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Factors influencing e-Health service in regional Bangladesh

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ABSTRACT

Objectives: This study probed the current status of e-health services use and associated factors that promote or hinder the people to get involved with e-health services.

Methods: The quantitative data were collected using a structured interview schedule considering 381 randomly selected respondents covering rural and urban areas of Patuakhali, Jhalakathi, and Barishal district during February–April 2019. Only the adult (more than 18 years age) male, female, and transgender people living in the study area were included in the sample of the study. Descriptive statistics, Chi-square test, and binary logistic regression were used to analyze data.

Results: Factors that significantly increased the likelihood of using e-health services included age (odds ratio [OR] = 1.05, 95% confidence interval [CI]:1.02–1.08), males (OR = 3.75, 95% CI: 1.70–8.26), knowledge in e-health (OR = 1.19, 95% CI: 1.02–1.38), and skill in using cell phone (OR = 1.11, 95% CI: 1.02–1.21). On the contrary, factor that negatively influenced the use of e-health services was residence in the rural area (OR = 0.209, 95% CI: 0.08–0.53). Although, this research is one of the few regional researches in e-health service use, the study has limited geographical coverage, failed to explore causality of factors, and did not address factors mediating the relationship of criterion and predictor variables.

Conclusion: Regional e-health service providers in developing countries need to focus more on minimizing e-health service divide based on gender and place of residence. In addition, they should also emphasize digital literacy, particularly e-health knowledge and skill in device use. The findings of this study may provide an applied guideline to enhance the use of e-health services among regional communities in developing countries.

Keywords: Coastal region, e-health, factors, regional Bangladesh, use

Introduction

At present, there are about 157 million mobile users in Bangladesh[1] creating an immense potential for establishing a standard Information Communication Technology (ICT)-based health-care service delivery system, which is also called e-Health. There are various reasons that e-health services can evolve and be popular in this country and can play a pivotal role in the improvement of the public health services. First, Bangladesh is a developing country which has a stringent shortage of workforce in the health sector. An estimate of the Ministry of Health and Family Welfare showed that there are 3.05 physicians and 1.07 nurses/10,000 populations.[2] Second, a substantial spatial variation of workforce distribution is also visible in the country with a high concentration in the urban areas. As explained by the World Health Organization, Bangladesh has shortage of human resources for health and it is also geographically maldistributed.[3] Moreover, the possibilities for receiving quality health services for rural people, composed 70% of the total population in Bangladesh, are further impeded by the health workers tendency to concentrate in urban secondary and tertiary hospitals.[3]

Health service, when delivered or enhanced through internet or related technologies, is termed as e-health.[4] With the rapid advancement of ICT, innovation and integration of ICT applications in health services, e-health has been given great attention around the world since the past few years.[5] E-health services have seen evolving tremendously with solutions such as easy accessibility, easy surveillance, conducive service cost, and quality in delivering health-care services.[6,7] Such services can be applied for better management of pregnant mothers,[8] mother and child health care, HIV/AIDS, malaria, tuberculosis,[9] improved care of patients with chronic illness,[10]

smoking cessation,[11] diabetes care,[12] physical activity,[13] nutrition,[14] weight loss,[15] and a more effective use of personal health records.[16] However, implementation of an effective e-health service in developing countries is often hindered by poor infrastructure, lack of basic ICT knowledge and skills, limited internet accessibility, financial and sustainability issues, and threat to privacy and/or security of electronic records.[17-19]

A host of other factors related to demographic characteristics,[20] education level,[21] patient's e-health knowledge,[22] ICT device use skill,[23] and location of residence[24] can profoundly affect the use and acceptance of e-health services. Studies in Bangladesh on acceptance and compliance to e-health services revealed age, gender, and education as influencing factor.[21,25] Factors such as monthly income and location of residence are also considered as potential determinants in shaping the use e-health services.[26] E-health literacy emerged as a strong predicament to the acceptance of e-health services in developing and low-income countries.[22,27] In ICT-aided health services, patients are often expected to check test results and perform other health-related tasks online, hence lack the digital skills needed to navigate a health portal found it difficult to use ICT-based health services.[28] Studies conducted in varied geographical locations speculated that digital literacy can crucially affect patients to adopt the ICT-aided medical services, where patients with low digital literacy found it struggling to use online health services without assistance.[29-31]

