

# BMJ Open Knowledge, attitudes and intention regarding mHealth in generation Y: evidence from a population based cross sectional study in Chakaria, Bangladesh

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## ABSTRACT

**Background and objectives** mHealth offers a new opportunity to ensure access to qualified healthcare providers. Therefore, to better understand its potential in Bangladesh, it is important to understand how young people use mobile phones for healthcare. Here we examine the knowledge, attitudes and intentions to use mHealth services among young population.

**Design** Population based cross sectional household survey.

**Setting and participants** A total of 4909 respondents, aged 18 years and above, under the Chakaria Health and Demographic Surveillance System (HDSS) area, were interviewed during the period November 2012 to April 2013.

**Methods** Participants younger than 30 years of age were defined as young (or generation Y). To examine the level of knowledge about and intention towards mHealth services in generation Y compared with their older counterparts, the percentage of the respective outcome measure from a 2×2 contingency table and adjusted odds ratio (aOR), which controls for potential confounders such as mobile ownership, sex, education, occupation and socioeconomic status, were estimated. The aOR was estimated using both the Cochran–Mantel–Haenszel approach and multivariable logistic regression models controlling for confounders.

**Results** Generation Y had significantly greater access to mobile phones (50%vs40%) and better knowledge about its use for healthcare (37.8%vs27.5%;aOR 1.6 (95% CI 1.3 to 2.0)). Furthermore, the level of knowledge about two existing mHealth services in generation Y was significantly higher compared with their older counterparts, with aOR values of 3.2 (95% CI 2.6 to 5.5) and 1.5 (95% CI 1.1 to 1.8), respectively. Similarly, generation Y showed significantly greater intention towards future use of mHealth services compared with their older counterparts (aOR 1.3 (95% CI 1.1 to 1.4)). The observed associations were not modified by sociodemographic factors.

**Conclusion** There is a greater potential for mHealth services in the future among young people compared with older age groups. However, given the low overall use of mHealth, appropriate policy measures need to be formulated to enhance availability, access, utilisation and effectiveness of mHealth services.

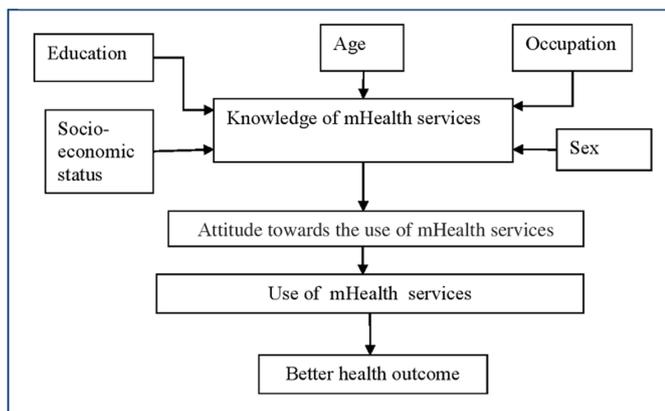
## Strengths and limitations of this study

- The size of the data used in this study is large and hence the results based on this dataset are expected to be reliable.
- Data were of high quality as they were collected as part of a regular health and demographic surveillance system by an expert team consisting of highly trained interviewers with strong supervision for quality control.
- No causal inference can be made because the study was based on a cross sectional survey.
- As the study was limited to respondents from a rural district in Bangladesh, findings cannot be generalised for urban areas because of differences between urban and rural areas.

