Re-Conceptualizing the Drivers Toward mHealth Adoption in a Least Developing Country: A Qualitative Exploration

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Abstract
Despite the recent proliferation of mHealth, the present research has not yet re-conceptualized on how mHealth can be used to promote healthcare over time. Researches have indicated that mHealth adoption and acceptance problems must be re-addressed to provide improved healthcare delivery. It is essential to explore the end-user centric factors for the complex implications process of mHealth before implementing it in practice. This research aims to re-conceptualize the contextual predictors of mHealth adoption in a least developing country. In-depth interviews with purposive and convenient sampling techniques were conducted with end-users (n=24) and healthcare professionals (n=15) in Bangladesh because qualitative research provides opportunities to explore end-user experiences and get detailed information about how they perceive user engagement in technology adoption. This study used grounded theory and thematic analysis to explain the state of mHealth adoption and to establish a theoretical basis for further investigations. Our findings indicate that traditional predictors for mHealth intention to use might not be enough. This study suggested four new predictors: “patients as a decision support unit,” “personal awareness building,” “health information exchange,” and “reward” to re-conceptualize the mHealth adoption. The study tried to clarify mHealth drivers from both end-users’ and healthcare professionals’ perspectives, which offered an alternative avenue that could provide the foundation for accepting mHealth widely.

Keywords
mHealth, chronic care, re-conceptualization, drivers, qualitative study, least developing country

Introduction
A fundamental shift in advanced healthcare technology is required to achieve sustainable health care systems globally. Mobile health (mHealth) technology is considered one of the most powerful self-care tools in the public health domain (Rehman et al., 2017). Recent studies reveal that mHealth diffusion is becoming the norm in healthcare delivery. At present, 83% of doctors use smart devices and medical apps to remotely monitor their patients (Inupakutika et al., 2020). The World Health Organization (WHO) defines mobile health as the use of mobile and wireless technology to achieve healthcare goals (Obro et al., 2021; WHO, 2011). The forms of mHealth use include text messaging, image transferring, voice and video chat, blogging, and, more recently, mobile apps (Godinho et al., 2020). mHealth plays a crucial role in incidence detection, patient information collection, and medical care provision (Varshney, 2014a). These could also be used to provide task shifting, instant access, monitor, or deliver clinical and/or relevant information to healthcare providers or contact other individuals. More precisely, the mHealth application serves as a crucial intermediary between a healthcare provider and end-users (P2U) and end-user to end-user (U2U) and vice-versa. mHealth technology may enhance the patient’s self-care management, improve health care quality, and provide better patient care systems (Burner et al., 2018). Over the past decade, numerous innovative scientific and corporate research has been conducted to enhance mHealth technology (Miah et al., 2017) and has primarily focused on the design, development, and implementation of specific issues of interest, especially in high-income countries (Amoakoh-Coleman et al., 2016). However, the utilization of mHealth varies by specific setting due to differences in cognitive and behavioral aspects. Numerous studies have examined...
the drawbacks of utilizing mHealth apps, including technology, security, and privacy issues. The end-user-centric determination of critical success factors for mHealth systems has only been investigated seldom in the literature. Besides, most of the adoption and acceptance of mHealth studies employed the traditional information systems (IS) framework, which has numerous shortcomings (i.e., contradictory evidence gap, low prediction capability of the traditional IS model, etc.). Previous mHealth research mainly employed traditional IS frameworks, which are not fully adapted to capture the reality of mHealth adoption and use by end-users (Wild et al., 2018), particularly those in a limited-resource setting, and there is a need to deepen understanding of the using experience. Alongside these, re-conceptualizing the drivers toward mHealth adoption will need to be explored in health information systems research from the end-user’s perspective.

Healthcare end-users prefer to use digital technologies like mHealth apps for self-care management to enhance quality healthcare (Gamble, 2020). In response to these evolving smart technologies, academic and market researchers have re-examined how end-user’s intention to use (ITU) of traditional healthcare systems is changing (Yan et al., 2021). Recent inquiries have investigated the factors affecting behavioral intentions, such as how significantly mHealth ITU impacts human behavior (Balapour et al., 2019). Findings reveal that determining the most critical factors that influence end-user’s ITU of this technology remain unresolved. As the healthcare industry has seen a growing trend, researchers argue for further study to uncover how health technologies are being used from end-user’s standpoints.

The number of mHealth research increased significantly between 2011 and 2020 (Tajudeen et al., 2022). Several reports have shown that mobile devices such as smartphones and tablets in the provision of healthcare services are becoming more common practice (Sezgin et al., 2017). Researches have indicated that mHealth adoption and acceptance problems must be re-addressed to provide improved healthcare delivery (Klasnja & Hekler, 2018; Loosman, 2020). It is essential to rethink end-users participation from the beginning of the acceptance process to correctly assess their existing knowledge, experiences, and thoughts about mHealth technologies (Schnall et al., 2016). The behavior of people who use mHealth may vary depending on their geographical location, cultural background, economic stability, etc. These findings indicate the necessity for additional research into the end-user’s aspect and preferences to discover which features and delivery mechanisms are most beneficial. In this regard, qualitative research provides opportunities to explore end-user’s experiences and get detailed information about how they perceive user engagement via in-depth interviews (Song et al., 2021). Therefore, the end-user’s usage of mHealth applications and the behavioral approach’s mechanism to utilize mHealth continue to be debated and require more research (Glomsås et al., 2021; Tajudeen et al., 2022). Varshney (2014b), however, indicated that mHealth is affected by a variety of challenges in developing countries, including infrastructure shortage, end-user’s education, conventional treatment therapies, cultural, and social resistance. Thus, we formulated the following research question that is supposed to be addressed: What factors are crucial to rethinking the IS framework when re-designing mHealth applications from end-user’s perspective to better-utilizing of mHealth? In line with the research question, therefore, this study aims to perform a qualitative investigation on re-conceptualizing the drivers of mHealth adoption in a least developing country.