Despite the widespread development and prosperity, the use of e-health service is still very low among the residents of Bangladesh.[32,33] In fact, in developing countries, e-health is comparatively new technology. Therefore, the success of the e-health system highly depends on the end user's acceptance. Deplorably, most of the e-health studies focus on the information technology infrastructure development and establishment, where as it is equally important to reveal the factors that influence users in adopting the system.[22] Hence, this research was designed to reveal the use of e-health services and associated factors among people in a selected region of Bangladesh with the following objectives:

1. To reveal the present status of the use of e-health services in a selected region of Bangladesh
2. To find out the reasons behind using e-health services
3. To explore the factors, determine respondent's use of e-health services in the study area.

Methodology

Study locale

This study was carried out in three purposefully selected upazilas (subdistricts), namely, Barishal Sadar, Dumki, and Nalchity. These three upazilas are belonging to three different districts called Barishal, Patuakhali, and Jhalakathi. All the selected districts are under Barishal Division of Bangladesh [Figure 1]. It is important to note that Bangladesh

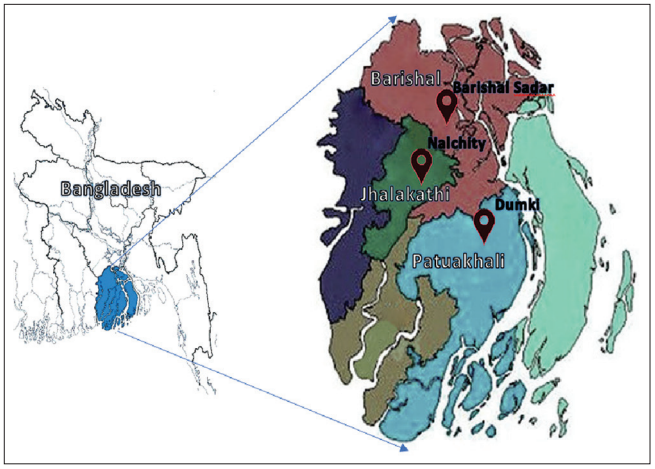

Figure 1: Map of the study area

is divided into nine divisions. Barishal is a coastal division composed of six districts and the total population reside in this division is 8,325,666.[34] The economy of Barishal is mainly based on fishing and wetland rice cultivation and has a very low contribution to GDP in transportation, storage and communication.[35] Despite the presence of a substantial number of cell phone users, the subscriber of internet service is low in Barishal and the public health service is suffering from a stringent shortage of workforce with 67% vacant posts in government medical services in different districts, upazilas, and unions.[36] However, to ensure inclusion of diversified respondents, this study included both urban and rural respondents. For instance, Barishal Sadar is a divisional city, whereas Dumki and Nalchity are rural areas.

Population and sampling

The population of this research included potential users of e-health services residing in in the study area. All the adult (more than 18 years age) male, female, and transgender people living in the study area composed the population of the research. The sample of the research was selected randomly following voter list collected from the concerned Union Parishad or Ward Councilor's Office. The total number of voters living in these selected villages and words was 14,243, which constitutes the population of the study. At 95% confidence interval (CI) and 5% margin of error, the required sample size was 375. However, this study considered 381 randomly selected respondents as the sample of the study, which is proportionately determined from the selected villages (Dapdapiya and Vorotkathi from Nalchity subdistrict; Srirumpur and Dumki from Dumki sub-district) and wards (20 and 21 from Barishal city).

Data collecting instrument and study variables

Data were collected by trained interviewers using a structured interview schedule in a face-to-face setting. Before the interviews, each respondent was informed about the study aims and objectives and ensured about the confidentiality of

the data. They were also informed that their participation in this interview will be regarded as the written consent to appear the interview. The interview schedule was finalized after pre-test on 20 similar respondents in Dumki upazila under Patuakhali District. The reliability of the questionnaire was checked through split-half method and significant correlation was found among the variables. Use of e-health service was measured based on a dichotomous response (Yes = 1 and No = 0), while events of using e-health service were measured through open form questions in the interview schedule. However, the predictor variables of the study were measured based on appropriate scales.

