

FACTORS MOTIVATING END-USERS' BEHAVIOURAL INTENTION TO RECOMMEND M-HEALTH INNOVATION: MULTI-GROUP ANALYSIS

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Abstract: *mHealth innovation is health innovation that is gaining adoption in developing countries. The COVID-19 impact and the brain drain of health practitioners in Nigeria are indicating higher importance of the innovation. However, while the literatures on adoption are rising there is paucity of literature on intention to recommend mHealth innovation particularly with gender context. The study considered determinants of end-users' behavioural intention to recommend mHealth innovation by considering multi-group analysis. Theory of reasoned action was modified with variables from health belief model and unified theory of acceptance and use of innovation to structure the intention to recommend mHealth model. Structured questionnaire with adapted items from extant studies were scaled on 7 point likert scale while snowball sampling technique was adopted in data collection. A total of 291 questionnaires were used in the analysis which was done through IBM Statistics version 23 and AMOS 23. The study used descriptive statistics, structural equation model and an invariant analysis to check the difference between the groups. The model showed good fit using a set of fit indices and coefficient of codetermination that indicates high predictive capacity. The SEM analysis show that subjective norm is the most vital factor that influences end-users' intention to recommend mHealth innovation to others. Generally, it indicates that male users have higher intention to recommend mHealth innovation than female users of mHealth innovation. The result of the analysis also show that the correlations between the exogenous factors are positive and at least moderate across gender thus indicating the direction for adoption of marketing communication strategies to deepen the awareness of the innovation and encourage recommendation to others. The recommendation suggested center on marketing communication strategies that involves use of role models, influencers, celebrities, health practitioners and other referents to encourage the awareness and intention to recommend the innovation. The key limitation of the study is on sample size and the use of cross-sectional survey design which could pose danger in generalisation of the findings. However, it is concluded in the study that male users of mHealth innovation have higher intention to recommend the innovation than the female users of the innovation.*

Keywords: mHealth, consumer-centric healthcare, healthcare market, behavioural intention, mobile technology.

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Introduction. In recent times, one of the significant trends and developments in the global health sector is the drive towards digitisation of the healthcare sector. The present state of global healthcare shows incidence of issues such as digital transformation and healthcare delivery model convergence which was highlighted more by COVID-19 pandemic (Deloitte, 2022). These are results of increasing global health issues such as rising rate of non-communicable diseases which according to World Health Organisation (2015) is exacerbated by factors such as globalisation of unhealthy lifestyle. This has led to consumer-centric healthcare and promotion of the digital healthcare market such as telemedicine and wearables (World Economic Forum and Accenture, 2016; Yeganeh 2019). To create meaningful impact in healthcare, Dwivedi et al., (2016) suggested health restructuring that has consistency and coherence with the present society's mobile lifestyle. This is significant because of the benefits of technological innovations and its applications on health. It is becoming important in healthcare. However, there are rising concerns between patients who have affinity to the innovation to handle their health and the inflexible health systems with health workers who have challenges to adapt to the rapid changes (Mesko et al., 2017).

mHealth or otherwise mobile health involves enhancement of mobile health service using the applications of mobile technology such as smartphones and personal digital assistants that has software applications support (Gagnon et al., 2016). Generally, World Health Organisation (2011) defined it as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other mobile devices". In early stages, limited scientific studies exist about mHealth's effectiveness (Free et al., 2014; Aranda-Jan et al., 2014) with studies indicating uniqueness of mHealth features to be important in assessing determinant factors (Gagnon et al., 2016). Others argued about its failure to meet stakeholders' expectation of its adoption (Kearney, 2012) with reasons inferred to be from the notoriety of late adoption of the healthcare sector towards innovations (Norris et al., 2009), poor awareness of its potentials (Kayyali et al., 2017), literacy issues about mhealth (Lin and Bautista 2017) and influence from peers (Van Woudenberg et al., 2018). In the present time, it is rarely about effectiveness. With the impact of COVID-19 highlighting its importance, Bassi et al., (2020) assert that it was helpful during the pandemic in facilitating connection between patient and doctors. It is becoming useful in various ways such as delivery and accessing healthcare services and information (Quaosar et al., 2018), and promotion of patient care and accessibility in a cost-effective way (Babatunde et al., 2021). Though mHealth is in developmental stage, it promotes communication and feedback between the user parties given its collaborative and mobility feature (Nachandiya et al., 2020). In developing countries such as Nigeria, for the adoption to be successful it is largely dependent on the user (Khan 2017) as evidences in the developing countries indicate poor rate of adoption (Ndayizigamiye et al., 2018).

