Health and Technology (2019) 9:471–486
https://doi.org/10.1007/s12553-019-00328-1

ORIGINAL PAPER

An insight into the bilateral readiness towards telemedicine

Md. Akram Hossain [1,2] · Rui Quaresma [3] · Md. Rakibul Hasan [1] · Asif Imtiaz [1]

Received: 14 July 2018 / Accepted: 10 April 2019 / Published online: 3 May 2019

Abstract

The primary purpose of this study is to profile and explore the technological and behavioral readiness of the physicians and patients towards telemedicine, supplemented by a secondary objective of getting additional insight about the status quo of technological readiness regarding the telemedicine in Dhaka city of Bangladesh. Structured questionnaire-based survey responses from 600 patients/individuals and 100 physicians are analyzed by using descriptive (i.e., Frequency Distribution) and inferential (i.e., Contingency Table of Association, Partial Least Square – Structural Equation Modeling, Factor Analysis) statistical tools for meeting the defined objectives of this study. Findings show favorable technological readiness of the respondents compared to behavioral readiness which is unfavorable. Gender diversity has a significant association with the different levels of access to elementary technology by the patients/individuals, whereas education level fails to prove to have any association. Different levels of skill at using technology by the individuals significantly influence their behavioral readiness and intention to accept telemedicine in Bangladesh. However, behavioral readiness is mostly defined by patients/individuals' expectation from telemedicine regarding the effectiveness, easiness, reliability, need, and satisfaction. The issue of the implication of this study can be enlightened from two perspectives. First, the findings of this study will provide the interested parties a greater insight in terms of telemedicine through addressing the perplexing situation of Bangladesh about to arise whenever someone going to introduce a new system or way doing anything as an alternative of the conventional way doing or thinking. It is usual to face a barrier in changing anything. That is why it is also essential to know the sources of the barrier, what they think and expect. So, in this study, the researchers try to address these issues of telemedicine.

Keywords Telemedicine · Readiness · Technological readiness · Behavioral readiness · Physicians · Patients/Individuals

1 Introduction

In 2018, Bangladesh turns into a land of 164.7 million inhabitants having the per capita income of US$ 1411, whereas the total GDP (Gross Domestic Product) is US$ 227.9 billion [1] [2]. As per the constitution of Bangladesh, the government is pledged to fulfill the basic needs of the people regarding food, clothing, shelter, education, and medical care [3]. On this ground, in 2007 the government in Bangladesh set a vision of economic prosperity for 2021, whereas the issue of ensuring these basic needs for the citizens is addressed carefully along with many other things regarding the economic development of Bangladesh to be middle-income country [4]. For doing so, the Bangladesh government has emphasized the process of digitization in every public and private sector responsible for delivering these basic needs to the recipients in an effective and efficient way [5]. As a consequence, the government has popularized the concept of "Digital Bangladesh" and 55 strategic contents were proposed in National Information and Communications Technology (ICT) Policy

✉ Md. Akram Hossain
akram@du.ac.bd; hossain@uevora.pt

Rui Quaresma
quaresma@uevora.pt

Md. Rakibul Hasan
hasan.mr@du.ac.bd

Asif Imtiaz
asifimtiaz.mis@du.ac.bd

[1] Department of Management Information Systems (MIS), University of Dhaka, Dhaka, Bangladesh

[2] Universidade de Évora, Évora, Portugal

[3] Departamento de Gestão - Escola de Ciências Sociais, Universidade de Évora and CEFAGE-UE, Évora, Portugal

of 2018 for attaining targets set on Vision 2021 and Vision 2041 through realizing the importance of digital innovation in economic development. The actual scenario of this digitization process can be realized based on the following rankings of Bangladesh.

- According to the Global Competitiveness Report of 2017 of World Economic Forum Bangladesh is in 120th position among the 137 countries in terms of technological readiness having a score of 2.76 [1].
- ICT Development Index (IDI) of International Telecommunication Union has ranked Bangladesh in the 147th position among the 172 countries in terms of the capability of accessing, using and developing skills of ICT [6].
- Networked Readiness Index (NRI) of 2016 reported by World Economic Forum showing the usage of ICT to achieve competitiveness by a country indicates that Bangladesh is in the position of 112 among 139 countries [7].
- The UN survey of E-government Survey of 2016 has ranked Bangladesh as 124th among the 193 countries which were 148th in 2014 in the E-government Development Index (EGDI) which represents the capability of using ICT in delivering government services [8]. In addition, in E-participation Index the position of Bangladesh is 84th among the 193 countries having a score of 0.39 out of 1 [9].

Moreover, in 2018 Bangladesh has entered the age of 4G (4th Generation Mobile Communication Technology) with 145.114 million mobile phone subscribers and 80.483 million internet subscribers [10].

However, the government of Bangladesh has to face more challenges in delivering healthcare supports for the population which is growing at a rate 1.37% in every year and currently having the density of 1090 people per square kilometer [11].

The total healthcare system of Bangladesh comprises of four layers containing 23,249 healthcare facilities; these are: (1) Tertiary Healthcare (e.g., Medical College Hospitals, Specialized Institutes), (2) Secondary Healthcare (e.g., District Hospitals, General Hospitals), (3) Primary Healthcare (e.g., Sub-district Health Complexes, Family Planning Offices), and (4) Daycare Facilities (e.g., Sub-district Sub-centers) [12].

137,024 hospital beds (both private and public hospitals) are available for the total population of Bangladesh, whereas every single bed is provided for 1169 people [11]. Only 4.48% of households are residing within the 1-km radius of a hospital [12]. Furthermore, only 5 registered physicians are available for every 10,000 people, whereas only 3 nurses are available for every 10,000 people [11].

Considering this alarming situation, the government has taken some remarkable initiatives of digitizing the healthcare system and applying technologies to tackle the odds. Regarding this matter the recent initiatives of Bangladesh government are as the followings [13]:

1. Application of Geographical Information System (GIS) for locating the healthcare needs and discrepancies in different regions of Bangladesh.
2. 24X7 mobile phone-based healthcare services are available for the citizens, whereas a portal is developed by the authority for providing the mobile numbers of the physicians.
3. SMS based maternity/pregnancy healthcare and complaints-suggestions services are being delivered to the patients.
4. Delivering health statistics through SMS to the intended users (e.g., physicians, practitioners, workers, researchers, etc.).
5. Online-based population health registry, digital training facility.
6. The government has implemented Bangladesh Health Information Systems Architecture (BHISA) for interconnecting the private and public entities responsible for delivering healthcare services.

Along with these, the government has also adopted the concept, framework, and functionality of telemedicine for the betterment of the healthcare system. Along with the advancements in technology and telecommunication, there has been an augmented interest among the physicians and patients throughout the world regarding telemedicine [14]. Any telemedicine system consists of the elements of (1) image, video, and audio processing technologies (2) network architecture for connecting service provider and receiver ends, (3) staffing of necessary experts, (4) application of clinical protocols, and (5) normative standards [15, 16]. Patients with less urgent needs can have the service from his/her home or locality with less cost of time and money [17]. It also prevents the probable transmission of infectious diseases among the patients and the medical staffs [18]. Physicians can consult with other physicians around them or at a distant location and verify their diagnoses and prescriptions [18]. It also enables doctors to learn new methods of treatments [17].

Realizing the significant of telemedicine, Bangladesh government has established 4536 Union Information and Services Centers (UISC) at different regions under the Access to Information (a2i) project of Prime Minister's office, whereas 22 centers are equipped with telemedicine systems [19]. In addition, two specialized, three district-level, and three sub-district-level hospitals also have telemedicine facilities implemented by the government [11].