## INTRODUCTION

In Bangladesh, there is a serious shortage of qualified medical health service provider,<sup>1 2</sup> and the majority of qualified healthcare providers are located in urban areas where only 20% of the population live.<sup>2</sup> Therefore, health services for rural populations depend on informal healthcare providers, such as so called village doctors, who make their living by selling drugs. Receiving treatment from informal healthcare providers often complicates patients' health conditions because they prescribe excess and inappropriate drugs.<sup>3 4</sup>

Given the shortage of qualified medical workers and their tendency to be concentrated in urban areas, access to quality health services for rural populations is limited. Under these conditions, mobile phone connectivity offers a new opportunity to link qualified healthcare professionals to the general population,<sup>5 6</sup> specially those living in remote areas. mHealth services have great potential to provide information



**Figure 1** Flowchart showing a conceptual framework on how knowledge of, and attitude towards mHealth services influence health outcome.

regarding healthy lifestyles to mHealth users.<sup>7</sup> Similarly, it is useful to healthcare providers to allow patients to make informed decisions by providing easy access to health information, which was not possible in the past.<sup>8,9</sup> In addition, increased use of mobile phone technology has great potential to reduce healthcare costs, ensure easy access to the healthcare system and promote prevention through behaviour change.<sup>10,11</sup>

There have been many successful examples of using mobile phones for healthcare in both low and high income countries: example includes 'My NM's Mychart App', developed by the North Western Medicine group of North Western University, and 'ASHA apps', developed by Accredited Social Health Activists (ASHA) under the 'ReMiND project' of Catholic Relief Services in Uttar Pradesh, India.<sup>7,12</sup> A recent review of the growth of mHealth services in Bangladesh documented 19 initiatives involving mHealth services, including a commercial health hotline, a health programme by the Ministry of Health and Family Welfare and non-governmental organisations, and research projects.<sup>13-15</sup> In addition, the government of Bangladesh is promoting the use of mobile phones in many sectors, including healthcare, as part of the 'Digital Bangladesh' vision by 2021. Given the potential of mobile phone technology in providing healthcare services, utilisation and uptake of mHealth services in the near future will depend on their availability and accessibility, and awareness.<sup>16-18</sup>

Figure 1 describes a conceptual framework on how the background characteristics of the general population are associated with knowledge and attitude towards mobile phone technology and mHealth services. A high level of knowledge about mHealth services and greater access to mobile phones would suggest optimism regarding the use of mobile phones for healthcare in the future, which may result in better health facilities given the shortage of qualified healthcare providers (figure 1). Similarly, the intention to use mHealth services in the future is another indicator of the future demand for mHealth use. It is also evident from a recent study<sup>16</sup> that knowledge of, and attitude towards, mHealth services varied

by level of education, occupation, age, sex and socioeconomic status. Therefore, to understand the potential of mHealth services in Bangladesh, it is necessary to understand the level of knowledge of, and attitude towards, mobile phone technology and mHealth services among the pro-technology generation (known as 'generation Y' or 'millennials').<sup>19-21</sup>

Generation Y refers to individuals who were born between the early 1980s and early 2000s.<sup>19,21</sup> Bangladesh is a developing country with 160 million people, of whom almost 35% are accounted for by generation Y.<sup>22</sup> Like other developed nations, generation Y in Bangladesh have an intuitive understanding of information and communication technology (ICT) beginning in childhood because of the environment in which they grew up.<sup>23-25</sup> With the rapid proliferation of mobile phones and the internet, in both developed and developing countries, generation Y is more likely to find technology useful, be at ease about using it and find the use of technology a norm among their peers compared with older generations.<sup>23-25</sup>

However, limited research has been conducted on the level of knowledge and patterns of mobile phone use for healthcare among generation Y in developing countries, including Bangladesh. Hence, we examined the level of knowledge about, attitudes towards and intention to use mHealth services among generation Y compared with older age groups using data from a survey carried out in Chakaria, a rural area of Bangladesh. The findings are likely to help facilitate the process whereby potential synergy between the pro-technology younger generation and potential of mHealth can be harnessed.