Bangladesh, a least developing country (UNCTAD, 2021), does not have a relatively long history of mHealth. Bangladesh is in the middle stage of establishing a mHealth system derived from the past few years of experience. The journey toward digital health in Bangladesh began in 1998 with the establishment of a non-profit organization called Swiften Charitable (Ahmed et al., 2014). Bangladesh government established its first eHealth effort in the same year. Several studies related to mHealth, such as fundamental healthcare delivery, patient monitoring, routine data collection, health management information systems (HMIS), and health awareness, have been undertaken in Bangladesh. Bangladesh has a population of approximately 165 million (Morrison et al., 2021). As of the end of January 2021, there are 171.854 million mobile phone subscribers (BTRC, 2021b), with mobile phones in the hands of nearly every household (Morrison et al., 2021; Yasmin et al., 2020). By the end of July 2021, there were 123.74 million Internet users, of whom 113.69 million were mobile internet users (BTRC, 2021a). This broad array of connectivity provides the potential to contact more individuals via mobile phone services, allowing for more customized health care. Although mHealth facilities are becoming popular, they have not yet achieved their maximum potential in Bangladesh. Several mHealth adoption studies have been carried out from a variety of perspectives in Bangladesh. Ahmed et al. (2014) investigated whether, in mHealth, the private sector increased more than the public sector. Khatun et al. (2014) reported that men, young people, highly educated persons, and members of wealthy families are more aware of the potential of mHealth. Another research conducted by Khatun et al. (2015) used a conceptual framework to evaluate the readiness of mHealth adoption. Several mHealth adoption studies have been carried out from a variety of perspectives in Bangladesh. For example, Hossain (2016) develops an effective mHealth paradigm from the user’s point of view; Hoque (2016) and Alam, Hu, Kaium, et al. (2020) investigate the influential factors of mHealth; Hoque and Sorwar (2017), Kaium et al. (2020), and Moudud-Ul-Huq et al. (2021) explored the factors influencing mHealth adoption by the elderly. A cross-cultural (Bangladesh and China) study on mHealth investigated the relative importance of several factors influencing the intention and actual use of mHealth (Alam, Hu, Hoque, et al., 2020). However, while the COVID-19 outbreak was in full swing, Barua and Barua...
(2021) investigated the acceptance and usage behavior of mHealth care services. Beyond the behavioral study, Miah et al. (2017) and Rahman et al. (2021) have designed the mHealth prototype and evaluated it using a mixed-method approach. However, all the prior studies employed the conventional IS framework rather than identifying the contemporary aspects and expectations of end-users adopting mHealth. Thus, there is a need to re-investigate the mHealth adoption factors in Bangladesh.

In addition, chronic disease diagnosis has grown over the past few years and is rapidly creating a significant global burden on healthcare service systems (Foley et al., 2020). Chronic illness refers to long-standing diseases triggered by the cumulative effects of genetic, physiological, environmental, and behavioral factors (WHO, 2018). The WHO (2020) study reported that approximately 41 million people are killed each year due to different forms of chronic illness, equivalent to 71% of global deaths. This prevalence is one of the top 10 leading causes of adult mortality and accounts for 80% of premature non-communicable disease (NCD) deaths (Lin et al., 2020). Resource-poor developing countries like Bangladesh face the most significant challenge in this aspect. Bangladesh holds the second-ranking in the southeast region according to the number of diabetes patients (8,372,200) (IDF, 2020). There are estimates of 59% of 886,000 deaths per year (UNCRC, 2020), and 41.92% of people have a chronic illness with a minimum of one side impairment due to chronic disease. A critical literature gap was identified regarding re-conceptualizing end-user’s perspective predictors for chronic care that influences mHealth adoption (Loosman, 2020; Modzelewski et al., 2018; Yuan, 2016). But the understanding of the drivers of the chronic care system for primary care is little explored. Therefore, mHealth approaches have to be re-conceptualized to improve health care among chronic patients.

In summary, the objectives of this qualitative study are as follows: (a) exploring the facilitators and barriers toward self-management behavior among end-users (chronic patients), and (b) re-conceptualizing the leading critical drivers influencing the mHealth adoption framework. We conducted this study among chronic patients in urban areas in Bangladesh. This qualitative study will contribute to the design of the health care intervention currently under development by analyzing the input provided by patients and health workers. This research offers theoretical and practical contributions to the existing mHealth literature by rethinking mHealth facilities from the standpoint of the end-users in the least developing country. The particular scientific contributions drawn from this research are outlined in the following:

First, we propose a new perspective that organizes the understanding of mHealth for the healthcare industry in a structured manner. Unlike prior studies, which mainly focused on the mHealth literature available in informal settings, our studies have demonstrated the importance of entirely re-conceptualizing mHealth services by looking at them from the mHealth literature and from the perspective of mHealth end-users over time. Thus, the identified factors of mHealth draw attention to aspects of end-users that would be most pertinent to healthcare settings. In practice, for effective planning, designing, developing, and implementing the particular tasks in mHealth, task shifting from the traditional to the concurrent paradigm is required. Moreover, this study can uncover the user-centric factors for concurrent mHealth use, which opens up new avenues for future mHealth research and assists policymakers and healthcare professionals in developing better policies and applications. This work aims to create a designed framework that allows researchers, clinicians, and industry partners to build solutions that promote mHealth.

**Methods**

To re-conceptualize the current state of mHealth for enhancing quality healthcare, a grounded theory (Strauss & Corbin, 1997) methodological approach, along with thematic analysis (Kiger & Varpio, 2020), has been used in this study. The primary objective was to use grounded theory to understand the current context and develop the theoretical foundation for further investigation into mHealth adoption for end-users. Grounded theory is helpful for the systematic collection of data to construct middle-range concepts about people’s behavior and experiences in health and social science (Belgrave & Seide, 2019). The thematic analysis also offers versatility in data interpretation and makes approaching large data sets more straightforward by grouping them into broad topics. This study followed the guidelines of the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Supplemental Document 1) (Tong et al., 2007). We obtained ethical approval (No: CMIN2020B003) for this study from the Center for Modern Information Management, Huazhong University of Science and Technology, Wuhan, China. The Nvivo 12 (QSR International) package program supported this study by coding and organizing data obtained through quotations and participants’ observations.