Moreover, in January of 2015 government has also launched another 25 telemedicine centers in different sub-districts under the project of "Info Sarkar" advocated by the Information and Communication Technology (ICT) division of Bangladesh [20]. Grameenphone, the leading telecommunication company in Bangladesh, has financed for establishing 15 centers of 25 [20]. Besides the public sector, the private sector is also coming forward to implement and finance telemedicine projects in Bangladesh. An US-based NGO, Distressed Children & Infants International (DCI), inaugurated a telemedicine center on Dhaka in August of 2014 [20]. Likewise, Table 1 contains the recent telemedicine initiatives taken by the private and public sector and their status.

Ironically, most of the recent telemedicine projects are suspended before being successful, whereas the reasons behind this scenario are still unknown and unaddressed. On this ground, an endeavor is undertaken by the researchers of this paper to address this issue from the perspective of the physicians and general users (i.e., patients, family caregivers) of telemedicine systems in Bangladesh. It is high time to look back again and to assess the readiness level of the stakeholders from the dimensions of access to technology and behavioral intention, and the users' demographic diversity. These are the things believed to form the context on which the success or failure of a telemedicine project depends. That is why the following objectives of this paper are set to address in congruence with the title of this paper – (1) Profiling technological and behavioral readiness level of the individuals and physicians towards telemedicine (termed as "Bilateral Readiness" in this research paper) in Bangladesh; and (2) Getting useful insights regarding the status quo of technological readiness in terms of its implication in applying telemedicine in Bangladesh.

2 Relevant literature, theoretical frameworks, and hypotheses

In 1998, a telemedicine service was initiated in South Africa for providing teleradiology and "Tele-ultrasound Services", initially accompanied with 256/kbps connection lines for the transmission of data. But, very few people accepted this service as they were somewhat skeptical about the effectiveness and cost efficiency of telemedicine [22]. In 2003, two telemedicine projects were launched on two different villages in the state of Michigan, one of which could not be successful because of poor organizational structure and resources [23]. The cases represent the diversity of obstacles in implementing telemedicine project, which may include excessive cost occurred in managing information and data, lack of skilled personnel, information security threats and absence of legal framework [24–26].

Considering this situation, many researchers have emphasized the need for conducting telemedicine readiness assessment by considering different dimensions and factors. These dimensions and factors may include ([27–29]; Khoja et al., 2007; [30]) (a) Motivational factors – both the practitioners and the users need to be interested to provide and receive healthcare services through telemedicine; (b) Engagement of healthcare service providers – it signifies their understanding regarding the benefits of telemedicine and their intention to invest in telemedicine; (c) Technological readiness – it represents stakeholders' basic skill to access and use technologies and communication mediums; (d) Resource readiness – initiation of telemedicine requires a significant amount of resources for both organizational and infrastructural development. So, it is important to analyze whether the intended parties can invest or not; and (e) Societal readiness – along with the previous one telemedicine also requires extensive communication links and partnerships among the organizations providing the healthcare service. So, the societal linkage of intra-groups and intra-organizational dimensions plays a big part.

On the other hand, the European Commission (EC) and Momentum had developed a set of 18 key success factors of telemedicine projects. That includes the cultural readiness, proper leadership, and identification of key customers' needs, involvement of the experts, a proper plan of initiation, management guidelines, service quality, legal aspects and privacy awareness [31]. Moreover, the infrastructure and the service

Table 1 Recent Telemedicine Projects in Bangladesh [21]

Telemedicine Project Name	Initiator	Current State	Remarks
HealthLine Dial 789	Grameenphone Ltd.	Operational	Not as expectation
Aponjon mHealth	Mobile Alliance of Maternal Action	Operational	Not as expectation
mHealth by Ministry of Health	Government	Operational	Not as expectation
Comfort Nursing Home	Bangladesh University of Engineering and Technology	Suspended	–
Dhaka University Telemedicine Project	Department of Biomedical Physics and Technology, University of Dhaka	Operational	Satisfactory
Bangladesh DNS diagnoses Centre, and Comfort Diagnoses & Nursing Home	NGO	Suspended	–
DAB and Faridpur General Hospital	NGO	Suspended	–

are needed to be user-friendly and monitored on a continuous basis [32].

Nevertheless, ultimate priority is given on the technological and behavioral readiness of the associated parties (e.g., service providers, consultants, and beneficiaries) in many research works since information technology is taking over the medical sector slowly but surely. Now many physicians are more comfortable with the keyboard rather than conventional pen and pencil. This is truer regarding medical students. So, both patients and physicians are familiar with the use of technology in health care technology. But what they don't familiar with is the proving and receiving of healthcare service with the help of information technology [33, 34].

In addition, there are several research papers addressing the issue of e-health or telemedicine users' behavioral aspects. For a new tech-based system perceived effectiveness, ease of use, trust and satisfaction level are considered prominent dimensions of behavioral intention to comply [35, 36]. Typically, there is a tendency of the users to resist any changes brought by a new system. In that situation, the system must promise the potential to do better [37]. Patients are used to getting their diagnosis and treatments face to face from the doctor [38]. It gives them a sense of reliability. But, in case of e-health or telemedicine services, where the patients get their treatment via cellular or Internet-based communication technology, they are usually disposed to doubt [39]. So, there remain some behavioral barriers that the patients are afraid to overcome. Though the telemedicine services would have saved them a lot of time and money, they prefer the traditional face to face one [40–42]. Despite that, the younger generations, who are more in touch with modern technology, are more interested in this [43]. However, it is imperative to conduct research to identify the service receivers and providers behavioral readiness to accept telemedicine [44]. Because, if any of the concerning parties are found incompetent then the whole initiative of implementing telemedicine can go into vain [45].

Based on the elaborate and arduous search and review of the literature, an unambiguous gap and deficiency of study have been found regarding the matter of what and how should be analyzed before going to implement any telemedicine project in a perplexing economic and social context like Bangladesh. With a view to addressing this gap, the objectives of this study are determined to assess the current readiness level of the respondents towards telemedicine and to analyze the impact and significance of technological readiness amongst all other relevant factors, which was stated earlier also. Pertaining to these objectives, the research questions, theoretical frameworks, and hypotheses of this study are as the followings.

- RQ 1: What is the current profile of technological and behavioral readiness of the patients/individuals and the physicians (e.g., Bilateral parties) towards telemedicine in Bangladesh?

The expectation regarding the primary finding of this study is set to provide the readiness level of the patients/individuals and physicians towards telemedicine in Bangladesh in terms of their behavioral intention to accept and orientation to basic technology. Table 2 contains the constructs used in this study along with the descriptions of these constructs.

- RQ 2: Is there any association between the demographic factors (e.g., gender and education level) of the individuals and their access to elementary technology?

Khatun et al. [52] built the m-Health readiness conceptual model where resource readiness was defined which dealt with the relationship between socio-demographic determinants (age, gender, education level) and awareness of m-Health services. That paper also showed that women, poor, older age groups and poorly educated or illiterate people are less likely to cope with the technology-based solution. Male patients in Northern Louisiana, USA showed a higher proclivity toward the use of telemedicine than female patients [53]. But at Kenyatta National Hospital in Kenya, there was no significant difference between male and female in adopting and using new technology [54]. Male and female students in Bangladesh also demonstrated insignificant variation in their ICT self-efficacy [55].

When comes education, one study found graduate patients are more polarized and inclined toward using telemedicine than patients from lower education level [53]. Though Agarwal and Prasad [56] stated that education had an impact on technology acceptance, Mucheneh [54] found no such impact.

So, in this study, it is tried to find any potential association among the variables of gender, education level and access to the elementary technology (i.e., Smartphone, computer, internet connection, social media usage) by the individuals and physicians. However, in the context of Bangladesh, the individuals are expected to be more diversified in terms of demographic factors rather than the physicians. That is why the physicians are omitted from his research question.