In African context, such as Nigeria the potential of mHealth is high particularly with the increasing subscription level and ownership of smartphones in the country. As at May 2022, there are over 204 million mobile subscriptions (The Nigerian Communication Commission, 2022) with 32% Nigerians owning smartphones (Oyelola, 2021). These are important foundations for the success of mHealth. It is important in any adoption of mobile technology. In Nigeria's case, its importance and necessity is highlighted by the decreasing doctor to patient ratio which is presently at 1:5000 against the recommendation of WHO which is at 1:600 (Muanya and Onyenucheya, 2021) as a result of brain drain in the country. During the COVID-19 pandemic mHealth technologies were useful in accessing quality health information and services (Eduoh, 2020). Some of these mobile health apps that were very useful and has gained increasing downloads are mobicure, hudibia, safermom (Babatunde et al., 2021) and mobile authentication service that facilitates control of sale of fake and sub-standardised drugs (Oyetunde et al., 2019). They are not really replacing the traditional physical consulting rather it is a facilitative innovation, supportive, complementary and useful means to mitigate the rising challenge in healthcare (Nachandiya et al., 2020). Though some successes have been recorded with its usage in Nigeria, issues such as unsustainable funding, business model that is unsuitable, and challenges associated with fragmentation hinder deepening processes of mHealth (Ohuruogu et al., 2015). Other challenges associated with mHealth adoption are non recognition of mHealth in eHealth policies in addressing the gap on health issues, and potential promotion of health inequality upon full adoption particularly among the disadvantage members in the country (Babatunde et al., 2021).

However, to overcome the challenges it will require addressing the factors militating against the successful adoption of the technology (Nachandiya et al., 2020). mHealth belongs to the class of mobile technologies that involves use of handheld devices that permits mobility and access to the network. Technological innovations have their uniqueness. A key factor that has largely being used in the study of technological innovations and intention studies is technological acceptance model (TAM) (Davis, 1989), and unified theory of acceptance and use of technology (Venkatesh et al., 2003) among others. Several studies modify any of

these models to meet the goals of their study. In addressing user behaviour to accepting novel technologies, TAM have been widely used and modified with several modifications. For instance, in conducting a meta-analysis of factors influencing mHealth adoption in China Zhao et al. (2018) developed a model with elements from different models. This is not dissimilar in study of technological innovations outside healthcare such as the inclusion of subjective norm in online shopping (Oloveze et al., 2021), and perceived trust in user behaviour to affective commitment (Oloveze et al., 2020). The essence is to address peculiar problems with a theoretical support. Thus, the uniqueness of mHealth has led to more focus on the innovation in assessing its usefulness and contribution to healthcare delivery (Zhao et al., 2018). Several studies on mHealth in Nigeria have tried to broaden the concept, policies and its application because of its novelty (Nachandiya et al., 2020; Babatunde et al., 2021; Ohuruogu et al., 2015). However, a few studies have explored the patient-centric perspective (as end-users) from a multi-group dimension (gender).

The focus of the study is to evaluate the factors that determine the intention of end users to recommend mhealth applications and services to others in Nigeria with a patient-centric concentration. Notably, patient-centric approach will help to focus on individuals/patients with respect to the provision of healthcare by healthcare providers.

Literature Review. The concept of mHealth deals with any tool or mobile devices not limited to wearables, personal digital assistants and mobile devices that facilitates medicine and public health (Octavius and Antonio, 2021). The mobile technology has been adopted in different healthcare issues such as adoption in healthcare by nurses (Nezamdoust et al., 2022), universal health coverage (Babatude et al., 2021), health organisation's adoption (Currie 2016), and primary healthcare workers attitude (Kenny et al., 2017). The growth of the mobile technology has been attributed to the rising ownership of mobile phones given its estimated global statistics of 6.37 billion smartphone owners and 7.10 billion mobile phone owners (Turner, 2022) and the global subscription hitting 8.6 billion as at 2021 (O'Dea, 2021). People are using mobile phones and smartphones for different purposes because of the opportunities and benefits it offer to individuals. Studies show that users of mobile phone and smartphone use it to expose themselves to social life, improve quality of life, communicate (Devendra, 2021) with the usage rising rapidly in Africa such that daily use by African users are limitless in ways that indicates it being entrenched in their lives (Deloitte, 2016). In Nigeria, while mobile penetration in urban and rural areas are increasing, Deloitte (2016) survey indicates that it is a way of life given the situations of its usage which are high in public transport, watching movies, spending time with friends and family, while they have the propensity to check their phones within 5 minutes of waking up from sleep or sleeping. This clearly indicates that smartphones and mobile phones is a modern culture (Rashid et al., 2020). Thus, the application of mobile technology to Health which is facilitated by these devices is noted as mobile health behaviour. According to Zhao et al. (2018) it is classified as health behaviour.

On the other hand, the consumer-centric or Patient-centric healthcare involves «respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions» (Institute of Medicine (US) Committee on Quality of Health Care in America, 2011). It is broadly seen as any healthcare approach that focuses on patients and respects their dignity and worth (Tzelepis et al., 2015). According to Ngongo et al., (2019) it is one that facilitates communication between patients and doctors or any healthcare provider (Ngongo et al., 2019). In this regard, several studies have utilised different information technologies such as TAM, Theory of planned behaviour (Ramírez-Correa et al., 2020) unified theory of acceptance and use of technology (UTAUT) (Zhang et al., 2019), motivation theories (Li et al., 2016), and UTAUT and health belief model (HBM) (Diño and de Guzman, 2014) to study mobile health innovation. The essential understanding from these studies was that there are differences in findings which could be from factors such as sample size and its characteristics, major concentration on traditional consumer adoption models, or the context of the study. While extant literature showed the significance of some factors such as awareness, social influence and effort expectancy (Ndayizigamiye et al., 2020), perceived ease of use and perceived usefulness on mHealth (Nezamdoust et al., 2022) studies rarely focused on gender intentions to recommend mHealth. This is important because adopting an innovation and recommending the innovation differ and could depend on different factors such as mobile technology literacy, innovativeness and ICT skills.