**Research Design**

In this study, a comprehensive, in-depth interview (IDI) technique was used because of its capabilities to capture individuals’ attitudes, perceptions, acceptability, and experience (Chang et al., 2013). Healthcare researchers generally use individual IDIs to co-create awareness with interviewees by rebuilding their perception of specific events and experiences related to health and health care delivery (DiCicco-Bloom & Crabtree, 2006). This inductive approach was used to gain a theoretical interpretation by analyzing how end-users conceptualized their motives.

The field team collected information from individuals who intended to practice self-care management tools. The IDI is usually characterized as an individual’s open
interview, ranging from 30 minutes to several hours. About 5 to 10 more specific questions are to be investigated about a particular subject or issue (DiCicco-Bloom & Crabtree, 2006). This approach allows the study of the data and the recognition of the principles that clarify the actions of users. Thus, this study has been performed in a single discussion setting, in which patients and healthcare practitioners have been interviewed with knowledge of self-care. Details of the issues discussed are presented in Supplemental Document 2.

Research Team, Fieldwork, and Reflexivity

The interview process was carried out directly by the lead researcher with another research assistant. Two independent freelance interviewers, both graduated in management information systems (MIS) with over 3-year of field research experience, assisted the research team. The field team regularly visits diabetes care clinics, the Bangladesh Diabetes Association (regional branch), the heart foundation, private clinics, and physical activity centers. The interviewer and respondents had no prior relationship. The interaction started between the interviewer and participants during the data collection. Thus, there was no possibility of arising bias. Before beginning the interview, all participants were informed of the study’s objective, and we confirmed their written consent by using a consent form to participate in the interview. We did everything possible to ensure that participants shared their experiences in a comfortable and open environment. In some instances, we attempted to accelerate and clarify unfamiliar words or phrases during the interview so that participants could understand clearly and respond better. A professional transcriptionist took part in transforming the response from the local language into English.

Sample Selection and Setting of the Context

This qualitative study applied both purposive and convenience sampling techniques to select end-users in urban areas in Bangladesh. We interviewed purposively urban population and educated people rather than mHealth non-users because of the possibility of receiving more in-depth understanding and knowledge in a specific context. Interviewing mHealth non-users employing other sampling techniques might mislead our objectives and might result in insufficient vital issues. Non-users will likely not grasp some critical problems, such as security, privacy, integrity, reliability, acceptability, accessibility, and so on, while constructing the IS conceptual framework. Another critical inclusion criterion is that participants usually use any form of mHealth service (i.e., doctor consultation, health information searching, health data tracking and monitoring, etc.) within the last 12 months. Healthcare professionals were also included based on their service experience and mHealth usage behavior. The sample size was not pre-determined, and data were collected from the above categories using a convenient sampling technique over a 1-month period (October 16, 2020–November 14, 2020). Due to the shortage of available funding opportunities and the respondents’ and healthcare professionals’ scheduling constraints, we applied a convenient sampling technique. We discontinued data collection when we reached the point of data saturation, as recommended by Guest et al. (2006). A Successful 39 in-depth interviews were completed with chronic patients (n = 24) and health professionals (n = 15) who had practiced mHealth applications. In particular, the participants’ ages ranged from 25 to 79 years, whether they had at least 5 years of experience with at least one type of chronic illness (or a minimum of 3 years of experience for healthcare professionals) and whether they came from diverse professional backgrounds.

One of the significant reasons for interviewing chronic patients is that this group of people primarily uses mHealth for better self-care management (Nabovati et al., 2020). Our interviews have included doctors, nurses, and healthcare technologists (including radiologic technologists, ultrasound technicians, etc.) because they also play a significant role in promoting mHealth. Table 1 provides a brief overview of the participants’ characteristics. The interview was recorded using a note-taking technique, and the notes were afterward examined in order to do additional analysis. We collected informants from both sexes, different age groups, and professional backgrounds to synthesize the most considerable amount of information possible. This maximized the number of different concepts and their diversity in terms of their properties and dimensions. Each opinion piece began with an open-ended question about their background up to the point where they started using the mHealth application. Using the real-life stories of participants helped us understand the feelings, attitudes, and contexts that affected their decisions. All participants expressing interest and being able to give written informed consent could participate in the discussion. No person was excluded due to race, religion, health status, or gender.