- RQ 3: What are the significant determining factors of "Behavioral Readiness" of individuals and what is the importance of "Basic Skill at Using Elementary Technology" in explaining behavioral readiness of the individuals towards telemedicine?

Figure 1 contains the hypothesized cause-effect relationships those are statistically analyzed to find what factors can significantly explain the changes in another factor of "Behavioral Readiness of the Individuals towards

Table 2 Constructs and Variable Used to Assess Readiness

	Dimensions/ Constructs	Description and Indicators
Technological Readiness	*Access to elementary technology*	Access to elementary technology means the patients/individuals' owning of technological devices (i.e., smartphone, computer), connection to the internet, and communication through internet or cellular based network [46].
	Basic Skill at Using Elementary Technology	Telemedicine requires a minimum level of skill at using elementary technology by the users to be at service of them [47]. The indicators of this construct are – skill at using computer/ Smartphone and browsing the internet for accessing data or communicating with others.
Behavioral Readiness	*Expected Easiness of Using Telemedicine Systems*	Expectations of the patients/individuals and physicians regarding the easiness of system signify their interaction with the system, which may include their expectations about how easy it will be to learn and use telemedicine [47].
	Reliability on Telemedicine Systems	Reliability means the system's trustworthiness as an alternative to the face-to-face interaction of getting healthcare service [48].
	Satisfaction with the Telemedicine Systems	Expected satisfaction level of the individuals and physicians with the telemedicine service over the conventional way of receiving and delivering healthcare services is the most prominent success indicator [49].
	Need Recognition of Telemedicine Systems	Need recognition means the feeling of the necessity of telemedicine which is indicated by the two parameters of willingness to use and encourage telemedicine to be used by others [50].
	Expected Effectiveness of Using Telemedicine Systems	Money and time-saving capability, and the quality telemedicine service represents the effectiveness of that system [51].

Telemedicine" and among which the construct of "Basic Skill at Using Elementary Technology" is emphasized more assess its impact on behavioral readiness of the individuals.

According to the research staff, ease of use is one of the strengths of the mobile phone technology which makes this technology acceptable to others in case of telemedicine [57]. General practitioners and nurses showed readiness to try new systems out and were certain of learning to use new equipment of modern technology [58]. In research on heart failure patients, most patients reported a high level of comfort and easy accessibility to mobile phone and computer while looking up for health information. [59]. Seto et al. [59] also reported that developing a straightforward and easy-to-use system could considerably raise the number of patients who could effectively use the technology which is handy in telemedicine. With the support of the evidence from the stated literature, we can propose the following hypothesis:

- *H1: Expected easiness of using telemedicine has a significant impact on the behavioral readiness of the respondents*

A sense of trust provided by the experience of telemedicine intervention can increase the capacity of stakeholders to get in touch with healthcare services [60]. Various vital and complex questions can be raised on the market of mobile health applications like reliability, security, efficiency and service quality [61]. Preferring telemedicine rather than the traditional one-to-one intervention with the doctor can be thought of a sign of reliability of patients on telemedicine. Female patients find m-Health as a good substitute of sharing health problems face-to-face with the male doctor since due to the cultural norm of the country they feel uncomfortable to share their confidential health issues. Again, patients couldn't see the doctor face to face and thus trust is a very important construct of the motivation behind using telemedicine (Khatun et al., Community readiness for adopting mHealth in rural Bangladesh: a qualitative exploration [52]). Not only the clients but also the nurses felt comfy with the reliability of the telemedicine technology in a form of home telecare diabetic support [62]. Bostock et al. [58] showed that patients valued the potential for the e-BP system to reduce regular visit to the surgery which was difficult for many patients. Thinking telemedicine as a better alternative to face-to-face interaction with the doctor and its trustworthiness can be thought of an indicator of the reliability of using telemedicine. Therefore, based on the above literature the following hypothesis is postulated:

- *H2: Expected reliability of using telemedicine has a significant impact on the behavioral readiness of the respondents*

The satisfaction derived from using telemedicine is a very important moderating factor in the expansion of comprehensive usage of telemedicine among mass people. Applying telemedicine via group psychotherapy among young adults with cancer experiences showed that patients were comfortable with the use of technology [63]. Service quality of m-

Table 3 Questionnaire Items and Variables

Constructs/ Variables	Respondents: Physicians and Individuals/ Patients		Variable Type	Scale	Response Pattern
	Items				
Demographic	Gender		Dichotomous	Nominal	Yes/No
	Age		Categorical		20–30/ 31–40/ 41–50/ 51–60
Access to Elementary Technology	Having a Smartphone		Dichotomous	Nominal	Yes/No
	Having an internet connection on the Smartphone				
	Having a personal computer				
	Having an internet connection on the computer				
	Having an account on a social media				
	Knowing how to download/ upload information through the internet				
	Knowing how to communicate with others through the internet				
Basic Skill at Using Elementary Technology	Skill at using the computer		Likert Scale	Interval	1 = Very Bad
	Skill at using the Smartphone				2 = Bad
	Skill at browsing the internet				3 = Moderate
	Skill at communicating with others through the internet				4 = Good
					5 = Very Good
Behavioral Readiness	Latent Variables	No. of Observed Variables			
	Expected Effectiveness of Usage	3	Likert Scale	Interval	1 = Strongly
	Expected Easiness of Usage	2			Disagree
	Expected Reliability	2			2 = Disagree
	Expected Satisfaction	1			3 = Neutral
	Need Recognition	2			4 = Agree
					5 = Strongly Agree
	Informed about telemedicine		Dichotomous	Nominal	Yes/No

Table 4 Data Analysis Tools to be Used

Research Questions	Data Analysis Tools	Nature of Analysis
RQ 1	Frequency Distribution	Descriptive
RQ 2	Contingency Table of Association	Inferential
RQ 3	Partial Least Square-Structural Equation Modelling (PLS-SEM) followed by Factor Analysis (FA)	

Health platforms and satisfaction from using those platforms are highly significant strategic instruments to ensure affirmative continuance intention of patients [64]. Sorwar et al. [65] stated that in a recent study on time and cost-effectiveness of telemedicine, almost 38% of the service recipients opined their high level of satisfaction with the introduced telemedicine service. Thus, we make the subsequent hypothesis:

- *H3: Expected satisfaction on using telemedicine has a significant impact on the behavioral readiness of the respondents*

Melton et al. [63] also showed that the cancer patients who received group psychotherapy using telemedicine would recommend the group to others since they felt an augmented sense of connection to others in the group and had sheer satisfaction. Patients would agree to continue remote monitoring if there were obvious and concrete benefits to their doing so [59]. The patients with type 2 diabetes felt like same in case of self-monitoring of the level of blood sugar [66]. Recommending telemedicine to others means the need for telemedicine has been recognized by the patients who used telemedicine at least once. So, we hypothesized the next statement:

- *H4: Need recognition of telemedicine has a significant impact on the behavioral readiness of the respondents*

Telemedicine technologies are thought to maintain and reduce costs while improving the quality of healthcare [62]. [63] showed evidence that telemedicine is much more convenient for the patients and it saves on an average of 2 h and 56 min of the patients if they made a roundtrip from home to cancer center. Khatun et al. [67] stated, "Community members who are aware of and use m-Health were motivated to use it in future because they see it as easy access, low-cost, time-saving." Telemedicine service cuts a considerable amount of time and costs off for the patients' access to the required health services [65]. Lower cost and saving time have made telemedicine effective to the user. Thus, the next hypothesis has been proposed:

- *H5: Expected effectiveness of using telemedicine has a significant impact on the behavioral readiness of the respondents*

Telemedicine naturally requires ICT infrastructures and acceptance by stakeholders who will use the specific technology [68]. Technology readiness has a strong association with behavioral intentions of using self-service technologies like mobile phone and internet [69]. Gholamhosseini and Ayatollahi [70] portrayed ICT readiness as an important tool to measure the e-health readiness of hospitals in Iran. In South Africa, effort expectancy has been pictured as an influential factor constructing e-health readiness where effort expectancy is a