## METHODS AND MATERIALS

### Study area

The study was carried out in eight unions of Chakaria Upazilla (sub-district), under Cox's Bazar district in the south east coastal area of Bangladesh, where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been running a Health and Demographic Surveillance System (HDSS) since 1999.<sup>26</sup> Chakaria is a relatively low performing area in terms of health and development indicators compared with areas in the central and western parts of the country.<sup>27</sup> The availability of health services in the area is typical of other rural areas with public and private healthcare services, with a very strong presence of informal healthcare providers (almost 10 times that of formal healthcare providers).<sup>28</sup> The private and public healthcare services are provided by physicians, nurses and community based medical assistance, such as sub-assistant community medical officer, community healthcare provider and medical assistant. Of them, only physicians have formal medical graduation (MBBS-Bachelor of Medicine, Bachelor of Surgery) while the others received formal training on medical short courses. The informal healthcare providers are so called village doctors, most of whom have no formal medical training

except school level general education and are basically drug sellers.<sup>3</sup> At the initial stage of the disease, people usually contact village doctors for consultation. Village doctors provide treatment and counselling if they think that the disease is not severe and refer to hospitals or physicians in emergency situations.

In addition, the ICDDR,B has been working with a selected number of communities since 1994, mainly in the area of primary healthcare, with direct involvement in running six village health posts established and managed by the community. ICDDR,B healthcare providers have been available for consultations by mobile phone for the past 10 years. More details on the existing health services in Chakaria have been published elsewhere.<sup>26–29–31</sup> As reported by Khatun *et al*,<sup>16</sup> the rate of using such mHealth services is still very low, despite very cheap call rate (less than 1 BDT per minute) in Bangladesh. However, the hope is that a significant per cent of people intend to use mHealth services in the future because of the low costs, time saved and instant treatment.

### Sampling design

A total of 62 459 household members aged 18 years and above living in 20 124 households in Chakaria HDSS area in November 2012 formed the sampling population for the survey. The survey was conducted independently of the regular HDSS but the HDSS was used as a sampling frame for the study. The sample size was calculated separately for this survey using the following steps. As the distribution of the population by both age and sex is unequal<sup>26</sup> and we wanted statistically reliable estimates for both men and women, a stratified sampling scheme with proportional allocation was used to determine the sample size of the survey. Stratification was done by separating men and women based on the age groups 18–29 years, 30–39 years, 40–49 years and 50 years and above. In the absence of any data on knowledge level regarding telephone based consultation services, a value of 50% was used to calculate sample size separately for men and women for each of the age groups to ensure a reliable estimate of the proportion of respondents with knowledge, using the services, and with a positive attitude towards mHealth (95% CI). This gave 384 (approximately 400) samples for each group (combination of men and age group or women and age group). Finally, the sample size for each group was calculated using the sampling fraction (400/population of the group with lowest population size) multiplied by the population value for the group. This resulted in a total of 5152 respondents, one from each household. Finally, a total of 4915 respondents (1964 men, 2951 women) were interviewed in the survey by repeated visits. However, the analysis was based on the 4909 respondents who had complete observations for all of the variables under study. Men were difficult to reach for interviews due to their absence in the household during the day. Three repeat visits were made to minimise non-response. This sampling design made the total sample self-weighted, making data analysis straightforward.

Data were collected using an interviewer administered questionnaire with a mixture of a pre-coded and open ended questionnaire developed in Bengali, which was validated in a pilot survey before finalisation. However, no systematic validation or test–retest was carried out. Fifteen experienced female interviewers were recruited for the survey and were given 3 days' training on the survey questionnaire. Two experienced supervisors supervised the data collection process. For quality control of the data collection, the supervisors revisited 5% of the households chosen randomly within 2 days of data collection by the field workers to recollect data on some of the key questions. The supervisors and the relevant field workers together resolved any inconsistencies in the collected data immediately, making additional field visits if required. The survey was conducted from November 2012 to April 2013.

### Ethical considerations

The ethics review committee of the ICDDR,B provided approval for the project. Informed written consent was obtained from all study participants, and confidentiality and anonymity were ensured.