Statistical analysis

Data collected in this research are described and analyzed by deploying descriptive statistics such as mean, and standard deviation, Chi-square (χ^2) test, and logistic regression analysis. The logit model considered age, gender, education, family income, marital status, place of residence, ownership of cell phone, type of cell phone, knowledge in e-health service, and skill in using cell phone, etc., as the predictor variables. All statistical analyses were performed through SPSS 23.0 software package.

Results and Discussion

Sociodemographic characteristics of the respondents

Data presented in Table 1 show that the average age of the respondents was about 40.97 years and a little less than half (49.3%) of them were female. A monumental shares (85.3%) of the responds were married and had an average education up to almost class 10 and more than half (57.7%) of the respondents were from villages. Regarding the annual income, 56% of the respondents had earning equivalent to or <150,000 Tk. In case of cell phone use, 82% used cell phone and 37% used smartphone. However, a detail of the other variables considered in this research can be observed from Table 1.

Status of e-health service use

The pie graph in Figure 2 is showing that among the total respondents, 15% used e-health services. The same graph further displays that only 3% of the users regularly used e-health services meaning that whenever they or their family members feel ill, they sought for e-health service, while the rest 11% seek e-health services rarely to occasionally.

Data on the events of using e-health services reveal that majority of the respondents seek e-health service for general sickness. The other events in rank order were sudden sickness, to fix appointment with physicians, pregnancy-related suggestions, menstrual problems, eye problem, fever, and calling ambulance.

Table 1: Sociodemographic characteristics of the respondents (n=381)

Variable	Mean	Standard deviation
Age	40.97	15.49
Education	10.04	5.31
Skill in cell phone use	7	7.1
Knowledge on e-health	2.3	2.73
Gender	Female = 188 (49.3%)*	
	Male = 193 (50.7%)	
Marital status	Married = 325 (85.3%)	
	Unmarried = 56 (14.7%)	
Residence	Village = 220 (57.7%)	
	City = 161 (42.3%)	
Income	<50,000 Tk = 95 (24.9%)	
	50,001–100,000 = 56 (14.7%)	
	100,001–150,000 = 63 (16.5%)	
	150,001–200,000 = 56 (14.7%)	
	>200,000 = 111 (29.1%)	
Own cell phone	Yes = 312 (81.9%)	
	No = 69 (18.1%)	
Cell phone type	Smartphone = 141 (37%);	
	Others = 240 (63%)	

1 USD= 85.76 TK (26.08.2020); *frequency (%)

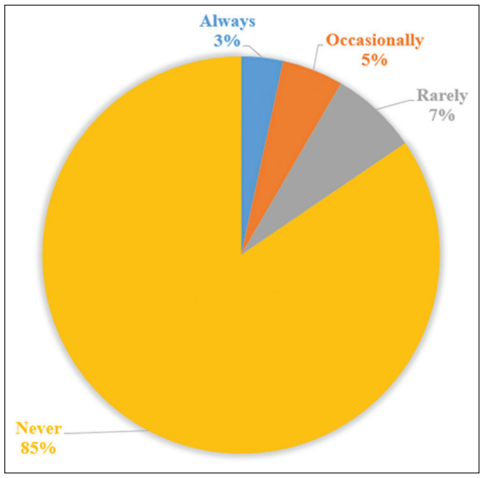

Figure 2: Pie graph showing use and regularity of e-health service use

Relationship between use of e-health and participant's characteristics

Table 2 displays the relationship between the respondent's use of e-health and the predictor variables. Characteristics, such as education ($P < 0.001$), family annual income ($P < 0.01$) residence ($P < 0.001$), cell phone ownership ($P < 0.001$), cell phone type ($P < 0.001$), knowledge on e-health ($P < 0.001$), and skill in using cell phone ($P < 0.001$), represented significant association with the use of e-health service.