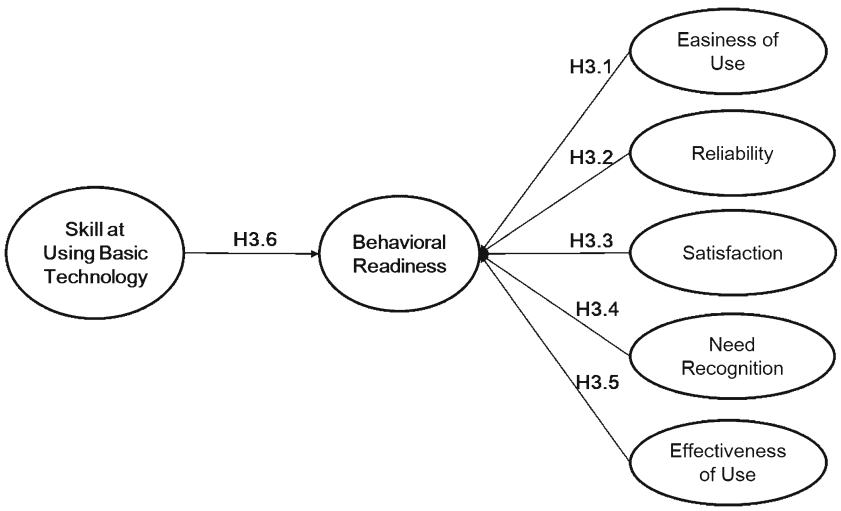

Fig. 1 Theoretical Framework Corresponding to the Third Research Question

blend of experience with technology, friendliness of use of technology and vendor support [71]. Readiness, as well as the willingness of the healthcare providers and seekers, is critically influenced by their perceptions on the usefulness of the technology and their existing level of ICT usage [72–74]. Physicians think user-friendly equipment must be availed for bolstering Telehomecare or telemedicine across every stratum of stakeholders [75]. Again, it has been found that short-term use of telemedicine brings positive change towards the perception of usefulness and technological ease of use of the system [76]. One interesting demonstration by Kiberu and his colleagues [68] reveals an insignificant association between readiness to incorporate telemedicine in the healthcare system and type of technology used. Thus, we bring the following hypothesis under empirical investigation.

- *H6: Basic skill at using elementary technology has a significant effect on the behavioral readiness of the respondents*

3 Methods, instruments and statistical techniques

Diverse methodological approaches are used to conduct this research for serving the corresponding research questions prepared based on the objectives. The nature of this study is explorative and conclusive at the same time. Methodological design associated with the first research question of exploring the readiness level illustrates the continuum of what is being practiced and not practiced. On the other hand, methodological design accompanying the second and third research questions will lead to the conclusion regarding the impact of technological readiness on behavioral readiness and the diversity of demographic dimensions in technology usage. The constructs, variables, and parameters are derived by means of systematic literature review and judgment of the researchers guided by the context of Bangladesh.

Target population and area of the study Patients/Individuals and physicians are two independent target population of this study. *Patients or Individuals* - those are getting any kind of healthcare services offered from government-owned hospitals located within the geographic area of Dhaka, Bangladesh. *Physicians or Doctors* – those are providing healthcare services for the patients/individuals through the government-owned hospitals in Dhaka city, these physicians are registered under the DGHS (Directorate of General Health Services) of Bangladesh. The discussion about the target population of that study implies that the geographic area of this research study is confined to the Dhaka city of Bangladesh and more specifically concentrating on the government-owned hospitals located in that city.

Sampling frame According to the DGHS of Bangladesh there are six public hospitals in Dhaka city [11]. List of the patients received healthcare services from those public hospitals during the year of 2017–18 is used as the sampling frame for selecting the sample units (i.e., patients of individuals), whereas this list is derived from the patient register book of those hospitals. On the other hand, the total number of doctors working under DGHS of Ministry of Health and Family Welfare (MoHFW) in Bangladesh is 20,602 in the year of 2018 among which 788 doctors are working on those six public hospitals in Dhaka city [11]. List of those doctors is used as the sampling frame for selecting the sample units (i.e., physicians).

Sample size calculation and sampling techniques According to the DGHS, physician to patient ratio in Dhaka city is 1:6 [11]. Considering this fact and following the non-probabilistic purposive sampling method 100 physicians and 600 patients are surveyed in this study. Maintaining randomness of the sample units by following probabilistic sampling technique is near to impossible in the context of Bangladesh because the respondents are highly reluctant to share their personal information with the researchers. As a result, the researcher's experience and judgment are applied to collect data from the respondents based on the willingness and availability of the respondents.

Instrumentation A structured questionnaire is used to gather responses from the physicians and the patients. Responses were collected by face-to-face interviews. The items of that structured questionnaire are depicted on Table 3 with the corresponding variable type and measurement scale.

Statistical techniques Data analysis tools used for this study for addressing three different research questions are described on Table 4.

All the quantitative figures on the following sections corresponding to different statistical tools are generated by using the software of Microsoft Excel, IBM SPSS, and SmartPLS.

4 Results and interpretations

4.1 Technological and Behavioral Readiness Profile

4.1.1 Explanation of Table 5

From Table 5, it can be observed that there are seven indicators of the constructs of "access to elementary technology" and four indicators of the construct of "basic skill at using

Table 5 Readiness Profile of the Respondents

Readiness	Constructs		Variables	Individuals		Physicians	
				Ready for Tele-medicine	Not Ready for Tele-medicine	Ready for Tele-medicine	Not Ready for Tele-medicine
				in % of N = 600		in % of N = 100	
Technology Readiness	Access to Elementary Technology	1	Having a smartphone	90	10	99	1
		2	Having internet connection on smartphone	62	38	93	7
		3	Having a personal computer	39	61	91	9
		4	Having internet connection on computer	25	75	89	11
		5	Having an account on a social media	56	44	91	9
		6	Knowing how to download/ upload information through internet	49	51	90	10
		7	Knowing how to communicate with others through internet	46	54	91	9
	Basic Skill at Using Elementary Technology	8	Skill at using computer	40	60	88	12
		9	Skill at using smartphone	86	14	97	3
		10	Skill at browsing internet	39	61	81	19
		11	Skill at communicating with others through internet	45	55	84	16
Total in % of the average value of 11 indicators of technology readiness				**52%**	**47%**	**90%**	**12%**
Behavioral Readiness	Expected Effectiveness of Usage	1	Telemedicine will save money	10	90	28	72
		2	Telemedicine will save time	11	89	33	67
		3	Telemedicine provides better quality	9	91	21	79
	Expected Easiness of Usage	4	Easiness of learning about how to use telemedicine	19	81	42	58
		5	Easiness of using telemedicine	16	84	33	67
	Expected Reliability	6	Telemedicine will be a better alternative of face-to-face interaction in getting healthcare services	5	95	25	75
		7	Telemedicine will be trustworthy enough	7	93	30	70
	Expected Satisfaction	8	Telemedicine will be more satisfactory than conventional way	13	87	31	69
	Need Recognition	9	Usage of tele-medicine should be encouraged	20	80	44	56
		10	Others should be recommended to use telemedicine	15	85	50	50
Total in % of the average value of 10 indicators of behavioral readiness				**11%**	**89%**	**31%**	**72%**

elementary technology". All of these indicators are representing the technological readiness level of the respondents. Now at the original structured questionnaire, binomial responses (e.g., Yes/No) are collected against the indicators of "access to elementary technology". Physicians or patients having a Smartphone, a PC, internet connection on those devices, social media account, knowledge regarding how to browse, how download or upload any content, and how to