### Dependent and independent variables

The questionnaire included background characteristics of the respondents, knowledge of mobile phone use for healthcare, available mHealth services, attitude toward mHealth, consultation through mobile phones, and socioeconomic and demographic characteristics of individuals and households. To understand the prospect of mHealth services among the generation Y in Bangladesh, four dependent variables—knowledge about use of mobile phones for healthcare (yes/no), knowledge about calling a special number (yes/no) and Upazilla Health Complex (yes/no), and intention to use mHealth services in the future (yes/no)—were considered. For each dependent variable, a set of independent variables including sex, age (over 18 years), education, occupation and socioeconomic status were considered. Based on the definition of generation Y (who were born between 1982 and the early 2000s), the maximum age of the participants in this cohort was 30 years at the time this survey was carried out (end of 2012 and early 2013). Therefore, respondents aged <30 years were defined as the younger generation.

### Statistical analyses

The association between exposure (young generation) response (knowledge and use of mHealth services) was investigated by estimating the proportion of positive response and OR from a 2×2 table. To mitigate the influence of a given confounder such as sex, education, mobile ownership, occupation or socioeconomic status, separate analyses were conducted for each level of confounders (stratified analysis). This provides the percentage of positive outcomes and OR (with 95% CI). The adjusted OR with 95% CI was then calculated as the weighted average

**Table 1** Background characteristics of respondents

Characteristic	Per cent of all respondents (n=4909)
<b>Age (years)</b>	
<30	36.4
≥30	63.6
<b>Sex</b>	
Men	39.9
Women	60.0
<b>Occupation</b>	
Household	46.8
Formal employment and business	9.2
Farming	6.2
Manual labour	22.1
Unemployed	15.7
<b>Education (years of schooling)</b>	
None	48.1
1–5	29.3
≥6	22.6

of stratum specific ORs controlling for the confounder (Cochran–Mantel–Haenszel approach). Furthermore, the association was investigated by estimating adjusted OR from multivariable logistic regression models controlling for all confounders simultaneously in a model. All analyses were conducted using Stata V.12.

## RESULTS

### Background characteristics of respondents

Table 1 shows the distribution of the respondents by their background characteristics, such as age, sex, education and occupation. It shows that 36% of the total respondents were aged <30 years, 63% were women and almost half had no schooling. Except for household work, the main occupation was farming or manual labour.

### Mobile phone ownership

The use of mobile phones has rapidly increased over the past decade. Data from the HDSS, independent of the present survey, recorded a steady increase in household ownership of mobile phones from 2% in 2004 to 81% in 2012 (results not shown). The present survey data also showed that 81% of households had at least one phone, while 46% of respondents reported having a mobile phone. Ownership of mobile phones was higher among generation Y compared with the older generation s(50% vs 42%) (table 2). When the distribution of ownership was adjusted for each of the other background characteristics, generation Y with any background characteristics had more access to mobile phone than their older counterparts. The difference was statistically significant for most of the cases.

**Table 2** Ownership of mobile phones by generation Y in comparison with the older age group

Variable	Age group	N	Per cent with mobile phone	p Value
Age (years)	<30	1791	49.9	<0.001
	≥30	3118	42.4	
<b>Sex</b>				
Men	<30	634	76.3	<0.001
	≥30	1330	54.9	
Women	<30	1157	35.5	0.312
	≥30	1788	33.7	
<b>Education</b>				
None	<30	430	44.4	<0.001
	≥30	1905	28.4	
1–5 years	<30	745	45.5	<0.001
	≥30	717	58.7	
≥6 years	<30	613	59.2	<0.001
	≥30	499	74.5	
<b>Occupation</b>				
Farming	<30	48	77.1	<0.001
	≥30	258	44.9	
Household	<30	857	37.9	0.722
	≥30	1432	37.2	
Employment and business	<30	100	91.0	<0.01
	≥30	358	79.5	
Manual labour	<30	320	67.8	<0.001
	≥30	768	44.4	
Unemployed	<30	456	48.4	<0.001
	≥30	312	20.1	
<b>SES</b>				
Poorest	<30	333	22.8	<0.05
	≥30	672	17.4	
2	<30	350	37.5	0.458
	≥30	617	35.2	
3	<30	354	54.1	<0.01
	≥30	648	44.9	
4	<30	362	57.6	0.067
	≥30	592	51.5	
Richest	<30	392	73.2	0.096
	≥30	589	68.2	
Total		4909	45.6	

SES, socioeconomic status.