Factors influencing the use of e-health service

Using e-health service was a dichotomous variable having binary response yes or no, hence the determinants of the use of e-health service are identified by logistic regression. The predictor variables were age, gender, education level, marital status, location of residence, use mobile phone, type of mobile phone, skill in using mobile phone, and knowledge in e-health. A test of the full model versus a model with intercept only was statistically significant χ^2 (8, n = 381) = 124.25, $P < 0.001$, and the model was able to correctly classify 95.6% of those who did not use e-health services and 47.6% of those, who use e-health service, for an overall success rate of 87.7%.

Table 3 shows the logistic regression coefficient, odds ratio (OR), 95% CI, and level of significance for each of the predictors. Employing a 0.05 criterion of statistical significance age, gender, residence, knowledge in e-health service, and skill in using cell phone had significant partial effects on the use of e-health service. The ORs (column 3 of Table 3) indicate that when holding all the other variables constant possibility of using e-health service will increase with the increase of age of respondents. It is further mirrored from Table 3 that if all the other variables remain constant, men are 3.75 times more likely to use e-health service compared to women. Inverting the odd of the location of residence indicates that when holding all the other variables constant people residing in urban areas have 5 times more chances to use e-health service than the respondents from rural areas. In case of knowledge in e-health service, 1-point increase in the knowledge in e-health service is associated with odds of using e-health service by a multiplicative factor of 2.18. Similarly, when comes skill in using cell phone, 1-point increase in the skill of using cell phone being associated with odds of using e-health service by a multiplicative factor of 1.116.

Discussion

This study aimed to examine the use and associated factors affecting the use of e-health services in regional Bangladesh and found that only 15% of the respondents used e-health services in a varied degree, which epitomize a very low use of e-health service among the participants. In fact, the introduction of e-health is a new phenomenon in the developing countries,[37] hence, a majority of physicians as well as patients till now are not very aware, skilled, and habituated to this service. A research also claimed that in low- and middle-income countries, the e-health field is still nascent.[38] Moreover, a supportive online-based infrastructure, such as patient's digital record, access to internet, pathological test reports, good quality image, and video processing, is necessary to find appropriate treatment, which is mostly non-existent in developing countries as well as in Bangladesh.[39]

The use of e-health services showed an increase with the increase of the age of the respondents. Approving our findings

Table 2: Relationship between e-health use and participant's characteristics (n=381)

Characteristics	Use of e-health service (s)			*P*-value*
	No, *n* (%)	Yes, *n* (%)	Total, *n* (%)	
Age				
<30	84 (26.42)	18 (28.57)	102 (26.77)	0.939
30–45	121 (38.05)	25 (39.68)	146 (38.32)	
46–60	70 (22.01)	13 (20.63)	83 (21.78)	
>60	43 (13.52)	7 (11.11)	50 (13.12)	
Gender				
Male	157 (49.37)	36 (57.14)	193 (50.65)	0.273
Female	161 (50.62)	27 (42.85)	188 (49.34)	
Education				
Illiterate	23 (7.23)	1 (1.58)	24 (6.29)	<0.001
Primary	87 (27.35)	2 (3.17)	89 (23.35)	
Secondary	100 (31.44)	8 (12.69)	108 (28.34)	
Higher secondary	33 (10.37)	16 (25.39)	49 (12.86)	
Graduate and above	75 (23.58)	36 (57.14)	111 (29.13)	
Family annual income (Tk)				
<50,000	49 (15.40)	7 (11.11)	56 (14.69)	0.001
50,001–100,000	88 (27.67)	7 (11.11)	95 (24.93)	
100,001–150,000	56 (14.69)	7 (11.11)	63 (16.53)	
150,001–200,000	45 (11.81)	11 (17.46)	56 (14.69)	
>200,000	80 (20.99)	31 (49.20)	111 (29.13)	
Marital status				
Married	273 (85.84)	52 (82.53)	325 (85.30)	0.498
Unmarried	45 (14.15)	11 (17.46)	56 (14.69)	
Residence				
Urban	107 (33.64)	54 (85.71)	161 (42.25)	<0.001
Rural	211 (66.35)	9 (14.28)	220 (57.74)	
Cell phone use				
Yes	250 (78.61)	62 (98.41)	312 (81.88)	<0.001
No	68 (21.38)	1 (1.58)	69 (18.11)	
Cell phone type				
Smart	227 (71.38)	13 (20.63)	240 (62.99)	<0.001
Others	91 (28.61)	50 (79.36)	141 (37.00)	
Knowledge on e-health				
None	127 (39.93)	11 (17.46)	138 (36.22)	<0.001
Low	130 (40.88)	8 (12.69)	138 (36.22)	
Moderate	36 (9.44)	20 (31.74)	56 (14.69)	
High	25 (6.56)	24 (38.09)	49 (12.86)	
Skill in using cell phone				
Low or no skill	215 (67.61)	13 (20.63)	228 (59.84)	<0.001
Moderate skill	51 (16.03)	15 (23.80)	66 (17.32)	
High skill	52 (13.64)	35 (55.55)	87 (22.83)	