Gender differences among users of technological innovations have been highlighted in extant studies to be critical in adoption of technological innovation. Given the end-user delay in adoption as one of the contending challenges to mHealth service (Zhang et al., 2020; Rahi et al., 2021), the context of gender differences is an important consideration. In several models dealing with relationships, gender has been deemed to be important (Ha et al., 2007) following its relevance in information technology models that began from 1990 which Gefen and Straub (1997) asserted that has been largely omitted in behavioural studies. The gender context has been applied in different areas such as mobile payment systems (Liébana-Cabanillas et al., 2018), mobile

commerce (Lu et al., 2017), and loyalty toward internet service providers (Sanchez-Franco et al., 2009). This dimension is important in mHealth given its lack of attention in literature. The obvious health disparity in gender following some health indicator differences such as life expectancy, usage of health services (Matud, 2017) demands attention in adoption of mHealth with clarity on gender perspective. Studies on gender in health have often focused on mortality and morbidity and patterns of diseases amongst them (Springer et al., 2012), mental health (Rosenfield and Smith, 2010), wellbeing (Diener and Ryan, 2014) and determinants of gender differences in health (Bird and Rieker, 1999). With the emergence of mobile technology in health, there is paucity of empirical literature evaluating the differences among gender in adoption or recommendation of mHealth.

However, intention to recommend (ITR) is often a consequence of experience either directly or indirectly (Kang and Choi, 2018). It takes the form of communication which can be passed through word of mouth, the social media or through any other information communication means. The information can be positive or negative (Kang and Choi, 2018). Intention to recommend e-innovation can be dependent on some factors such as quality perceptions (Finn et al., 2009). In other words, perceptions of users of technological innovations are vital when using a device as it can influence their intentions to recommend the innovation. In this regard, extant literatures indicate difference between male and female preferences (Debrand and Johnson, 2008) and in their attitude and behaviour (Kim et al., 2012). For instance prior to recommendation male and female tend to be moved by factors such as functional value by male (Yang and Lee, 2010) and relational value by female (Chan et al., 2015) as this can play a role in their tendencies to recommend a service or product.

On the other hand, while several models such as HBM, TAM, UTAUT, theory of planned behaviour (TPB), and protection motivation theory (PMT) among others have been used to study mobile technology in mHealth it has been more of utilisation of variables from these models to address uniqueness of the problems. In this regard, given the key drive of the study on intention to recommend mHealth with a multi-group context and a social psychology perspective, theory of reasoned action (TRA) by Fishbein and Ajzen (1975) was adopted with modifications. The theory emphasises attitude and subjective norm to be fundamental in behavioural intention prior to the actual behaviour. It is most successful in situations where the behaviour is under individual's decision and control. The importance of the theory to mHealth adoption is indicated by Zhang et al. (2014) who asserted the importance of attitude in the adoption of the innovation. The health dimension of the theory can be helpful in discovering where to target marketing communication strategies, awareness campaigns and other strategies that will help in changing adoption behaviour and intention to recommend mHealth technology.

Essentially, TRA posits subjective norm (SN) to be critical in behavioural intention. Subjective norm deals with the perception of individuals on what most people that are important in their live think about adopting behaviour (Fishbein and Ajzen, 1975). The subjective perception deals with social pressures that influence the individual to move in a desired way. Beliefs and motivation are key components of subjective norm (Ramos de Luna et al., 2019). With belief the individual has a reliance on the opinion of the referent while with motivation the individual is driven to behave according to the referent's direction. However, the level of motivation is dependent on how the group norm and the characteristics of the innovation are compatible with each other (Graham, 1956). In this instance, the influence of third parties is highlighted in technological innovations such as mHealth as Jiang et al., (2016) asserts that it can contribute to an individual being moved to conform to the referent's expectation. Particularly, when the influence is favourable it tends to increase adoption of technological innovation (Webster and Trevino, 2017). Most importantly, subjective norm is highlighted in situations where individuals lack usage experience and are uncertain about adoption of behaviour because of presumed consequences of such action thereby leading the individual to seek others' opinion (Oloveze et al., 2020). The importance of the variable is highlighted by its inclusion in various studies such as user behaviour to point of sale terminal (Oloveze et al., 2020), mobile payment systems (Ramos de Luna et al., 2018), microblogging (Jiang et al., 2016), and NFC mobile payments (Liébana-Cabanillas et al., 2018) among others. With studies on mHealth, its significance on intention to adopt behaviour is highlighted (Ndayizigamiye et al., 2020; Almegbel and Aloud, 2021; Zhang et al., 2014) but not significant in continuance intention to adopt mHealth services (Asvinigita et al., 2022). With the following discourse and the direction of the study on end-user's intention to recommend mHealth services, the following hypotheses are proposed:

H1: Subjective norm is positively related to behavioural intention to recommend mHealth innovation and significantly stronger among male than female

H2: Subjective norm positively correlates perceived benefit of mHealth innovation and significantly higher among male

H3: Subjective norm positively correlates effort expectancy of mHealth innovation and significantly higher among male