Results and Discussion

Demographic Information

The demographic information about the participants is summarized in Table 1. In this study, males surpassed females by a margin of 53.8% to 46.2%. The majority age group was between 31 and 40 years old (41%), followed by 41 to 50 years old (30.8%). The combined responses of 80% of the participants indicate that they are highly educated, indicating that they are aware of the technology. The majority of respondents (37/39) were married in this study. In terms of occupation, we found 17.9% of being business people, 15.4% being teachers, and 12.8% being housewives. Medical practitioners, on the other hand, account for almost two-thirds (73.3%). Overall, 87.5% of those who took part in this study had at least 8 years of experience affected by any form of
| Table 1. Demographic Characteristics of Patients and Healthcare Professionals. |
|---------------------------------------------------------------|
| **Participants n (%)** | **Healthcare professional n (%)** | **Total n (%)** |
| **Gender** | | | |
| Male | 15 (62.5) | 6 (40) | 21 (53.8) |
| Female | 9 (37.5) | 9 (60) | 18 (46.2) |
| **Age (years)** | | | |
| 20–30 | — | 4 (26.7) | 4 (10.3) |
| 31–40 | 11 (45.8) | 5 (33.3) | 16 (41) |
| 41–50 | 6 (25) | 6 (40) | 12 (30.8) |
| 51–60 | 4 (16.7) | — | 4 (10.3) |
| 60+ | 3 (12.5) | — | 3 (7.7) |
| **Education** | | | |
| Higher secondary | 2 (8.3) | — | 2 (5.1) |
| Graduate | 7 (29.2) | 8 (53.3) | 15 (38.5) |
| Post-graduate | 13 (54.2) | 3 (20) | 16 (41) |
| Nursing | — | 3 (20) | 3 (7.7) |
| Medical technology | — | 1 (6.7) | 1 (2.6) |
| M.Phil. | 1 (4.2) | — | 1 (2.6) |
| Ph.D. | 1 (4.2) | — | 1 (2.6) |
| **Marital status** | | | |
| Single | — | 1 (6.7) | 1 (2.6) |
| Married | 24 (100) | 13 (86.7) | 37 (94.9) |
| Widow | — | — (0) | (0) |
| Divorce | — | — | (0) |
| Separate | — | 1 (6.7) | 1 (2.6) |
| **Occupation** | | | |
| Teacher | 6 (25) | — | 6 (15.4) |
| Business | 7 (29.2) | — | 7 (17.9) |
| Housewife | 5 (20.8) | — | 5 (12.8) |
| Government Officer | 2 (803) | — | 2 (5.1) |
| Retired | 4 (16.7) | — | 4 (10.3) |
| Nurse | — | 3 (20) | 3 (7.7) |
| Medical technologies | — | 1 (6.7) | 1 (2.6) |
| Specialist medical practitioner | — | 11 (73.3) | 11 (28.2) |
| **Duration since diagnosis (duration of experience of healthcare providers)** | | | |
| 5 | — | 4 (26.7) | 4 (10.3) |
| 6 | 2 (8.3) | 3 (20) | 5 (12.8) |
| 7 | 1 (4.2) | 3 (20) | 4 (10.3) |
| 8 | 13 (54.2) | 1 (6.7) | 14 (35.9) |
| 9 | 3 (12.5) | 2 (13.3) | 5 (12.8) |
| ≥10 | 5 (20.8) | 2 (13.3) | 7 (17.9) |
| **Income (BDT)/USD** | | | |
| ≤20,000 ($≤235) | 5 (20.8) | 1 (6.67) | 6 (15.4) |
| 20,001–30,000 ($236–$352) | 9 (37.5) | 2 (13.3) | 11 (28.2) |
| 30,001–40,000 ($353–$470) | 2 (8.3) | 1 (6.67) | 3 (7.7) |
| 40,001–50,000 ($471–$588) | 1 (4.2) | — | 1 (2.6) |
| >50,000 ($>588) | 7 (29.2) | 11 (73.3) | 18 (46.2) |
| **Mobile device preference** | | | |
| Smartphone | 23 (95.8) | 12 (80) | 35 (89.7) |
| Tablet PC | — | 3 (20) | 3 (7.7) |
| Traditional phone | 1 (4.2) | — | 1 (2.6) |
| **Mobile device use experience (years)** | | | |
| ≤1 | — | — | (0) |
| 1–3 | — | — | (0) |

(continued)
Table 2. Distribution of Themes and Sub-Themes.

| Theme/supported theories | Sub-theme |
|--------------------------|----------|
| Patients as a decision support unit (IDI findings) | Patients as self-decision-maker |
| Social influence by culture and family support (TRA: Fishbein & Ajzen, 1975; UTAUT 2: Venkatesh et al., 2012) | Language barrier and traditional use of mobile |
| | Friends and family support |
| | Self-perception |
| Price value (UTAUT 2: Venkatesh et al., 2012) | Smart device and internet cost |
| Perceived enjoyment (MM: Davis et al., 1992) | Enjoy using the technology |
| | Autonomy |
| | Curiosity |
| Personal awareness building (IDI findings) | Self-awareness management |
| Facilitating condition (UTAUT 2: Venkatesh et al., 2012) | Resource availability |
| | Compatible with other technology |
| | Primacy care training |
| | Easy use of technology |
| | Useful for self-care |
| | Information exchange |
| Perceived usefulness (TAM: Davis, 1989) | Personal information exchange |
| Intention to exchange health information (IDI findings) | Patients’ experience of technology usage |
| Patients’ effort expectancy (UTAUT 2: Venkatesh et al., 2012) | Intractability between/or among users and technology |
| Habit (UTAUT 2: Venkatesh et al., 2012) | Patient adherence to the mHealth apps |
| Perceived barriers (HBM: Becker, 1974) | Anxiety of privacy |
| | Barrier to action |
| Reward (IDI findings) | Self-reward |

Table 1. (continued)

| Participant n (%) | Healthcare professional n (%) | Total n (%) |
|-------------------|-------------------------------|-------------|
| 4–6               | 3 (20)                        | 3 (7.7)     |
| 7–10              | 1 (6.7)                       | 1 (2.6)     |
| ≥10               | 24 (100)                      | 11 (73.3)   | 35 (89.7) |

Perceived competency of mobile device use:
- Excellent: 10 (41.7)
- Good: 11 (45.8)
- Moderate: 3 (12.5)
- Bad: —

How frequently do you use mHealth apps:
- Once a week: 1 (4.2)
- Once in a month: 12 (50)
- Once in quarterly: 7 (29.2)
- Once half-yearly: —
- Once in last 12 months: —
- When needed: 4 (16.7)

Type of your institute:
- Public/Government: 14 (58.3)
- Private: 5 (20.8)
- Training and research: —
- Community/urban clinic: —
- No workplace: 5 (20.8)

Note. Patients participants: n = 24, healthcare professional: n = 15.
*1 USD = 85 BDT (approximately).
chronic illness. When monthly income is considered, the majority of healthcare professionals (73.3%) earn more than 50,000 BDT (about 888 USD), whereas the majority of patients (58.3%) earn less than 30,000 BDT (approximately 352 USD). A smartphone was used by the vast majority of participants (89.7%), followed by a tablet PC (7.7%), with just one patient (an elderly person) using a traditional phone. All patients (100%) have used a mobile device for more than 10 years, whereas overall, (89.7%) of respondents have used a mobile device for more than 10 years. The majority of individuals (92.3%) are competent at using a mobile device. Approximately 72% of respondents use mHealth at least once a month, with 10.3% using it occasionally. However, a significant proportion of the interviews were conducted in public organizations (51.3%), followed by private organizations (30.8%), and 12.8% of the interviews were conducted in open places.