*P values are derived through Chi-square tests

Table 3: Factors influencing the use of e-health service in regional Bangladesh (*n*=381)

Characteristics	COEF.	OR	95% CI	*P*	Result
Age	0.05	1.05	1.02–1.08	0.001	Supported
Gender					
Male	1.32	3.75	1.70–8.26	0.001	Supported
Female (Ref)		1.0			
Education	0.03	1.03	0.93–1.15	0.580	Not supported
Family annual income (Tk)					
<50,000	0.64	1.90	0.59	6.14	Not supported
50,001–100,000	0.66	1.93	0.58	6.44	
100,001–150,000	0.33	1.38	0.44	4.39	
150,001–200,000	−0.01	0.10	0.38	2.63	
>200,000 (Ref)		1.0			
Residence					
Rural	-1.57	0.209	0.08-0.53	0.001	Supported
Urban (Ref)		1.0			
Cell phone use					
Yes	1.60	4.94	0.57-42.61	0.147	Not supported
No (ref)		1.0			
Cell phone type					
Smart	0.78	2.18	0.68-6.95	0.188	Not supported
Others (ref)	1.0				
Knowledge on e-health	0.18	1.19	1.02-1.38	0.023	Supported
Skill in using cell phone	0.11	1.11	1.02-1.21	0.011	Supported
Constant	-7.79	1.12		0.000	
Observation (*n*)	381				
Cox-Snell R-square (%)	27.80				
Likelihood ratio static	124.25***				
Hosmer Lemeshow static (*P*-value)	3.67 (0.886)				
Mean VIF (Max)	2.01 (4.14)				

OR: Odds ratio, CI: Confidence interval

studies also found that middle-aged population had more tendencies to access e-health services compared to young participants.[30,40] A recent study in Bangladesh also revealed that acceptance of e-health services significantly increased with the increase of age.[23] In fact, non-communicable diseases also known as chronic diseases, such as heart attacks, strokes, cancers, chronic respiratory diseases, and diabetes, are often associated with older age groups.[41] Thus, necessity of information on disease risk factors, medical suggestions, treatment process and doctor appointment, renting emergency medical equipment, etc., are more for aged people.

Gender of the respondents evolved as a decisive factor in shaping e-health service use, where male showed significantly more use e-health services compared to women. In line with this finding, a study focusing acceptance of e-health services in Bangladesh also found that males are more likely to accept e-health services compare to women.[25] Another study conducted in different countries of Africa and Asia claimed that women were lagging behind men in terms use of m-health services.[42] Actually, a myriad of sociocultural factors related to institutional, economic, cultural, and educational barriers negatively impinge on women physical well-being along with their access to appropriate health-care services in developing countries.[43] Moreover, women are comparatively more passive than men in relation to adventure, exploring new things, and adopting technologies.[44] A wide range survey in Bangladesh also revealed that compared to men, women are less likely to own mobile phone and less aware of available health services.[45]

Place of residence has emerged as a crucial factor in the use of e-health services, where rural people represented a remarkably low use of e-health services. Several other studies also revealed that people residing in rural areas are less interested to access e-health service than their urban counterpart.[30,40] In Bangladesh, there is a wide gap between rural and urban areas in terms of cell phone usage, accessibility, and internet penetration. A survey covering different words and villages in majority districts of Bangladesh revealed conspicuous digital divine between urban and rural areas where rural dwellers are lagging behind in terms of the use of cell phone, internet, social media, and other platforms.[46] This spatial digital divine may be the cause of e-health use difference between rural and urban areas.