communicate with others through the internet are considered as ready for telemedicine services in Bangladesh. On the contrary, those are not having those characteristics considered as not ready for telemedicine services. For example, 90% of the physicians and 49% of the patients know how to upload or download any content at any platform by using internet which very essential for interacting with any telemedicine service, because they may have uploaded or load medical reports or any other health-related documents whenever they are going to use a telemedicine service point. Likewise, the indicators of "Basic Skill at Using Elementary Technology" are measured in a five-point Likert scale (i.e., 1-Very Bad Skill, 2-Bad Skill, 3-Moderate, 4-Good, and 5-Very Good). Respondents having moderate, good, or very good basic skill at using elementary technology are inferred as ready for telemedicine in Table 5. At the same way, for measuring behavioral readiness of the respondents five constructs (i.e., effectiveness, easiness, reliability, satisfaction, and need recognition) are used, whereas ten indicator variables are used to represent their corresponding constructs (See Table 3) those are measured in a five-point Likert scale (e.g., 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree). Physicians or patients those are disagreeing with the statements regarding the indicators of behavioral readiness are inferred as not ready for telemedicine. For the sake of simplicity in profiling the readiness level of the respondents in terms of technical know-how and intention required for telemedicine, original scales of the indicator variables are transformed according to the following rules depicted in Table 6.

From Table 5 (containing the frequency data), it is obvious that the respondents' technical readiness is satisfactory, whereas it seems that they are behaviorally not motivated to accept telemedicine service. Furthermore, the physicians are more technically sound and behaviorally inclined to use telemedicine rather than the patients/individuals. In that context, awareness programs regarding telemedicine are believed to work in persuading individuals as well as the physicians towards telemedicine. Motivational or awareness programs should be organized by the interested parties, those are planning to capitalize on the technical soundness of the stakeholders and introduce telemedicine projects in Bangladesh.

4.2 Association between demographic factors and access to elementary technology by the individuals/ patients

Tables 7 and 8 contain the statistical analysis results representing the degree of association between the demographic factors of the patients with their access to elementary technology. Statistical tools like Chi-square test, phi-coefficient, and contingency coefficient depicted on the following table signify the hypothesis that there are statistically significant associations of gender and education level with the different indicators of access to the elementary technology required for using telemedicine services in Bangladesh.

4.3 Determinants of behavioral readiness of the individuals and the importance of basic skill at using elementary technology in explaining behavioral intention – partial least square based structural equation modelling (PLS-SEM) analysis

For addressing this research question the following variables depicted Table 9 are used corresponding to the constructs.

Table 6 Transformed Scale of the Variables

Original Scale	Transformed Scale
0 – No 1 – Yes	0 – No → Not in Favor of Tele-medicine 1 – Yes → In Favor of Tele-medicine
1 – Very Bad Skill 2 – Bad Skill 3 – Neutral 4 – Good Skill 5 – Very Good Skill	1 – Very Bad Skill 2 – Bad Skill 3 – Neutral — Not Ready for Telemedicine 4 – Good Skill 5 – Very Good Skill — Ready for Telemedicine
1 – Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree	1 – Strongly Disagree 2 – Disagree 3 – Neutral — Not Ready for Telemedicine 4 – Agree 5 – Strongly Agree — Ready for Telemedicine

Table 7 Association between Gender and Access to Elementary Technology

Gender		Having Smartphone		Having Internet Connection on Smartphone		Having Personal Computer		Having Internet Connection on Computer		Having a Social Media Account		Knowing How to Download or Upload Digital Contents		Knowing How to Communicate with Others through Internet	
		Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Male	N(300)	247.0	53.0	211.0	89.0	134.0	166.0	98.0	202.0	269.0	31.0	112.0	188.0	164.0	136.0
	%	82%	18%	70%	30%	45%	55%	33%	67%	90%	10%	37%	63%	55%	45%
Female	N(300)	145.0	155.0	98.0	202.0	71.0	229.0	59.0	241.0	132.0	168.0	89.0	211.0	47.0	253.0
	%	48%	52%	33%	67%	24%	76%	20%	80%	44%	56%	30%	70%	16%	84%
Male	Expected Freq.	196.0	104.0	154.5	145.5	102.5	197.5	78.5	221.5	200.5	99.5	100.5	199.5	105.5	194.5
Female	Expected Freq.	196.0	104.0	154.5	145.5	102.5	197.5	78.5	221.5	200.5	99.5	100.5	199.5	105.5	194.5
Chi-square Test (Sig. @ 5% Level)		76.56		85.20		29.41		13.12		141.12		3.96		100.07	
Phi Coefficient (Sig. @ 5% Level)		0.36		0.38		0.22		0.15		0.48		0.08		0.41	
Contingency Coefficient		0.34		0.35		0.22		0.15		0.44		0.08		0.38	

Table 8 Association between Education Level and Access to Elementary Technology

Education Level		Having Smartphone		Having Internet Connection on Smartphone		Having Personal Computer		Having Internet Connection on Computer		Having a Social Media Account		Knowing How to Download or Upload Digital Contents		Knowing How to Communicate with Others through Internet	
		Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Higher Secondary or Below	N(337)	254	83	187	150	52	285	24	313	172	165	45	292	53	284
	%	75%	25%	55%	45%	15%	85%	7%	93%	51%	49%	13%	87%	16%	84%
Above Higher Secondary	N(263)	138.0	125.0	122.0	141.0	153.0	110.0	133.0	130.0	229.0	34.0	156.0	107.0	158.0	105.0
	%	52%	48%	46%	54%	58%	42%	51%	49%	87%	13%	59%	41%	60%	40%
Higher Secondary or Below	Expected Freq.	220.17	116.83	173.56	163.45	115.14	221.86	88.18	248.82	225.23	111.77	112.90	224.11	118.51	218.49
Above Higher Secondary	Expected Freq.	171.83	91.17	135.45	127.56	89.86	173.14	68.82	194.18	175.77	87.23	88.11	174.90	92.49	170.51
Chi-square Test (Sig. @ 5% Level)		34.20		4.90		119.99		144.34		86.53		140.08		127.43	
Phi Coefficient (Sig. @ 5% Level)		0.24		0.38		0.48		0.46		0.09		0.45		0.49	
Contingency Coefficient		0.020		0.012		0.027		0.029		0.025		0.028		0.02	

Table 9 Variables Used in PLS-SEM Analysis

	Latent Constructs		Observed Variables
LC1	Basic skill at Using Elementary Technology	OV1.1	1. Skill at Using Smartphone
		OV1.2	2. Skill at Using Computer
		OV1.3	3. Skill at Browsing Internet
		OV1.4	4. Skill at Communicating with others through the Internet
LC2	Easiness of Using	OV2.1	1. Expected Easiness to learn
		OV2.2	2. Expected Easiness to Use
LC3	Reliability	OV3.1	1. Believing telemedicine as a better alternative to face-to-face interaction
		OV3.2	2. Trustworthiness of telemedicine
LC4	Satisfaction	OV4.1	1. Expected satisfaction level from telemedicine
LC5	Need Recognition	OV5.1	1. Tele-medicine should be encouraged
		OV5.2	2. Tele-medicine should be recommended to others
LC6	Effectiveness of Use	OV6.1	1. Expectation regarding telemedicine will save money
		OV6.2	2. Expectation regarding telemedicine will save time
		OV6.3	3. Expectation regarding telemedicine will provide better quality

Based on these variables and constructs the partial least square-structural equation modeling analysis is conducted with the help of SmartPLS software, whereas the results are presented on the following figure. Moreover, the standard or acceptable limit values of the parameters (i.e., path coefficient values, reliability, and validity test values) in Fig. 2 are described in Table 10.