### Knowledge of mobile phone use for healthcare

Knowledge of mobile phone use for healthcare was higher among generation Y compared with their older

**Table 3** Level of knowledge about mHealth services among generation Y in comparison with the older age group

Variable	Age group	N	Per cent aware of mHealth services	OR* (95% CI)	OR† (95% CI)
Age (years)	<30	1791	37.8	1.6 (1.4 to 1.8)	-
	≥30	3118	27.5	1.0	
<b>Own a mobile</b>					
No	<30	895	29.6	1.9 (1.6 to 2.3)	1.5 (1.3 to 1.7)
	≥30	1788	18.1	1.0	
Yes	<30	893	46.0	1.3 (1.1 to 1.50)	
	≥30	1333	40.1	1.0	
<b>Sex</b>					
Men	<30	634	42.7	1.3 (1.1 to 1.6)	1.7 (1.5 to 1.9)
	≥30	1330	36.5	1.0	
Women	<30	1157	35.1	2.1 (1.7 to 2.4)	
	≥30	1788	20.8	1.0	
<b>Education</b>					
None	<30	430	32.1	2.2 (1.8 to 2.8)	1.1 (0.9 to 1.3)
	≥30	1905	17.5	1.0	
1–5 years	<30	745	28.1	0.77 (0.62 to 0.97)	
	≥30	717	33.5	1.0	
≥6 years	<30	613	53.7	0.8 (0.6 to 1.1)	
	≥30	499	57.1	1.0	
<b>Occupation</b>					
Farming	<30	48	35.4	1.3 (0.7 to 2.6)	1.7 (1.5 to 1.9)
	≥30	258	29.1	1.0	
Household	<30	8575	33.0	1.7 (1.4 to 2.1)	
	≥30	1431	26.6	1.0	
Employment and business	<30	100	57.0	1.1 (0.7 to 1.7)	
	≥30	358	55.2	1.0	
Manual labour	<30	320	30.3	1.14 (0.86 to 1.5)	
	≥30	768	27.6	1.0	
Unemployed	<30	456	48.3	4.5 (3.2 to 6.5)	
	≥30	312	16.9	1.0	
<b>SES</b>					
Poorest	<30	333	18.9	1.3 (0.95 to 1.9)	1.6 (1.4 to 1.8)
	≥30	672	14.6	1.0	
2	<30	350	26.8	1.4 (1.1 to 1.9)	
	≥30	617	20.7	1.0	
3	<30	354	33.1	1.4 (1.1 to 1.8)	
	≥30	648	25.8	1.0	
4	<30	362	41.7	1.7 (1.3 to 2.3)	
	≥30	592	29.1	1.0	
Richest	<30	392	64.3	1.8 (1.4 to 2.3)	
	≥30	589	49.9	1.0	
Total		4909	31.3	aOR‡ (95% CI) 1.6 (1.3 to 2.0)	

SES, socioeconomic status.

\*OR (95% CI) unadjusted.

†OR (95% CI) adjusted for each confounder.

‡aOR (95% CI) adjusted for all confounders simultaneously in a multivariable model.