**Thematic Analysis**

This study found that the drivers of acceptance of mHealth in patients living with chronic disease were 12 themes and 23 sub-themes. The identified concepts were labeled and classified using an open, axial, and selective coding process. The six most popular thematic analysis steps, including familiarization, coding, generating themes, reviewing themes, defining and naming themes, and writing up, have been performed among the different approaches (Braun & Clarke, 2006). This study also identified four new patient-centric themes of intention to practice mHealth: patients as a decision support unit, personal awareness building, health information exchange, and reward. Eight other themes are identical to the previous theories. Table 2 provides a summary of the themes and sub-themes.

**Patients as a decision support unit.** Global healthcare systems face the challenge of supporting people with chronic diseases, particularly the elderly and people with hard-to-reach areas. Patient empowerment is an advanced health and social care approach. The term “empowering patients” means engaging explicitly in the self-decision process from the viewpoint of self-advocacy. The literature revealed the need for more awareness and patient’s decision support so that patients and practitioners have the opportunity of providing a shared decision-making method (Zheng et al., 2020). The active participation of patients is a mechanism in which patients recognize their responsibilities and comply with healthcare professionals’ particular tasks. While some research has been focused on the term “capacity building,” in the sense of sustainable change, it must be emphasized that capacity building focuses on the individual development of modern medication issues. Young adults are potential groups to improve personal sensibilities and consider them for the mHealth services decision support unit. This study found:

> “I can observe and compare the Internet-based knowledge to my underlying health findings during any emergency without a physician’s help, and I can determine what to do? Based on the historical treatment.” [CP2(33y), CP17(37y)]

Simultaneously, physicians think:

> “mHealth based medical information enhances patients’ self-empowerment.” [HP1 (27y) HP4 (37y) HP6 (35y), HP7 (42y)].

Besides, other chronic patients aged 31 to 50 years [CP5 (33 years), CP13 (41 years), CP16 (48 years)], and living in hard-to-reach areas showed self-efficacy.

> “I live in a hard-to-reach area. I have a diabetes testing tool and a digital blood pressure machine. I can measure my blood pressure, and diabetes, and pulse rate and compare the results in my mobile apps with the previous health record, eliminating travel to healthcare facilities.”

It is worth noting from Table 1, none of those chronic patients is less educated. Findings suggest that, if the elderly group of patients between 31 and 50 are well trained, they may at least be able to provide primary care for their surroundings, especially in hard-to-reach areas. This approach could minimize preliminary care expenses for older adults, that is, hospital visits, medical examination costs, and travel issues.

**Social influence by culture and family support.** Social influence indicates that users perceive motivations for others important to them through social pressure. The current study reveals that user group experience would help improve understanding and use of new technology (Alalwan et al., 2016). User groups may share their perspectives and provide opinions in identical situations with similar chronic prevalence. According to Reading et al. (2019), several mHealth community networks, such as online forums, can influence online users to use or not use a new system. There are, however, some drawbacks, like language barriers among the elderly and people with low education. These disadvantages affect particularly women, who are less educated and the elderly.

> “Many mHealth applications do not have national language support. The English language makes reading challenging for the hard-to-reach community, such as lower educated people.” [CP12 (53y)].

> “Elderly people, specifically women, do not prefer smartphones. They prefer voice communication rather than text or any other form of mobile communication.” [CP19 (61y)].

Although very few mHealth apps have been developed in Bengali (Shermin et al., 2017), it is necessary to have both English and Bengali apps. Lower literacy rates and language
barriers in Bangladesh are significant drawbacks to health app adoption (Zaman & Mamun, 2017). Moreover, according to [CP16(48 years)]

“I understand nothing else about mHealth. My grandson helps me in an emergency to find medical information. If I need more details, another adult family member can help me communicate and chat with doctors. In critical circumstances, I felt more relaxed with my physicians.”

In this case, the doctor’s physical appearance is significant in emergencies, but they feel the importance of family member support during routine medication periods. Seeking medical information via the internet and online communication such as video chat with doctors is difficult without others’ assistance. Simultaneously, some patients are oblivious to regular medication, family and technological support (reminder systems) cannot be ignored for real-time monitoring.

As a cardio patient, I require routine drugs with family assistance and communication technologies for regular medication. And in continuous monitoring assistance, I cannot avoid the contribution of our health care provider for their constant follow-up support via mobile apps [CP 9(63y)].

This will improve patients’ communication skills and positively influence family caregivers by offering a forum for keeping in touch with families, friends, and professionals. Furthermore, young health professionals tend to work more online with patients’ treatment. They enjoy trying new prototypes. They can operate any new prototype, such as newly launched mHealth apps due to rapidly using the technology. Last but not least, young doctors often tend to use the aid of technology to communicate with patients. According to [HP3 (29 years)]

“The use of mHealth apps suits my way of dealing with patients.”

And young patients are also interested in mHealth as this study found that:

“I would like to explore emerging technologies.” [CP7 (34y)]

“I could perform the work with mHealth applications If I had never used such a device before, like mHealth.” [CP8 (37y)]

While prototype designers do not really know patients’ needs, the healthcare providers would align their IT teams with patients’ needs to enhance the delivery of mHealth services. Besides, medical social media access provides a support and knowledge sharing facility (through a closed chronic care community) for other patients receiving or assisting in consultation.

Price and economic value. While both patients and healthcare practitioners are increasingly involved in mHealth, there is little evidence of how mobile apps bring price value to patient care. The price value initially implemented in the UTAUT 2 models (Venkatesh et al., 2012) decides cognitive negotiations between the end-users’ perceived benefits and their financial costs. Patients and medical professionals have identified cost as a barrier to mHealth adoption. As in previous research, the cost of smartphones and the internet has also been one of the significant obstacles to health care use (Zhou, Bao, et al., 2019). However, internet cost in Bangladesh is not affordable to all socioeconomic groups (Nahar et al., 2020). According to [HP4 (37 years), HP5 (42 years)]:

“Although smartphone costs for branded phones are high, China’s mobile availability overcomes such barriers.”