Perceived benefit (PB) is a concept that deals with individual's belief of having a better state after adoption (Kim et al., 2008). It is a function of several attributes that includes tangible and intangible attributes, functional and non functional gains, intrinsic and extrinsic gains which could be derived directly or indirectly (Lee, 2009; Choi et al., 2013). From the point of theory of rationality, behaviour results from rational computation (Alvarez and Porac, 2020). This provides understanding to the motivation of actions from attached benefits (Chen et al., 2022). It is a key variable of HBM which combines with other variables such as susceptibility and severity to influence behavioural intention (Pan et al., 2020). Mobile technologies like mHealth offer some benefits such as convenience in form of utilities like time and place (Pal et al., 2015). In healthcare, mobile technological innovation is indicated to be useful to end users such as healthcare practitioners in effective communication, information management, clinical decision making, and monitoring of patients (Ventola, 2014). In situations where there is higher projection of perceived benefits associated with mobile technologies, individuals are positively influenced towards behavioural adoption but negatively influenced in cases of few benefits (Keeny et al., 2017). Thus, innovations like mHealth can be easily adopted by patients when the benefits are obvious to them (O'Connor et al., 2016). However, poor awareness can impact successful adoption by them (Khatun et al., 2016). Extant studies indicate how users' perception of benefit influences adoption of behaviour (Petter and McLean, 2009). For instance, there is a tendency for patients to adopt a behaviour that satisfies them and meets their needs (Motamarri et al., 2014). In this regard, when mHealth meets end-users' need, they will likely recommend it. In the context of the study on end-users' intention to recommend mHealth, the researchers proposes the following hypotheses:

H4: Perceived benefit is positively related to behavioural intention to recommend mHealth innovation and significantly stronger among male

H5: Perceived benefit positively correlate effort expectancy of mHealth innovation and significantly higher among male

Effort expectancy (EE) is about the extent of ease involved in the use of mobile technology (Venkatesh et al., 2012). It is key variable in UTAUT. In some literatures it was likened to perceived ease of use by Davis (1989). It is considered to be one of the significant factors that influence the adoption of mobile technology. This is because users place emphasis on the ease of using a technology before adoption (Venkatesh et al., 2012). Thus where there is less effort required to use the technology, the chance of adoption is high (Shareef et al., 2017). In relation to mHealth, the presence of user-friendliness is considered important while being simple to use and easy to navigate without having several steps to follow to get what they want (Nguyen et al., 2022). In addition, limiting the use of medical terminologies and having an easy sign-up mechanism are key contexts that are considered vital in mHealth (Nguyen et al., 2022). Extant studies indicate that it determines user intention to adopt mHealth (Zhang et al., 2017; Almegbel and Aloud, 2021).

H6: Effort expectancy is positively related to behavioural intention to recommend mHealth innovation and significantly stronger among male

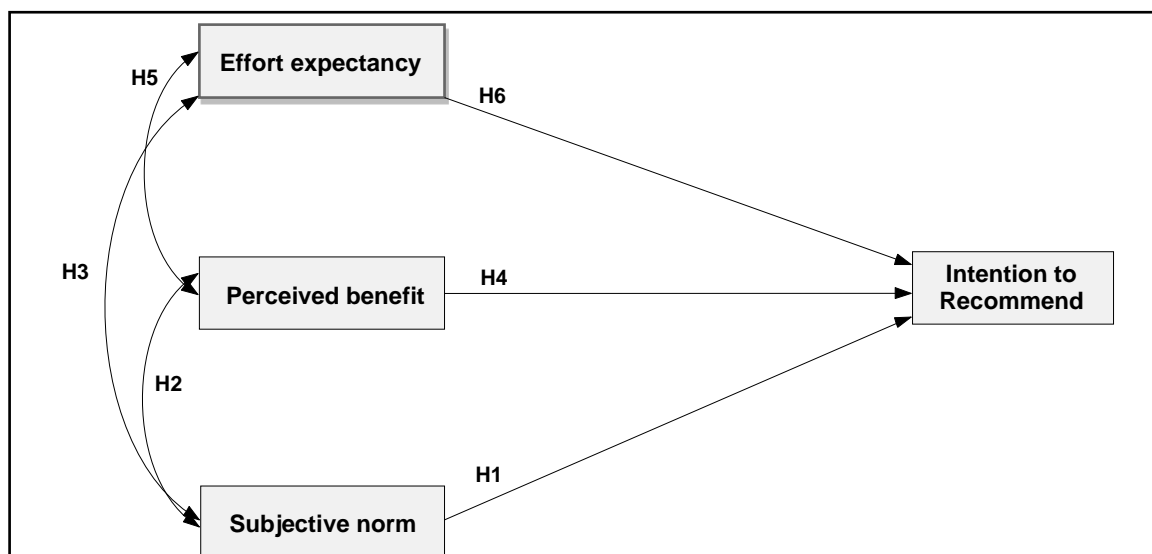


Figure 1. Proposed structural model

Sources: developed by the authors.