**Table 4** Level of knowledge about existing mHealth services among generation Y in comparison with the older age group

Variable	Age group	N	Knowledge about calling special call centre numbers			Knowledge about calling Upazilla Health Complex		
			%	OR* (95% CI)	OR†(95%CI)	%	OR* (95% CI)	OR†(95%CI)
Age (years)	<30	1791	6.7	3.2 (2.4 to 4.3)	-	6.3	1.5 (1.2 to 1.9)	-
	≥30	3124	2.2	1.0		4.2	1.0	
Sex								
Men	<30	634	12.9	3.4 (2.4 to 4.8)	3.6 (2.7 to 5.0)	9.2	1.4 (0.9 to 1.9)	1.6 (1.3 to 2.2)
	≥30	1330	4.2	1.0		6.9	1.0	
Women	<30	1157	3.3	4.7 (2.5 to 8.7)		4.8	2.2 (1.4 to 3.3)	
	≥30	1794	0.7			2.2	1.0	
Own a mobile								
No	<30	895	0.9	3.9 (1.2 to 13.2)	2.6 (1.9 to 3.5)	3.0	1.2 (0.8 to 2.0)	1.4 (1.1 to 1.8)
	≥30	1788	0.2	1.0		2.4		
Yes	<30	893	12.5	2.5 (1.9 to 3.4)		9.6	1.5 (1.1 to 1.9)	
	≥30	1333	4.8	1.0		6.6		
Education								
None	<30	430	5.4	10.7 (5.1 to 22.6)	1.9 (1.4 to 2.6)	4.9	2.2 (1.7 to 3.7)	1.1 (0.8 to 1.4)
	≥30	1905	0.5	1.0		2.3	1.0	
1–5 years	<30	745	2.6	1.8 (0.8 to 3.7)		3.9	0.8 (0.5 to 1.4)	
	≥30	717	1.5	1.0		4.3	1.0	
≥6 years	<30	613	12.6	1.3 (0.9 to 1.9)		10.3	0.9 (0.6 to 1.3)	
	≥30	499	9.6	1.0		11.4	1.0	
Occupation								
Farming	<30	48	6.3	17.1 (1.7 to 68.2)	3.9 (2.7 to 5.5)	4.2	0.8 (0.2 to 3.7)	1.6 (1.2 to 2.1)
	≥30	258	0.4	1.0		5.1	1.0	
Household	<30	867	3.1	5.1 (2.4 to 10.8)		3.8	1.7 (1.1 to 2.8)	
	≥30	1432	0.6	1.0		2.2	1.0	
Employment and business	<30	100	16.0	1.3 (0.7 to 2.4)		12.0	0.9 (0.5 to 1.8)	
	≥30	358	12.5	1.0		12.4	1.0	
Manual labour	<30	320	4.7	3.1 (1.4 to 6.7)		5.9	1.7 (0.9 to 3.7)	
	≥30	768	1.6	1.0		4.3	1.0	
Unemployed	<30	456	12.9	15.3 (4.7 to 49.4)		10.3	2.1 (1.2 to 3.8)	
	≥30	313	0.9	1.0		4.8	1.0	
SES								
Poorest	<30	333	0.0	-	3.1 (2.2 to 4.2)	3.3	1.5 (0.3 to 3.3)	1.4 (1.1 to 1.9)
	≥30	672	0.2			2.1	1.0	
2	<30	350	2.0	1.8 (0.6 to 5.2)		2.3	1.1 (0.5 to 2.7)	
	≥30	623	1.1	1.0		2.1	1.0	
3	<30	354	4.0	6.6 (2.2 to 20.3)		4.8	1.9 (0.9 to 3.7)	
	≥30	648	0.6	1.0		2.6	1.0	
4	<30	362	5.8	4.5 (1.9 to 10.2)		6.1	1.9 (1.1 to 3.6)	
	≥30	592	1.3	1.0		3.2	1.0	
Richest	<30	392	19.9	2.7 (1.8 to 4.0)		14.0	1.3 (0.8 to 1.8)	
	≥30	589	8.3			11.5	1.0	
Total		4909	3.8	OR‡ (95% CI)	3.8 (2.6 to 5.5)	4.9	aOR‡ (95% CI)	1.4 (1.1 to 1.8)

SES, socioeconomic status.