And [CP13 (41 years), CP18 (35 years)] described that,

“The cost of mobile internet in Bangladesh is still high. Although WiFi networks are available in urban areas, it is only possible to use mobile internet in rural areas.”

Moreover, it is worth noting from an economic perspective, that the design, development, marketing, and implementation costs of mHealth are not quick and affordable to all organizations. Both HPs and CPs think:

“Design, development, and implementation of mHealth apps, including developers, marketing, and intervention costs, are costly.” [HP12 (43y)]

“mHealth is very cost-effective in minimizing patient re-consultation and readmission expenses, traveling costs, unnecessary diagnostic tests, and physicians’ consulting costs.” [HP13 (47y), HP8 (42y)].

“While the face-to-face consultation fee is a minimum of BDT 500 in most cases, I can consult with a specialist through mHealth, expending BDT 50-100, which saves my money, time, and traveling hassle.” [CP23 (54y)]

Perceived enjoyment using the technology. Perceived enjoyment as a motivating tool, an approach is considered fun in itself, except for its practical benefit. This concept was primarily derived from two theories: the motivational model (Davis et al., 1992) and UTAUT 2 (Venkatesh et al., 2012) that represented enjoyment as intrinsic motivation and significantly encouraged the use of new technology. Individuals’ experiences and the impression of using emerging technologies effectively increase users’ interests and enhance positive attitudes toward technological advancements, which generate new technology. In mHealth adoption, enjoyment was investigated through qualitative exploration after using a few mHealth games. Users played online games to get a positive experience and encouraged patients to use mHealth programs widely. A young adult patient said:
“I am delighted to use mHealth. Some games are entertaining for me.” [CP21 (39y)].

Simultaneously, self-handling management focuses on chronic patients’ autonomy and trust, without the requirement of involving a third-party caregiver in delivering the mHealth service that accounts for self-satisfaction. According to the [HP2 (26 years), HP7 (29 years), HP9 (36 years)]

“I have a preference to handle my healthcare because I used to mHealth services.”

Autonomy is defined as one of the fundamental principles in healthcare ethics and human rights, allowing chronic patients to choose self-care without influencing others, as the patient’s opinion is following

“mHealth Decision support tools help me with self-care management, and I became autonomous in choosing healthcare service providers.” [CP22 (32y)]

However, this study shows that young people are the leading autonomous community to seek health care behavior, given their need to establish a clear understanding of perceived autonomy in routine medication. They would like to see themselves as self-employed to select the medical professionals and providers. Advanced innovation would most likely have been used by people who have a deep sense of curiosity. Curiosity inspires and encourages people to understand what motivates mysterious or fascinating problems (Reeve, 1989). The distinctive features of a modern innovation will enhance users’ attention and make their engagement with mHealth services fun. An intense curiosity regarding new functionalities of mHealth means a great deal of perceived enjoyment (Liu et al., 2019). Intending to design a user-centric primary healthcare system, young people are curious about the appearance of esthetic themes, user interfaces, colors, fonts, and more. According to [HP1 (27 years—technologist), HP15 (36 years)].

“I am curious about different forms of medical applications. I am delighted about the theme, user interface, colour, font, application vocabulary, etc. I intend to design a user-friendly primary healthcare system.”

Personal awareness building. Awareness building regarding chronic disease is recognized as crucial for monitoring and reducing social burden. Personal awareness building on knowledge and attitudes in risk and communication management plays an important role. Social interaction is a commonly used cytoprotective mechanism that reveals that the risk evaluation depends on the individual’s interaction level (Ezeah et al., 2020). A person’s stronger communication skills are the better route to interaction by routine medication. A substantial number of studies argue that public awareness of health and existing circumstances should be increased (Schillinger et al., 2020). Hence more users participate in social media to access health information, the greater the likelihood of reforming or improving their attitudes. Patients marginally adjust their diet and drug thoughts after spending sufficient time on their health records for several weeks. The following participates [CP6 (41 years), CP11 (46 years), CP14 (57 years)] described as

“I personally modify my diet plan and meditate my mind by reviewing my health record for several weeks. I check my outcome. I spend enough time clarifying the importance of the findings.”

Moreover, [CP11 (46 years)] said

“I could make the right choice to achieve my self-control objectives that help my healthcare staff create a better decision.”

Facilitating conditions compared to other technology. Prior literature outlined the facilitating conditions as a tool of promoting patients’ confidence that the structural, environmental, and process resources were available to allow their efficient mHealth usage. In the context of mHealth adoption, facilitating conditions signify both tangible and intangible resources like patients’ expertise, knowledge, operational infrastructure, and training. Previous researches have shown that intensify the facilitating condition has strengthened users’ behavioral intentions. This qualitative study has identified different indicators that could quantify conditions, including the availability of resources, competence with other technologies, organizational training, and so on. Nowadays, patients have the necessary hardware, software, and relevant knowledge of using mHealth decision tools and express their preference for the consultation procedure. Participate [CP3 (64 years)] said

“I have all the devices and instruments required to use mHealth. I prefer voice chat more, but consultation reports delivered as the text message is helpful.”

And “Although digital health services are available in various forms, mHealth is easy to use and simple. Once installed and sign-in, do not have any more trouble.” [CP1 (38y)].

However, it is necessary to motivate them to provide primary care training. Recently, many NGOs have provided training on the appropriate and efficient usage of mHealth. Evidence shows the following

“An NGO has taught us how to use mHealth, which explains how powerful mHealth is? How does mHealth deliver the patients’ centric healthcare service?”

“I attained an education program for primary healthcare to encourage self-care management and health well-being.” [CP15 (36y)].
Application developers and project managers should look at issues such as the availability of the right infrastructure to incorporate such systems and public awareness.