Methodology and research methods: The study is a cross-sectional design. The questionnaire was adapted from extant literature. Effort expectancy and subjective norm (social influence) were adapted from Almegbel and Aloud (2021), perceived benefit was adapted from Chaniotakis and Lymperopoulos (2006), while intention to recommend was adapted from Octavius and Antonio (2021) with the items scaled on 7 point Likert scale that has the value of 1 as strongly disagree and 7 as strongly agree. All the variables have 4 items each except subjective norm that has 3 items. The questionnaire was structured in three sections that involve the introduction a brief to mHealth, demographic variables, filter question, and the constructs of the study. The questionnaire was subjected to preliminary test using face validity and content validity through expert in the field. The moderated questionnaire by the experts were distributed through snowball sampling given that it will enable the researchers connect to individuals with experience on mHealth (Oloveze et al., 2022). The use of filter questions «have you ever used mobile health application or service or innovation» and «have you ever used any of mobicure app, hudibia app, safermom app or mobile authentication service that checkmates fake and substandard drugs» were used to screen out irrelevant responses. To limit the effect of common method bias (CMB), the questions were word in negative and positive way to control extreme and acquiescence responses. This was in addition to the experts input on the questionnaire. The data collection lasted about seven months.

Results. The analysis of the data was done with IBM SPSS 23 and Amos 23 software package. In the first place, within the period of the data collection, 291 valid questionnaires were collected after removing the irrelevant ones that was less than 10% of the total collected questionnaire. Herman’s single factor technique was used to check for the significance of the CMB. By adjusting all factors to single factor the value of 46.78% indicates that CMB do not have significant influence given that the threshold is 50% (Kalinic et al., 2019; Oloveze et al., 2022). Secondly, factor analysis was conducted using principal component analysis with varimax rotation technique. The values of KMO (Kaiser-Meyer-Olkin) and Bartlett's Test of Sphericity were 0.935 and 3321.383(0.000) respectively. This confirms the sampling adequacy (KMO need to be more than 0.5) and rejection of rejection of non-existing difference between correlation and identity matrix respectively ($p \leq 0.001$). In addition, the values of the communalities were all above 0.5 thus indicating good representation of the variables. Thirdly, the confirmatory factor analysis that was conducted show that all the factor loadings were above 0.6. Cronbach alpha (CA) and composite reliability (CR) were used to test the reliability. All the variables exceeds the minimum threshold for reliability [(CA: EE = 0.864; PB = 0.906; SN = 0.873; ITR = 0.894)(CR: EE = 0.844; PB = 0.806; SN = 0.767; ITR = 0.872) thus indicating adequate reliability as indicated in extant literature (Hair et al., 2011). The convergent validity done through average variance extracted (AVE). The results (AVE: EE = 0.576; PB = 0.510; SN = 0.523; ITR = 0.631) met the recommended values in literature (Hair et al., 2011). Further illustrations are on table 1.

Table 1. Confirmatory factor analysis and descriptive statistics

| Variable | Item | Factorial loadings | Cronbach Alpha | Composite reliability | Average variance extracted | Mean | Standard deviation |
|------------------------|------|--------------------|----------------|-----------------------|----------------------------|------|--------------------|
| Effort expectancy | EE1 | .688 | .864 | .844 | .576 | 5.76 | 1.310 |
| | EE2 | .817 | | | | 5.88 | 1.177 |
| | EE3 | .718 | | | | 5.41 | 1.337 |
| | EE4 | .804 | | | | 5.91 | 1.275 |
| Perceived benefit | PB1 | .748 | .906 | .806 | .510 | 5.77 | 1.136 |
| | PB2 | .700 | | | | 5.89 | 1.109 |
| | PB3 | .681 | | | | 5.94 | 1.161 |
| | PB4 | .725 | | | | 6.02 | 1.161 |
| Subjective norm | SN1 | .686 | .873 | .767 | .523 | 5.41 | 1.157 |
| | SN2 | .707 | | | | 5.68 | 1.138 |
| | SN3 | .774 | | | | 5.84 | 1.172 |
| Intention to recommend | ITR1 | .745 | .894 | .872 | .631 | 6.19 | 1.076 |
| | ITR2 | .805 | | | | 6.05 | 1.104 |
| | ITR3 | .832 | | | | 6.14 | 1.012 |
| | ITR4 | .793 | | | | 6.35 | 0.979 |

Sources: developed by the authors.

The key demographic profiles used were gender and age. The results show 59.5% male and 40.5% female while 54.6% being above 36 years and 45.4% were below 36 years. They are further illustrated in figure 1 and 2 respectively.

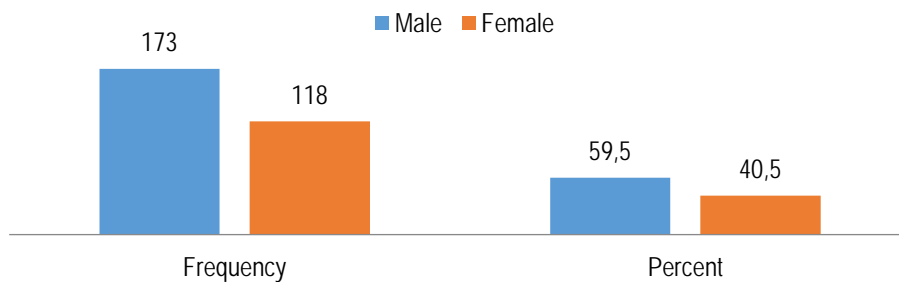


Figure 2. Gender

Sources: developed by the authors.