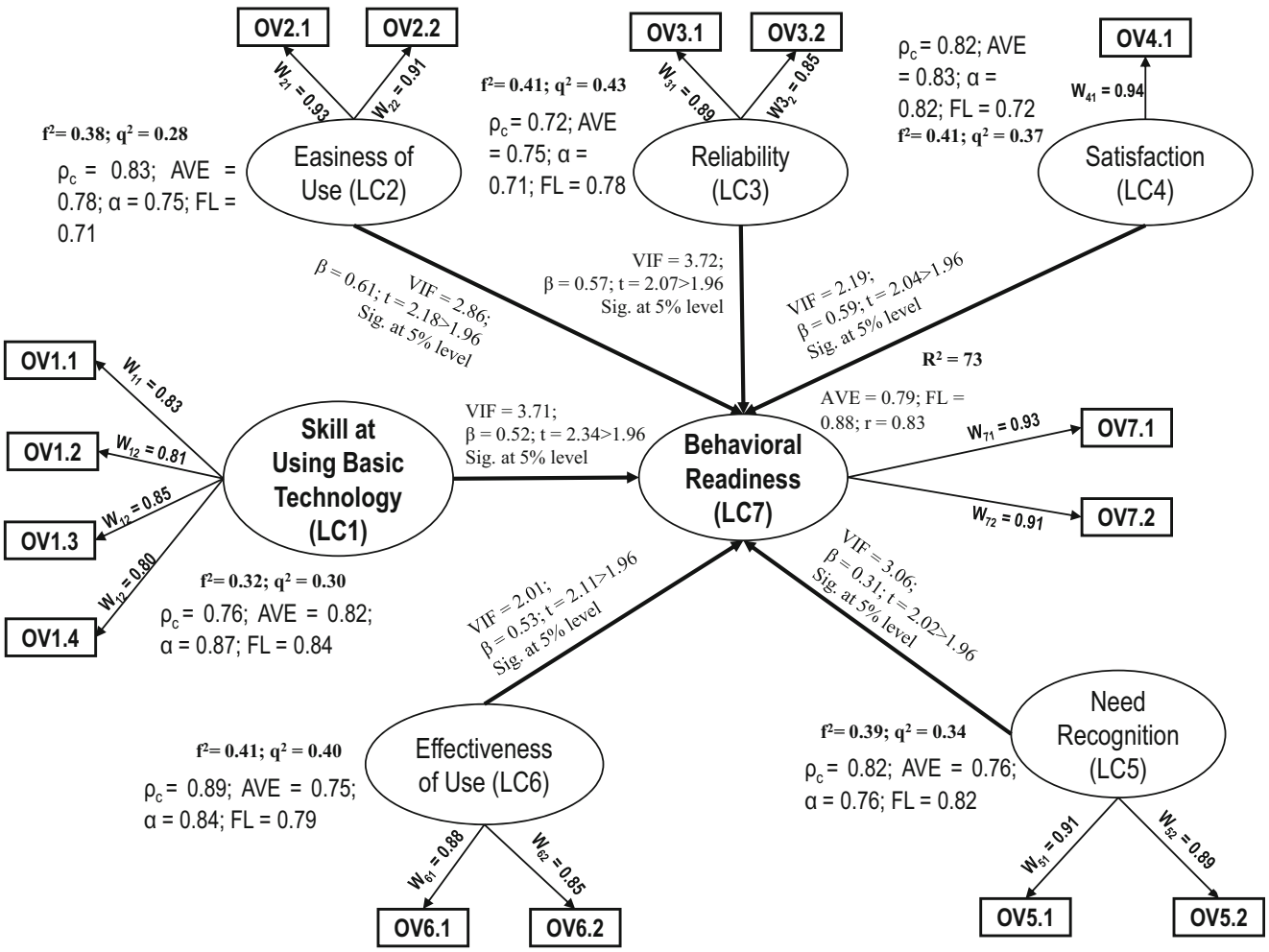

Fig. 2 Result of PLS-SEM analysis (Values are generated by SmartPLS Software)

Table 10 Standard Values of the Parameters for Comparing with the Calculated Values [77]

Notations	Description/ Standard Limits
W_{ij}	Weight/Outer Loadings of the LVs (More than .80 is acceptable)
ρ_c	Composite Reliability (0.70 to 0.90 is acceptable)
AVE	Average Variance Extracted (0.70 to 0.90 is acceptable)
α	Cronbach's Alpha (0.70 to 0.90 is acceptable)
VIF	Variance Inflation Factor (Less than 5 is acceptable)
f^2	The effect size of the constructs (More 0.35 represents strong effect)
q^2	Predictive relevance of the constructs (More 0.35 represents strong effect)
r	Test-retest reliability value (More than 0.80 carries strong correlation)
FL	Fornell-Larcker Criterion ($\sqrt{AVE}$ > Correlation with any other constructs)
R^2	The coefficient of Determination (More than 0.50 is acceptable)
β	Path Coefficients (Acceptable if it is significant at 5% level)
t	The calculated value of t-statistic

4.3.1 Interpretation

Based on the values in Fig. 2 and their standard/ acceptable limits in Table 10, the following conclusion can be derived for the alternative hypotheses proposed for the third research question of this study. Table 11 contains the status of the hypotheses adopted on this study for empirical testing.

4.3.2 Recommended Action Plan

It is obvious that the telemedicine project must promise to provide usefulness and effectiveness for users. On the other hand, basic technical skill also plays an important role as a success factor. So, a proper plan and approach about how a telemedicine service will create value for the patients are essential which can be articulated by the appropriate understanding of individuals' requirements.

5 Implications

Social implication of the findings of this research work is enormous, whereas the policy makers, government, business organizations, or any other interested will be facilitated by insights provided on this paper.

There is no wonder that expected easiness of using positively influences the behavioral intention of telemedicine among stakeholders. But to derive the highest possible benefit from telemedicine service, one needs to have a benchmark knowledge about how to deal with necessary technologies well. In this sphere, men are somehow ahead of women which imply access to healthcare via telemedicine is inequitable to some extent. To address this problem, a training program on basic ICT awareness build up could be organized. Women are like vanguards in the family culture of the society where the study was conducted. Therefore, an upgrade in the ability of women to grab the best from what telemedicine offers is obviously beneficial for society.

Before the introduction of telemedicine to the patients, even after the introduction, there is a common perception that a kind of satisfaction patients get when they meet their doctors face-to-face. This scenario can be changed, though in a steady speed, by a smooth video conference or conversation by any trusted means between the doctor and the patients. A pinpoint diagnosis of disease using diagnostic tools used in telemedicine can gear the speed of this change up. The higher the reliability of telemedicine, the more is the intention of the continuance of it among patients. Easiness of use and reliability make important sense to bring satisfaction of the users of telemedicine.

If a patient finds having treatment from telemedicine satisfactory, he or she can recommend telemedicine to others and thus telemedicine projects can get more reach toward people.

Table 11 Accepted Hypotheses

Hypotheses	Decisions
H1: Expected easiness of using telemedicine has a significant impact on the behavioral readiness of the respondents	Accepted
H2: Expected reliability of telemedicine has a significant impact on the behavioral readiness of the respondents	Accepted
H3: Expected satisfaction on using telemedicine has a significant impact on the behavioral readiness of the respondents	Accepted
H4: Need recognition of telemedicine has a significant impact on the behavioral readiness of the respondents	Accepted
H5: Expected effectiveness of using telemedicine has a significant impact on the behavioral readiness of the respondents	Accepted
H6: Basic skill at using elementary technology has a significant effect on the behavioral readiness of the respondents	Accepted

Success stories of current telemedicine projects will attract more interested parties and doctors to initiate and take part in such projects. To save money, time and to make life easier, the need for telemedicine is inevitable. If patients in rural areas can get the best treatment from renowned doctors practicing in cities, there is no incentive for them is going to cities to make a direct intervention with doctors and thus time and money will be saved. This recognition and effectiveness of telemedicine will inspire the patients to be behaviorally prepared in the direction of being treated by telemedicine more than before.