**Perceived usefulness for self-care.** While mHealth is promising, it is still an open question of estimating routine medical care in chronic conditions patients. Our results found that patients’ perceived usefulness would maximize task efficiency by considering implementing a particular technological tool that is critical in resolving adversity or challenges in daily life. An optimistic view of a more comfortable use of technology can be beneficial when users believe it is easier for physicians and healthcare centers’ physical visits. In an emergency, that is, COVID-19 lockdown, remote access to medical care can less optimally facilitate the patient’s health-seeking behaviors. Recently, young people have been eager to use mHealth because of its convenient access to wearable technology and system reliability. mHealth might save time to focus on some other tasks, which increases their attitude toward technology use.

“For my follow-up treatment, I consulted a physician. We cannot access the medical centers because of the COVID-19 lockdown. However, mHealth removes the barriers. Remote access to healthcare training has facilitated medical services learning and expanding their skills [CP24 (43y)].”

In parallel, older or young adults found mHealth as part of their lives because they felt a transformative unit for programs to use. The literary evidence suggests that new technology is most likely to impact self-effectiveness and self-innovations. This study found the following:

“I can monitor my medical record with mHealth, which involves step counting, blood pressure calculation, heart bit measurement, etc.” [CP5 (33y)]

“mHealth can get tracking my health status from the office, from the laboratory, and become a fundamental part of my life.” [CP9 (63y)]

Automated anomaly detection in routine treatment can bridge patients and health caregivers if they choose to share information about mHealth systems. Thus, family members may become alternate health caregivers. Data security issues arise here. According to the study:

“mHealth app holds my exercise record, dietary behaviour and sends warnings when there is an anomaly. It becomes my personal physician. Other people, e.g., my son, can keep a close eye on my health report when I share my information.” [CP3 (64y), CP14 (57y)]

**Intention to exchange health information.** Despite numerous attempts and the incentives that healthcare practitioners have conceptualized to share health information, patient personal health information sharing remains an unresolved issue for health care professionals. In particular, the movement toward a confidential exchange of information between caregivers and patients has intensified, supplying all parties with electronic communication in the healthcare industry. Moreover, mobile applications could provide a solution to the growing need for electronic health information exchanges and offer an exciting approach to treating chronic diseases. While Serrano et al. (2016) conclude that older adults are less likely to exchange personal information about well-being, this research result suggests that young people have a greater chance of engaging with online writing and chatting. This online participation in health information sharing is because of the sensitivity or complexity of transmitting health information. Peer-to-peer communication is best to prevent divulging confidential matters outside of the patients and healthcare professionals. Evidence suggests that

“Sometimes, patients wouldn’t explain their issues in physical appointments, and I feel I don’t get all the patients’ answers that I need for efficient treatment service. However, they feel relaxed writing and talking across online channels.” [CP8 (y), CP9 (63y)].

Effective and efficient sharing of health information may increase clinical practice quality, supporting Venkata (2014).

**Patients’ effort expectancy of technology usage.** According to Venkatesh et al. (2003), patients’ effort expectancy is the degree of simplicity concerning the technological framework that may differ significantly by age, gender, and experience. This implies that the effort expectancy refers to the skills required for using the application, whether convenient or convoluted. Often, user-friendly inventions can be adopted quickly by user groups. Almost all individuals seek technology that would allow flexibility, usability, and simplicity of using it. The sophisticated process flow measures the ease of use of a system. Within the context of effort expectation, the user finds the system for clear communication, improving the system’s capability, promoting the system’s operational activity, and facilitating training. In the present context, effort expectancy refers to the users’ experiences and efficient use of mHealth systems.

“Instead of generalised health care, I expect customised healthcare. I often update my health records in the mHealth systems to receive the service provider’s benefit. And I may take my own decision in an emergency if my doctor is physically unavailable.” [CP1 (38y)]

“mHealth applications boost my contact with doctors. I have comfort in paying the medical costs and receiving a short-term benefit. Throughout the service, I can save my time.” [CP4 (44y, business person)]

In this respect, patients deserve outstanding, non-complex, easy-to-use healthcare facilities that offer beneficial effects.
Habit. Patients’ optimistic motivation to use mHealth for medical treatment may be accomplished because study participants are ordinary users of conventional medical behavior as part of their culture. From a psychological point of view, the health-seeking choice can be viewed as an intentional mechanism and a source of behavioral patterns. The older adults adopted using the mHealth apps because of the reminder for medication systems that assist them with routine care. Participants [CP20 (37 years)] said:

“I am benefiting from installed adherence apps that remind me of adherence to the guidelines.”

But older people should get support from their families while still learning how to use the apps correctly. Some participants share exciting opinions about the preference for practical issues. For instance, drug adherence patterns indirectly minimize medical costs as they monitor dietary and physical activity more effectively.

“Medication adherence reduces my hospitalisation costs.” [CP5 (33y)].

However, the young participants were happy to use mHealth apps that offer critical buying benefits from the pharmacy.

“Nowadays, mHealth offers me critical buying benefits from the pharmacy.” [[HP10 (39y), HP13 (47y)]

The mHealth applications efficiently and practically offer users’ habitual reforms. Participants explained how useful mHealth apps were and how their success had encouraged them to build habits. It is helpful for chronic patients to use mHealth combined with medical records for healthier behaviors and best performance.

Perceived barriers to action. Perceived barriers were overcome by persuading people of what might have occurred in the quest for healthcare. However, trust in the mHealth implementation and data security issues were other challenges perceived at an individual level. Perceived barriers included lack of confidentiality of mHealth and access to the internet in rural areas. Often, barriers may also be turned into facilities. The consistency of patient-provider relationships takes into consideration whether they act as obstacles to care facilitators. Participants, particularly females, have identified several challenges to the use of mHealth systems. As some mHealth applications do not have strict privacy systems, our participants’ prominent barriers came from data protection problems. Evidence shows that:

“Often, I’m worried about sharing my personal data on the mHealth platform since some of mHealth applications do not have strict privacy schemes.” [CP11 (46y)].