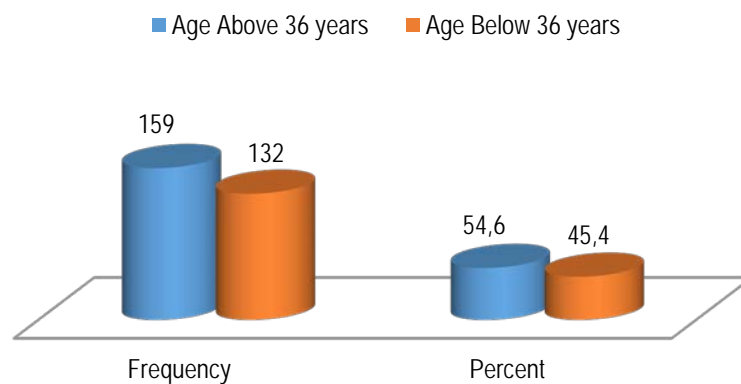


Figure 3. Respondents' Age

Sources: developed by the authors.

The proposed hypotheses were analysed using structural equation model (SEM). Firstly, the parsimony and incremental fit measures were analysed with the results indicating reasonable goodness of fit model. The various values met the thresholds besides GFI and RFI which are marginally acceptable. The result is further illustrated on table 2.

Table 2. Structural model fit indices in the proposed model

| Fit indices | Recommended value | Value in structural model | Reference |
|-------------|-------------------|---------------------------|-----------------------------|
| CMIN/DF | ≤5.00 | 1.93 | Bentler and Paul (1996) |
| RMR | ≤0.08 | 0.07 | Pituch and Stevens (2016) |
| GFI | ≥0.90 | 0.88 | Hair <i>et al.</i> , (2010) |
| AGFI | ≥0.80 | 0.82 | Hu and Bentler (1999) |
| NFI | ≥0.90 | 0.91 | Byrne (1994) |
| RFI | ≥0.90 | 0.88 | |
| IFI | ≥0.90 | 0.95 | Bollen (1989) |
| TLI | ≥0.90 | 0.94 | Bentler and Paul (1996) |
| CFI | ≥0.90 | 0.95 | Schumaker and Lomax (2016) |
| RMSEA | ≤0.08 | 0.06 | Hu and Bentler (1999) |
| PCLOSE | >0.05 | 0.12 | |

Notes: RMR/SRMR = Standardized root mean squared residual. GFI = goodness-of-fit index. AGFI = adjusted goodness-of-fit index. NFI = Normed fit index. RFI = relative fix index. IFI = incremental fit index. TLI = Tucker-Lewis index. CFI = Comparative fit index. RMSEA = Root mean squared error of approximation

Sources: developed by the authors.

In carrying out the analysis through SEM, multi-group path analysis was conducted. The sample was divided in two groups of male and female to ascertain each group's intention to recommend mHealth and determine appropriate strategies to encourage adoption of mHealth. Based on this, invariance analysis was used to determine significant difference. This was done by comparing the chi-square values and degree of freedom of the constrained model and the fully constrained model. The result shows that the fully constrained

model has a worsening significant overall model fit ($\chi^2 = 341.898$, $df = 166$, $p \leq 0.05$). A chi-square difference test was conducted to test the significance. Therefore, the null hypothesis of all paths being the same for the groups was rejected. Thus, the unconstrained path model proved to be better and adequate fit to the data. This is consistent with the approach adopted by Molina et al. (2013) in conducting multiple group analysis of the role of everyday discrimination on self-rated physical health among Latina/os in the United States. The results are further illustrated on table 3.

Table 3. Invariance analysis

| | Model chi-square | Df | Difference Chi-square | Difference df | p-value | Threshold for significant Chi-square difference | Invariant |
|--|---------------------|-----|--------------------------|------------------|----------|--|-----------|
| Unconstrained model | 309.465 | 160 | 32.433 | 6 | 0.000013 | 32.433 | No |
| Fully constrained model | 341.898 | 166 | | | | | |

Sources: developed by the authors.

Following the proposed hypotheses and the structural model, SEM with maximum likelihood method was used given that it is deemed efficient in determining the parameters of a model because of its consistency in estimation. Out of the six hypothesised relationships five hypotheses were significant with the path between effort expectancy and intention to recommend mHealth (H6: EE→ITR) not statistically significant for both groups (male and female). In analysing the group differences, the beta coefficient and the p-values were used. Firstly, the key paths in the structural model are H1, H4 and H6 while H2, H3 and H5 are correlations between the exogenous variables. Generally, in analysing the paths (H1, H4 and H6) the results show that the path SN→ITR (H1) indicates that subjective norm significantly predict the intention of end-users to recommend mHealth for both groups while perceived benefit (PB→ITR for H4) only predicts male users' intention to recommend mHealth and not for female users of mHealth. Thus, for H1, the result shows that the p-values for both male and female users of mHealth are statistically significant ($p \leq 0.001$) and a higher intention for male users to recommend mHealth to others than the female users of mHealth. This is consistent with studies of Zhang et al., (2014) from the aspect of male users of mHealth having a stronger adoption of mHealth than female users. For H4, the result indicates a significant stronger prediction of intention to recommend mHealth among male users though the result of female users was not statistically significant. In accessing the correlations between the exogenous variables for both groups, the results generally show stronger correlations among the exogenous variables for male users of mHealth than the female users. For H2, the relationship between subjective norm male users of mHealth innovation and their perceived benefit of the innovation is stronger while it is average in the case of female users. For H3, the estimated relationship between subjective norm of male users of mHealth innovation and effort expectancy is also higher among male users than female users of mHealth. The correlation for female users was also average. However, in respect to H5 which is the relationship between perceived benefit and effort expectancy, both groups indicate strong correlations though male users of mHealth innovation show higher correlations than female users. In assessing the predictive power of the model for the two groups, the R^2 for male users of mHealth indicate better explanation of the variance than the variance explanation accounted in the model for the female users. At .817, the predictors explained 81.7% of the variance for the male users of mHealth innovation while at .719, the predictors explained 71.9% of the variance for the female users of mHealth innovation. The results are further illustrated on table 4 and figure 4.