Knowledge on e-health positively significantly influences the use of e-health services. In the previous studies, a similar relationship was revealed where knowledge on e-health service and possible options significantly influence the use of e-health service and acceptance of e-prescription.[47,22] E-health literacy is the knowledge that maximizes the ability of the patient's to obtain, process, and understand basic e-health information and services needed to make appropriate health decisions.[48] If people do not know what the technology can offer they might not adopt the technology.[49] Therefore, e-health literacy can trigger the future adoption of e-health services.[50]

Participant's having low skill in using cell phone represents significantly lower use of e-health services. Approving this finding, another study showed that digital literacy can crucially affect patients to adopt the ICT aided medical services, where patients with low digital literacy found it struggling to use online health services without assistance.[30] Similarly, other two separate studies in Australia and Greece also identified

digital literacy as crucial contributor to e-health access and use.[31,32] Adequate digital literacy aids widespread anytime access to e-health service. Therefore, without digital literacy, a person may not be able to access, interpret, and respond to e-health services.

The policy recommendation from this research indicates that there was a wide spatial variation in the use of e-health service, where urban people represented significantly more use of e-health services compared to the people living in the rural areas. It is, therefore, essential to launch special policy for inclusion of rural people with e-health services. Gender biased inclusion policy is also essential as women represented a lower use of e-health services in the study area. Policies must also focus on e-health education which is a key driver of e-health service use. Since cell phone use skill emerged as a decisive factor in determining the use of e-health services, policies must identify pathways to develop the skill of individuals in using cell phones for e-health services.

This study contributes to the current literature in several ways. This research is one of the few regional researches in e-health services use, which is very crucial for place-based strategic planning.[51] Moreover, the present study sheds lights on the determinants of the use of e-health services in a remote area of Bangladesh situated in the coastal zone. Along with specific significance, this research also recognizes some limitation in the research design. First, the small geographical coverage may crate obstacle in drawing generalized conclusions. Second, due to its cross-sectional design, this study failed to explore the causality of factors. Similarly, the factors supposed to moderate or mediate the significant relationships between the predictor and criterion variables were not addressed.

Conclusion

Acute shortage and maldistribution of workforce, particularly physicians and nurses in the health sector of Bangladesh, are impeding people's access to health services in different regions. In this context, well-structured and easily accessible e-health service system can be a decisive option to overcome this limitation to a large extent and can ensure people access to quality health services regardless of geographical location. This study endeavors to reveal the present status of e-health services use and contributing factors in regional Bangladesh and found age, gender, place of residence, knowledge on e-health, and skill in using the cell phone as the most significantly influential factors. Thus, regional e-health service providers in developing countries intend to provide e-health services in a particular region need to focus more on minimizing e-health service divide based on gender and place of residence. In addition, they also need to focus on digital literacy, particularly on e-health knowledge and skill in device use.

The findings of this study may provide an applied guideline to enhance the use of e-health services among regional communities in developing countries. E-health service providers, physicians, and technology developer may gain a better understanding of the end users, which, in turn, will assist them to device appropriate strategies in designing and implementing effective and successful e-health services.

Author's Declaration Statements

Ethics approval and consent to participate

This research was approved by the Research Ethics Committee of Patuakhali Science and Technology University (Ref: PSTU/IEC/2018/3, Date: July 1, 2018) and written consent of each participant was ensured before the interview.

Availability of data and material

Authors are ready to share data and materials on request**.**

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Authors' Contributions

This study was evolved from an original idea of MIS and MMUR. Both the authors contributed to study design. MIS collected and analyzed data and wrote the first draft. MMUR guided all the stages of research and preparation of the manuscript.

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