“I do worry about security too much because I have much personal information not to disclose.” [CP14 (57y)]

Data protection and privacy concerns relating to the mHealth app’s use were an obstacle identified by the interviewees. The exchange of information would be beneficial if peers mainly revealed it. Some females were concerned with their private and sensitive information,

“I am not willing to share my personal data with people who are not close to my condition. However, sharing the details of the same condition helps me compare the outcomes of treating the same medication and exercise.” [CP22 (32y)]

Young females feared being more vulnerable to this deformity. In addition, the poor usability of mHealth apps has been described as another obstacle.

Reward. In mHealth, it’s no wonder that encouraging behavior transformation has long always been one of the main barriers and potentials. A reward function enables a user to accumulate points by engaging with the app and achieving their intended health goals. The primary motivation for providing this program is to offer incentives to patients taking better care of their health. There are two types of incentives that can be categorized: tangible and intangible. Tangible rewards, such as financial benefits, are the most significant incentive for an individual to work hard. For example, when the apps show, you get a smartwatch once you hit a distance of 100 mi. Patients would undoubtedly be encouraged. Parallelly, the intangible reward system is meant to inspire healthcare professionals by stimulating their competitive spirit. Earning “Like” and “Inspiring Comments” are noteworthy when I devote myself to my patients.

“Like”, and 'Comments' from my fellow members inspire me to go on exercise.” [CP10 (52y), HP11 (46y) HP14 (43y)]

In the present situation, increasing participation requires implementing an incentive system in which patients are not only urged to use it but also financially rewarded for doing so. The “reward points” function as differentiating factors that distinguish mHealth applications, allowing patients to earn points for healthier behavior. This study found:

“Healthcare providers are front-line heroes in our country, but the government does not treat them equally. Motivation is important. The government’s financial incentive or the patients’ reward points would inspire us to offer quality care.” [CP14 (42y), CP15 (48y)]

Strengths and Weakness

A significant strength of this study was our emphasis on both the patient and healthcare provider perspectives, as both are perceived to be very important for the acceptance and
implementation of mHealth. Another strength of this research was the selection of participants from various backgrounds, including a range of ages, incomes, education, and work experience. Moreover, the results of this study were strengthened by improved qualitative reporting strategies that utilized COREQ (Tong et al., 2007). In order to ensure impartial public opinion activities for participants, independent interviewers were appointed. Finally, this study revealed new aspects and factors important to adopting mHealth, including “patients as a decision support unit,” “personal awareness building,” “personal information exchange,” and “reward.” Reflecting upon all four of these factors will support future studies in integrating mHealth into healthcare.

Despite that, this research also had limitations. The end-user-centric mHealth predictors are derived from urban areas in Bangladesh. Therefore, external validity, for example, the effectiveness of generalizing findings in remote, underserved areas and to other nations, continues to be a constraint of this study. Moreover, patients and healthcare practitioners are not only the centerpiece of mHealth, but also mHealth designers and developers (IT viewpoint) play a pivotal role in re-designing mHealth. Thus, the views of mHealth designers and developers would be more useful in mHealth re-conceptualization. In addition, this research was performed with relatively limited sample size. It could cause a weakening of the findings presented. However, the exploratory objective is to contribute to future studies that can be conducted with larger sample sizes. Furthermore, the findings presented in this study don’t reflect the views of those who are not familiar with the existing mHealth system, and our findings do not represent their views.

Implication for Practice and Future Research
These findings are significant to all health care professionals, mobile app developers, and health researchers looking to improve mHealth systems. Re-conceptualizing challenges toward using mHealth for self-management and analytical findings from historical medical data will help healthcare professionals predict future risks and consider appropriate treatment. Theoretically, while prior mHealth research primarily relied on conventional mHealth literature to investigate mHealth adoption, our study showed the significance of re-conceptualizing mHealth systems over time by looking at them from both the mHealth literature and the viewpoint of end-users. The patient’s aspect in mHealth systems must be reinforced. This study assists researchers and practitioners in identifying the intervention components that help improve the mHealth system’s performance. Another possible benefit would be the use of this research to assist with other business initiatives. Currently, mHealth applications are positioned as a value-added product or as complementing tools for connected devices (Liew et al., 2019). Today, mobile phones have enough power to accumulate and calculate various physiological measures using powerful processors, sensors, and cameras. Such coordination is used to build health and well-being tracking software into stand-alone consumer products.

Future studies should seek out other affected stakeholders. Craven et al. (2014) strongly encourage the participation of all stakeholders—including caregivers and clinicians, whose involvement would likely create facilities that are easy to incorporate into practice. Several studies (Breeman et al., 2021; Tremblay et al., 2020) have applied this holistic view and included several users’ found commonalities concerning widespread support for technical advancement.

Finally, one physician’s recommendation ought to be contextual to the theoretical simulation of mHealth adoption. Perceived belief of aged people that physicians only care for patients’ best interests. Thus, it may strongly influence the intention to use mHealth services in the healthcare decision process after a health professional recommends them.

Conclusion
mHealth innovations are recommended as a privileged means to increase access to health care for individuals regardless of time and location (Salgado et al., 2020). Modern healthcare is emerging in large part independently from the national public health system. This research leads to our understanding of the technologies needed by future patients, which can satisfy the health care system and advance personalized health care. Effective results will include improvements in both patient and healthcare provider attitudes. There are some mHealth apps out there that may not present a real benefit to users. Therefore, the ability to better re-conceptualize the underlying motivation of patients using mHealth technology is essential for intervention success. The focuses of this study were to get a better re-conceptualizing of the perception of mHealth drivers from both users and healthcare professionals to view in practice. This strategy brought an alternate viewpoint that could provide a basis for the acceptance of mHealth applications. In that regard, this research brought together healthcare professional experiences and explored patients’ perceptions of mHealth applications for chronic illness.

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**Supplemental Material**

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