Table 4. Hypotheses tests

| Hypotheses | Relationship | Standard coefficient | | | Standard coefficient | | | Difference |
|----------------|--------------|----------------------|---------|-------------------------|----------------------|---------|-----------------------|-----------------|
| | | Male | P-value | T-value | Female | p-value | T-value | |
| H1 | SN→ITR | .603 | .000 | 7.527*** | .488 | .000 | 4.911*** | Yes |
| H2 | SN↔PB | .786 | | | .572 | | | Yes |
| H3 | SN→EE | .728 | | | .534 | | | Yes |
| H4 | PB→ITR | .214 | .023 | 2.274** | .035 | .805 | .246 ^(n/s) | Yes |
| H5 | PB↔EE | .817 | | | .779 | | | Yes |
| H6 | EE→ITR | -.005 | .941 | -0.073 ^(n/s) | .025 | .845 | .196 ^(n/s) | Not significant |
| R ² | ITR | .817 | | | .719 | | | Yes |

Note: $p \leq 0.001$; $p \leq 0.05$; n/s = Not significant

Sources: developed by the authors.

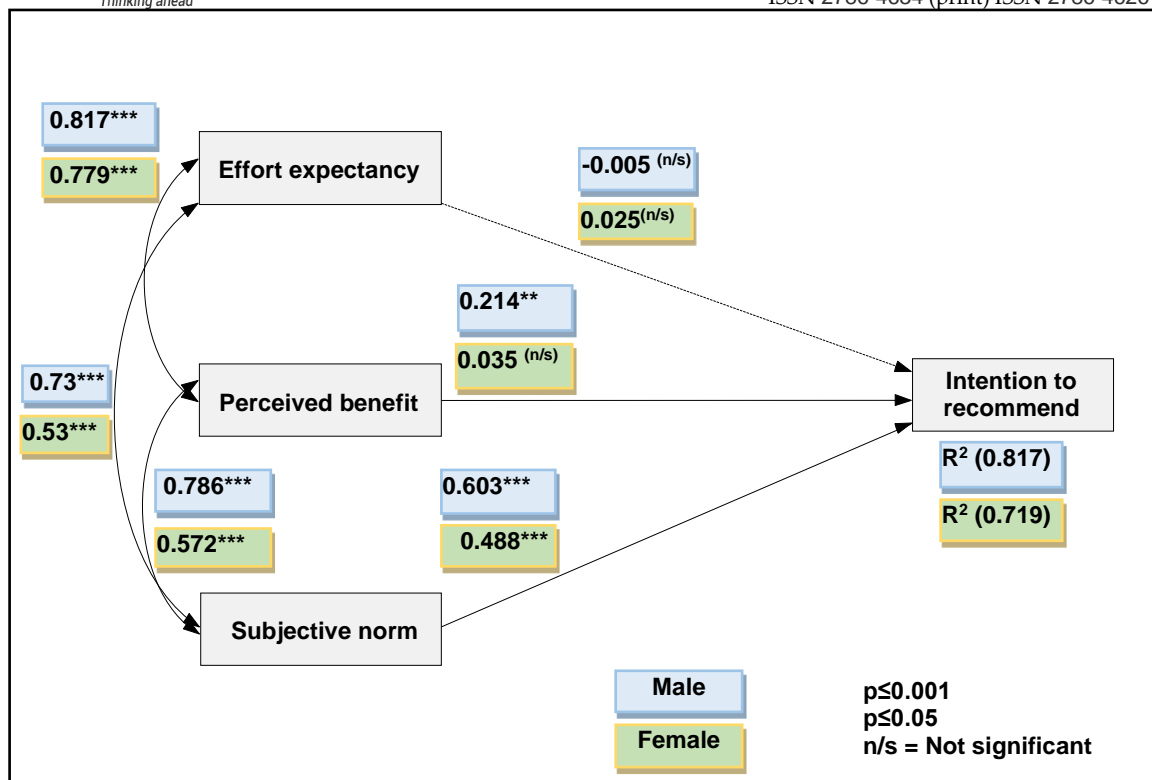


Figure 4. Structural model results

Sources: developed by the authors.

Conclusion: The study considered a multi-group analysis to end-users' intention to recommend mHealth innovation in Nigeria. Focus was specifically on mobicure, hudibia, safermom and mobile authentication service without excluding other mHealth innovations such as ones mHealth tools (InStrat COVID-19 health worker training app by Otu et al. (2021) that was used to support COVID-19 training and surveillance in Ogun State.

Firstly, the indications from the group model shows that the unconstrained model provided a better fitting model than that fully constrained model which indicated worsening fit model. The goodness of fit of the unconstrained model shows that all the values met the recommended thresholds thereby confirming the model to be adequate and acceptable. Further analysis generally shows that male users of mHealth innovation have stronger intention to recommend the innovation to others than the female users. This is not contrary to the results of adoption whereby men show higher tendency to adopt information systems and other mobile technologies than the female users (Zhang et al., 2014). This is often dependent on the men looking for functional values than women who are for relational values.

