 (3), 19-43.
- Pigott, T.D. (2001), "A review of methods for missing data", *Educational Research and Evaluation*, Vol. 7 No. 4, pp. 353-383.
- Ramlugun, V. G. and Issuree, H. (2014) 'Factors Determining Mobile Banking Adoption in Mauritius', *International Journal of Innovative Research & Development*, 3(1), pp. 193–202.
- Rogers, E. (1995). *Diffusion of Innovations* (4th ed.), Free Press, New York
- Rogers, E. (2003). *Diffusion of Innovations*, Free Press, New York
- Saadatfard O, Å. E. (2016) 'M-health Apps by Numbers'.
- Siddharthan, T. et al. (2015) 'Downloaded from content.healthaffairs.org by Health Affairs on November 3, 2015 at Bolivia: HEALTH AFFAIRS Sponsored'
- Silic, M., Barlow, J., & Back, A. (2018). *Evaluating the role of trust in adoption: a conceptual replication in the context of open source systems*. *AIS Transactions on Replication Research*, 4(1), 1-17.
- Steele, J., Bourke, L., Luloff, A. E., Liao, P. S., Theodori, G. L., & Krannich, R. S. (2001). *The drop-off/pick-up method for household survey research*. *Community Development*, 32(2), 238-250.
- Stephenson, A., McDonough, S. M., Murphy, M. H., Nugent, C. D., & Mair, J. L. (2017). *Using computer, mobile and wearable technology enhanced interventions to reduce sedentary behaviour: a systematic review and meta-analysis*. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), 1-17.
- Sundin, P., Callan, J., & Mehta, K. (2016). *Why do entrepreneurial mHealth ventures in the developing world fail to scale?*. *Journal of medical engineering & technology*, 40(7-8), 444-457.
- Tarhini, A., et al. (2015) 'A Critical Review of Theories and Models of

Technology Adoption and Acceptance in Information System Research,
6(December), pp. 58–77

UTR (2019), *National Digital Health Strategy 2019–2024*, Ministry of Health, Community Development, Gender, Elderly and Children, Dar es Salaam

Waight, C. F., & Bath, A. J. (2014). Recreation specialization among ATV users and its relationship to environmental attitudes and management preferences on the Island of Newfoundland. *Leisure Sciences*, 36(2), 161-182.

WHO (2016), *Global diffusion of eHealth: Making universal health coverage achievable, Report of the third global survey on eHealth*

WHO (2018), Non-communicable diseases; [https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases#:~:text=Noncommunicable%20diseases%20\(NCDs\)%20kill%2041,%2D%20and%20middle%2Dincome%20countries](https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases#:~:text=Noncommunicable%20diseases%20(NCDs)%20kill%2041,%2D%20and%20middle%2Dincome%20countries). Retrieved March 2020

Zhao, Y., Ni, Q., & Zhou, R. (2018). *What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age*. *International Journal of Information Management*, 43, 342-350.