\*OR (95% CI) unadjusted.

†OR (95% CI) adjusted for each confounder.

‡aOR (95% CI) adjusted for all confounders simultaneously in a multivariable model.

counterparts (37.8% vs 27.5%; OR 1.6 (95% CI 1.4 to 1.8)) (table 3). When the relationship was adjusted for each of the background factors of the respondents, the findings

revealed that younger individuals were more knowledgeable compared with older participants. For example, after controlling for sex, the odds of having knowledge among

**Table 5** Level of intention for using mHealth services in future among generation Y in comparison with an older age group

Variable	Age group	N	Intention to use mHealth services in future	OR* (95% CI)	OR† (95% CI)
Age (years)	<30	1586	31.8	1.3 (1.1 to 1.5)	
	≥30	2495	26.3	1.0	
<b>Sex</b>					
Men	<30	574	36.9	1.2 (1.0 to 1.5)	1.4 (1.19 to 1.58)
	≥30	1155	31.9	1.0	
Women	<30	1012	28.8	1.5 (1.2 to 1.8)	
	≥30	1340	21.5	1.0	
<b>Own a mobile</b>					
No	<30	895	25.4	1.4 (1.2 to 1.6)	1.2 (1.1 to 1.3)
	≥30	1788	18.6	1.0	
Yes	<30	893	37.7	1.1 (0.9 to 1.2)	
	≥30	1333	34.7	1.0	
<b>Education</b>					
None	<30	364	28.6	1.6 (1.2 to 2.1)	1.1 (0.9 to 1.2)
	≥30	1427	19.7	1.0	
1–5 years	<30	663	24.9	0.8 (0.6 to 1.0)	
	≥30	608	29.6	1.0	
≥6 years	<30	556	42.3	1.0 (0.8 to 1.3)	
	≥30	457	42.5	1.0	
<b>Occupation</b>					
Farming	<30	42	40.5	1.9 (0.9 to 3.7)	1.3 (1.16 to 1.50)
	≥30	218	26.6	1.0	
Household	<30	749	26.9	1.3 (1.1 to 1.6)	
	≥30	1130	21.8	1.0	
Employment and business	<30	94	43.6	1.0 (0.6 to 1.5)	
	≥30	306	44.4	1.0	
Manual labour	<30	283	29.3	1.2 (0.8 to 1.6)	
	≥30	647	26.1	1.0	
Unemployed	<30	418	38.5	1.9 (1.3 to 2.8)	
	≥30	194	24.7	1.0	
<b>SES</b>					
Poorest	<30	268	20.5	1.3 (0.9 to 2.0)	1.3 (1.10 to 1.46)
	≥30	476	15.9	1.0	
2	<30	302	28.2	1.2 (1.1 to 2.1)	
	≥30	494	20.5	1.0	
3	<30	315	26.9		
	≥30	517	26.5	1.0	
4	<30	330	36.1	1.5 (1.1 to 2.1)	
	≥30	503	27.5	1.0	
Richest	<30	371	43.1	1.1 (0.8 to 1.4)	
	≥30	505	40.6	1.0	
Total		4075	28.5	aOR‡ (95% CI) 1.3 (1.1 to 1.4)	

SES, socioeconomic status.

\*OR (95% CI) unadjusted.

†OR (95% CI) adjusted for each confounder.

‡aOR (95% CI) adjusted for all confounders simultaneously in a multivariable model.

generation Y was 1.7 times higher (95% CI 1.5 to 1.9) compared with those in the older group. Furthermore, when controlling for all confounders simultaneously in a multivariable model, the odds of having knowledge was 60% higher in generation Y (aOR 1.6 with 95% CI: 1.3 to 2.0) compared with older participants.