Access to healthcare is a constitutional right for the citizens of Bangladesh, whereas telemedicine can improve the access privilege for the citizens to healthcare service. But, for any new system going to be implemented, it is essential to know with whom this system is going to interact and by whom this system is going to be operated. This research initiative is conducted for addressing this paradoxical situation. Furthermore, this study has found the baseline for further studies going to be conducted on this discipline.

6 Limitations

The major limitation of this study is the sampled units. For conducting this research sampled units are taken from Dhaka city which is only a representation of an urban area. So, in that case, the findings of this research may be considered as not a proper representation of the rural people. The constraints regarding the budget and time cause this limitation to prevail here.

7 Conclusion

The first focus of this study is to assess the readiness level of the potential telemedicine service users and service providers regarding their technological skill and behavioral intention. From the technical point of view, the physicians show their soundness followed the individuals, whereas behaviorally their intention to use telemedicine looks somewhat demotivated. The second focus of this study is to analyze the relationship of access to technology with the demographic variables of the individuals, whereas gender has proved to be associated with access to technology rather than education level. The third focus of this study is to know whether there is any cause-effect relationship between the skill level of technology usage and behavioral readiness of the individuals. Statistical analysis based on primary data shows the significance of this hypothesized relationship.

Funding The authors are pleased to acknowledge financial support from Fundação para a Ciência e a Tecnologia (grant UID/ECO/04007/2013) and FEDER/COMPETE (POCI-01-0145-FEDER-007659).

Compliance with ethical standards

Conflict of interest Authors (all) declares that we have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Schwab K. The Global Competitiveness Report 2017–18. Geneva: World Economic Forum; 2017.
2. The World Bank. *Country Data*. Retrieved from Bangladesh. 2018; https://data.worldbank.org/country/bangladesh
3. Ministry of Law, People's Republic of Bangladesh. The Constitution of the People's Republic of Bangladesh. 2018. Retrieved from Laws of Bangladesh. http://bdlaws.minlaw.gov.bd/sections_detail.php?id=367&sections_id=24563
4. Center for Policy Dialogue. Bangladesh Vision 2021. Dhaka: CPD; 2007.
5. Rahman L. Digital Bangladesh: Dreams and reality. 2018. Retrieved from The Daily Star: http://www.thedailystar.net/supplements/24th-anniversary-the-daily-star-part-1/digital-bangladesh-dreams-and-reality-73118
6. International Telecommunication Union-ITU. ITU Data of Bangladesh. Retrieved from ICT Development Index 2017. 2018. http://www.itu.int/net4/ITU-D/idi/2017/index.html#idi2017economycard-tab&BGD
7. Baller S, Dutta S, Lanvin B. The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum; 2016.
8. Department of Economic and Social Affairs, United Nations. United Nations E-government Survey 2016: E-government in Support of Sustainable Development. New York: UN; 2016.
9. United Nations-UN. *EGOV-Country Data*. Retrieved from E-government Development Index-Bangladesh. 2018; https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/14-Bangladesh
10. Bangladesh Telecommunication Regulatory Commission-BTRC. Annual Report 2017–18. Dhaka: Ministry of Posts and Telecommunications, Bangladesh; 2018.
11. Directorate General of Health Services. Health Bulletin 2017. Dhaka: Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh; 2018.
12. Bangladesh Bureau of Statistics-BBS. Report on Health and Morbidity Status Survey 2014. Dhaka: Statistics and Informatics Division (SID), Ministry of Planning, Bangladesh; 2015.
13. Ministry of Health and Family Services. eServices. Retrieved from Directorate General of Health Services, Bangladesh. 2018. http://www.dghs.gov.bd/index.php/en/e-health/our-ehealth-eservices
14. Glassman P, Dugoni AA. Teledentistry Improving Oral Health Using Telehealth-Connected Teams. 2016. Retrieved August 21, 2017. from www.pacificspecialcare.org
15. Sachpazidis I. Image and Medical Data Communication Protocols for Telemedicine and Teleradiology (dissertation). Darmstadt: Department of Computer Science, Technical University of Darmstadt; 2008.
16. Sood S, Mbarika V, Jugoo S, Dookhy R, Doarn CR, Prakash N, et al. What Is Telemedicine? A Collection of 104 Peer-Reviewed Perspectives and Theoretical Underpinnings. Telemedicine and e-Health. 2007;13(135):573–90.