Secondly, from the multi-group analysis subjective norm is the most significant predictor for both groups. The essence of subjective norm is further highlighted by its dual functions of referents influence on others' belief and their motivation to adopt behaviour. The vital aspect of this result is that with experience from usage, they serve as referents in recommending the innovation to others while at the same time being influenced by other users to motivate them to recommend it others. With the result of the intention to recommend being higher among male users of mHealth innovation than female users, it indicates direction of marketing communication strategies. For instance in targeting male users, emphasis is to be placed on functionality of the mHealth innovation given that men are driven by functional values than women (Yang and Lee, 2010). This is vital given that the perceived benefit is indicated to be statistically significant in predicting male users' intention to recommend mHealth innovation. In other words, the more male users perceive any rationality in adopting the innovation, the chance of recommending the innovation to others increases. In this guise, the emphasis is placed on user friendliness, ease of navigation, ease of sign-in and sign-up, use of medical terminologies that are not complex to understand but importantly on its usefulness and awareness of its usefulness to connect to health practitioner, manage, control and improve health.

Thirdly, the relationships between the latent variables show that there is better correlation of the variables among male users of mHealth than female users. More importantly it indicates there is at least average relationship between the each of the proposed relationships across gender. This deepens the knowledge that

third party, rationality in use of the innovation, and the involvement of less effort are all vital in having a positive recommendation of mHealth innovation. The relations are at least moderate and positive thereby showing the direction of relationship when articulated in marketing communication strategies to mHealth innovation.

In conclusion there are gender differences in recommending the mHealth innovation to others because of social differences in perceiving mHealth innovation and the usefulness easily observed and perceived by them.

Following the findings of the study, recommendations are suggested. The significance of the subjective norm among the groups calls for adequate marketing communication strategies. This might involved the use of role models, celebrities, revered and followed politicians, top health practitioners and their medical body/association (Nigerian medical association), top influencers including social media influencers, and other health associations to spread the information about its usefulness and the benefits of having it on the mobile phones or smartphones. This is important given that it will encourage management of health and reduce the stress on the medical practitioners in Nigeria who were already overwhelmed with the number of patients to attend to (1:5000). In addition, with the communication strategy the emerged culture of Nigerians tendency to check their mobile phones and smartphones within 5 minutes to sleep or waking up will help draw their attention to their health before sleep and after waking up from sleep each day.

Moreover, in the process of the study, there are limitations which should guide generalisation of the findings. The study is purely a cross-sectional survey. It used a sample size that can be considered small which impliedly should guide application of the findings in a society.

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Фактори, що впливають на поведінку споживачів у частині рекомендації послуг у сфері mHealth: множинний груповий аналіз

Інновації мобільного здоров'я – це інновації в галузі охорони здоров'я, які набувають поширення в країнах, що розвиваються. Вплив COVID-19 і відтік мізків медичних працівників у Нігерії свідчать про зростання важливості інновацій. Незважаючи на значну кількість досліджень питання інновацій в сфері охорони здоров'я, досі бракує літератури про фактори, які впливають на споживачів у частині готовності рекомендувати інновації в сфері мобільного здоров'я. Особливо відчувається нестача досліджень цього питання залежно від фактору гендерної належності. Автори дослідили детермінанти поведінкових намірів кінцевих користувачів щодо

рекомендації інновацій mHealth шляхом аналізу кількох груп. Теорія аргументованих дій була модифікована за допомогою змінних із моделі переконань у здоров'ї та уніфікованої теорії прийняття та використання інновацій, щоб структурувати намір рекомендувати модель mHealth. Структурована анкета з адаптованими елементами з існуючих досліджень була оцінена за семибальною шкалою Лайкерта. Для збору даних була використана методика вибірки «сніжна куля». Загалом відповіді на запитання з 291 анкети були використані в аналізі, який проводився за допомогою IBM Statistics версії 23 і AMOS 23. У дослідженні використовувалися описова статистика, модель структурних рівнянь і інваріантний аналіз, щоб перевірити різницю між групами. Модель показала достатню відповідність, що показують набір індексів відповідності та коефіцієнт співдетермінації, що вказує на її високу прогностичну здатність. Аналіз SEM показує, що суб'єктивна норма є найважливішим фактором, який впливає на намір кінцевих користувачів рекомендувати інновації mHealth іншим. Загалом це вказує на те, що користувачі чоловічої статі мають більший намір рекомендувати інновації mHealth, ніж жінки, які користуються інноваціями mHealth. Результати аналізу також показують, що кореляції між екзогенними факторами є позитивними та принаймні помірними між статтю, що вказує на напрямок прийняття стратегій маркетингової комунікації для поглиблення обізнаності про інновацію та заохочення рекомендацій іншим. Автори рекомендують зосередитися на стратегіях маркетингових комунікацій, яка передбачає використання зразків для наслідування, впливових осіб, відомих особистостей, лікарів-практиків та інших референтів для заохочення обізнаності та наміру рекомендувати інновацію.

Ключові слова: mHealth, охорона здоров'я, орієнтована на споживача, ринок охорони здоров'я, поведінкові наміри, мобільні технології.