17. Saylor M. The Mobile Wave: How Mobile Intelligence Will Change Everything. 1st ed. New York: Perseus Books/Vanguard Press; 2012.
18. Conde JG, De S, Hall RW, Johansen E, Meglan D, Peng GC. Telehealth Innovations in Health Education and Training. Telemedicine and e-Health. 2010;16(1):103–6.
19. a2i. Access to Information (a2i) Program. 2018. Retrieved September 09, 2017, from Union Digital Centers: http://a2i.pmo.gov.bd/content/union-digital-center
20. Mahmud F. Telemedicine: Health Care from Distance. Retrieved from The Independent News. 2018. http://www.theindependentbd.com/printversion/details/74800
21. Prodhan UK, Rahman MZ, Jahan I. Systematic analysis of the Telemedicine Services in Bangladesh. 1ST international conference on advanced information and communication technology 2016 (ICAICT 2016). Chittagong: IEEE; 2017.
22. Gulube SM, Wynchank S. Telemedicine in South Africa: success or failure? J Telemed Telecare. 2001;7(2):47–9.
23. Whitten P, Adams I. Success and failure: a case study of two rural telemedicine projects. J Telemed Telecare. 2003;9(3):125–9.
24. Hjelm NM. Benefits and drawbacks of telemedicine. J Telemed Telecare. 2005;11(2):60–70.
25. Moffatt J. *Barriers to the uptake of telemedicine in Australia – a view from providers*. Queensland: The University of Queensland, School of Medicine; 2011.
26. Strehle E, Shabde N. One hundred years of telemedicine: does this new technology have a place in pediatrics? Arch Dis Child. 2006;91(12):956–9.
27. Demiris G, Oliver D, Porock D, Courtney K. Home telehealth: The Missouri telehospice project: Background and next steps. Missouri: Home Health Care Technology Report; 2004.
28. Jennett P, Jackson A, Healy T, Ho K, Kazanjian A, Woollard R. A study of a rural community's readiness for telehealth. J Telemed Telecare. 2003;9(1):218–23.
29. Lehman W, Greener J, Simpson D. Assessing organizational readiness for Change. J Subst Abus Treat. 2009;22(1):197–209.
30. Jennett P, Gagnon M, Brandstadt H. Preparing for success: Readiness models for rural telehealth. J Postgrad Med. 2005;51(4):279–85.
31. EC. 18 factors to make telemedicine a success. 2014. Retrieved September 13, 2017, from https://ec.europa.eu/digital-single-market/en/news/18-factors-make-telemedicine-success
32. AMD. Keys To A Successful Telemedicine Program. 2017. Retrieved September 13, 2017, from https://www.amdtelemedicine.com/telemedicine-resources/keys-to-successful-telemedicine-program.html
33. Chau PY, Hu PJ-H. Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories. Inf Manag. 2002;39(4):297–311.
34. Perednia D, Allen A. Telemedicine technology and clinical applications. JAMA. 1995;273(6):483–8.
35. Adenuga KI, Iahad NA, Miskon S. Towards reinforcing telemedicine adoption amongst clinicians in Nigeria. Int J Med Inform. 2017;104:84–96.
36. Parasuraman A. Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies. J Serv Res. 2000;2(4):307–20.
37. Hu PJ, Chau PY, Sheng OR. Adoption of Telemedicine Technology by Health Care Organizations: An Exploratory Study. J Organ Comput Electron Commer. 2002;12(3):197–221.
38. Coulthard P, Kazakou I, Koran R, Worthington H. Referral patterns and the referral system for oral surgery care. Part 2: The referral system and telemedicine. Br Dent J. 2000;188(7):388–91.
39. Hung MC, Jen WY. The adoption of mobile health management services: An empirical study. J Med Syst. 2012;36(3):1381–8.
40. Abodunrin O, Akande T. Knowledge and perception of e-health and telemedicine in LAUTECH Teaching Hospital, Osogbo, Nigeria. International Journal of Health. 2009;2(1).
41. Khoja S, Scann RE, Casebeer L, Mohsin M, Ishaq A, Gilani S. e-Health Readiness Assessment Tools for Healthcare Institutions in Developing Countries. Telemedicine and e-health. 2007a;13(4):425–31.
42. Khoja S, Scott R, Ishaq A, Mohsin M. eHealth International Journal. Testing the Reliability of eHealth Readiness Assessment Tools For Developing Countries. eHealth International Journal. 2007b;13(1):425–32.
43. Giuse DA, Kuhn KA. Health information systems challenges: the Heidelberg conference and the future. Int J Med Inform. 2003;69(2–3):105–14.
44. Berg M. Patient care information systems and health care work: a sociotechnical approach. Int J Med Inform. 1999;55:87–101.
45. Bauer J, Brown W. The digital transformation of oral health care. Teledentistry and Electronic Commerce. 2001;132(2):204–9.
46. Dupare R, Kuamr P, Datta S, Dupare A. Tele Dentsitry in Dental Eduaction: A Futuristic Appoch. Indian Journal of Dental Eduaction. 2012;5(4):197–203.
47. Chen J, Hobdell M, Dunn K, Zhang J. Tele Dentistry and its use in dental eduation. J Am Dent Assoc. 2003;134(1):342–6.
48. Mihailovic B, Mihailovic M, Vujicic B. Telemedicine in Teledentistry. In: Graschew G, Roelofs T, editors. Advances in Telemedicine: Application in various medical disciplines. Rijeka: InTech; 2011. p. 215–30.
49. Golder D, Brennan K. Practicing Tele Dentistry in the age of telemedicine. J Am Dnet Assoc. 2000;131(1):734–44.
50. Lehman W, Greener J, Simpson DD. Assessing organizational readiness for change. J Subst Abus Treat. 2002;22(1):197–209.
51. Zailani S, Mina Sayyah Gilani DN, Iranmanesh M. Determinants of telemedicine acceptance in selected public hospitals in Malaysia: Clinical Perspective. J Med Syst. 2014;38:111.
52. Khatun F, Heywood AE, Ray PK, Bhuiya A, Liaw ST. Community readiness for adopting mHealth in rural Bangladesh: a qualitative exploration. Int J Med Inform. 2016;93:49–56.
53. Gurupur V, Shettian K, Xu P, Hines S, Desselles M, Dhawan M, et al. Identifying the readiness of patients in implementing telemedicine in northern Louisiana for an oncology practice. Health Informatics Journal. 2017;23(3):181–96.
54. Mucheneh O. Assessing the Level of Readiness for Computerized Health Management Information System Among Nurses in Kenyatta National Hospital, Nairobi, Kenya. Nairobi: Kenyatta University; 2014.
55. Sultana R, Imtiaz A. Gender Difference in Internet Usage Pattern: A Study on University Students of Bangladesh. Scholars Journal of Economics, Business and Management (SJEBM). 2018;5(5):413–21.
56. Agarwal R, Prasad J. Are individual differences germane to the acceptance of new information technologies? Decis Sci. 1999;30(2):361–91.
57. Cleland J, Caldow J, Ryan D. A qualitative study of the attitudes of patients and staff to the use of mobile phone technology for recording and gathering asthma data. J Telemed Telecare. 2007;13(2):85–9.
58. Bostock Y, Hanley J, McGown D, Pinnock H, Padfield P, McKinstry B. The acceptability to patients and professionals of remote blood pressure monitoring using mobile phones. Primary Healthcare Research & Development. 2009;10(4):299–308.
59. Seto E, Leonard KJ, Masino C, Cafazzo JA, Barnsley J, Ross HJ. Attitudes of heart failure patients and health care providers towards mobile phone-based remote monitoring. J Med Internet Res. 2010;12(4).
60. Vatnoy TK, Thygesen E, Dale B. Telemedicine to support coping resources in home-living patients diagnosed with chronic obstructive pulmonary disease: Patients' experiences. J Telemed Telecare. 2017;23(1):126–32.

61. Silva BM, Rodrigues JJ, da la Torre Diaz I, Lopez-Coronado M, Saleem K. Mobile-health: A review of the current state in 2015. J Biomed Inform. 2015;56:265–72.
62. Hebert MA, Paquin MJ, Iversen S. Predicting success: stakeholder readiness for home telecare diabetic support. J Telemed Telecare. 2002;8(3):33–6.
63. Melton L, Brewer B, Kolva E, Joshi T, Bunch M. Increasing access to care for young adults with cancer: Results of the quality-improvement project using a novel telemedicine approach group psychotherapy. Palliative & Supportive Care. 2017;15(2):176–80.
64. Akter S, D'Ambra J, Ray P. Service quality of mHealth platforms: development and validation of a hierarchical model using PLS. Electron Mark. 2010;20(3):209–27.
65. Sorwar G, Rahman MM, Uddin R, Hoque MR. Cost and time effectiveness analysis of a telemedicine service in Bangladesh. Studies in Health Technology and Informatics. 2016;2(31):127–34.
66. Peel E, Douglas M, Lawton J. Self-monitoring of blood glucose in type 2 diabetes: a longitudinal qualitative study of patients' perspectives. BMJ. 2007;335(7618):493.
67. Khatun F, Heywood AE, Ray PK, Hanifi SM, Bhuiya A, Liaw ST. Determinants of readiness to adopt mHealth in a rural community of Bangladesh. Int J Med Inform. 2015;84(10):847–56.
68. Kiberu VM, Scott RE, Mars M. Assessment of health provider readiness for telemedicine services in Uganda. Health Information Management Journal. 2019;48(1):33–41.
69. Lin JSC, Chang HC. The role of technology readiness in self-service technology acceptance. Managing Service Quality: An International Journal. 2011;21(4):424–44.
70. Gholamhosseini L, Ayatollahi H. The design and application of an e-health readiness assessment tool. Health Information Management Journal. 2017;46(1):32–41.
71. Kgasi M, Kalema B. Assessment E-health readiness for rural South African areas. Journal of Industrial and Intelligent Information. 2014;2(2).
72. Ajami S, Bagheri-Tadi T. Barriers for adopting electronic health records (EHRs) by physicians. Acta Informatica Medica. 2013;21(2):129.
73. Biruk S, Yilma T, Andualem M, Tilahun B. Health Professionals' readiness to implement electronic medical record system at three hospitals in Ethiopia: a cross sectional study. BMC Medical Informatics and Decision Making. 2014;14(1):115.
74. Mannan R, Murphy J, Jones M. Is primary care ready to embrace e-health? A qualitative study of staff in a London primary care trust. Journal of Innovation in Health Informatics. 2006;14(2):121–31.
75. Hebert MA, Korabek B. Stakeholder readiness for telehomecare: implications for implementation. Telemed J E Health. 2004;10(1):85–92.
76. Cranen K, Veld RHIT, Ijzerman M, Vollenbroek-Hutten M. Change of patients' perceptions of telemedicine after brief use. Telemedicine and e-Health. 2011;17(7):530–5.
77. Hair JF Jr, Hult GM, Ringle CM, Sarstedt M. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks: SAGE Publications, Inc; 2014.