### Knowledge of existing mHealth services

Regarding knowledge of existing mHealth services through Upazilla Health Complexes, an initiative of the Ministry of Health and Family Welfare, or the availability of special call centre numbers, younger people had better knowledge than older participants, with estimated OR values of 3.2 (95% CI 2.4 to 4.3) and 1.5 (95% CI 1.2 to 1.9), respectively, although very few people were aware of these services in general (table 4). This held true when controlling for each confounder separately in stratified analyses. Similar results were also observed when the association between generation and knowledge was adjusted for all confounders in a multivariable model.

### Intention to use mHealth services

This study revealed that younger participants showed a greater intention to use mHealth services compared with older participants (31.8 vs 26.3) (table 5). The odds of intending to use mHealth services in the future was 30% higher among generation Y than those in the older generation, with an estimated OR of 1.3 (95% CI 1.1 to 1.5). This finding held true when controlling for each confounder in stratified analyses. Similar findings were also observed with the estimated aOR 1.3 (95% CI 1.1 to 1.4) after controlling for all confounders in a multivariable model.

## DISCUSSION

This study investigated the level of knowledge and attitude regarding mHealth services among the young generation with the aim of exploring the prospect of mHealth services in the near future in Bangladesh. As reported in the study findings, the younger generation had greater access to mobile phones, better knowledge about its use in healthcare and more positive attitudes towards the use of mHealth services in future compared with the older generation. This was true across all sociodemographic strata. These findings are as expected as the young generation have a positive behaviour towards technology. The younger generation's use of time at work or study tends to consist of a lot more entertainment and play compared with that of the older generation, and this behavioural pattern is very compatible with the new technologies, such as mobile phones and the internet.

These findings are similar to those reported by Halewood and Keny<sup>32</sup> in a recent study on young people and ICT in developing countries. They reported that young people have widespread access to and use of ICT in various sectors, such as education, employment and income generating activities, compared with their parents

and grandparents. The old generation in Bangladesh are comparatively less educated, most are working as manual labours or farmers, and hence have inadequate perceptions regarding the usefulness, ease of use and subjective norms of mobile phones in practice. In addition, even if educated, they have fears about handling mobile phones, particularly text messaging (SMS) and mobile internet use, which is often used for connecting to mHealth services. However, there are very limited opportunities for mobile phone literacy in Bangladesh. This will not be a problem because younger members of the family can help older member by informing them of the available mHealth services and operating the mobile phone to get the services.

Bangladesh has a population of 160 million people, of whom 96 million are <30 years old.<sup>22</sup> Hence it is clear that the young generation is the future force to a greater extent than usual because of their size, literacy and exposure to changing global technology. It is likely that the large size of this generation will create a wave of change in the use of mHealth in Bangladesh in the near future in the face of shortages in the medical workforce, particularly in rural areas. Therefore, targeting the young generation, which already has a positive attitude towards this technology, would be a good approach for maximising the potential of mHealth. The mHealth programme has had great success in high income countries, including the USA and EU nations, with different types of solution being offered and services being delivered through simple SMS to complex apps. The main reasons for their success in developed countries includes high literacy, general access to and use of the internet and mobile phone technology, high level of knowledge about mHealth services and availability of adequate qualified resource persons to manage the services.<sup>7</sup> To maximise the opportunity offered by mobile phone technology in low income countries such as Bangladesh, its potential and challenges should be well understood.

The use of ICT in various development sectors in Bangladesh has rapidly increased in the past half decade after the government's announcement of the 'Digital Bangladesh by 2021' vision.<sup>33</sup> The 'Digital Bangladesh' vision is a new formula for development. As part of this vision, the government has made several initiatives for increasing ICT facilities, formed a separate ministry with a significant amount of resources and initiated a long term plan to expand the use of ICT in every sector in Bangladesh on a priority basis, with healthcare being one of the top sectors on the list.<sup>34</sup> Accordingly, the target is to accumulate young individuals from school or university, with the aim of creating a generation mentally fit to adapt to any technological challenge. Being motivated by the government, the young generation has already started to use mobile phones for retrieving examination results, applying for jobs and so forth.<sup>33</sup> Similarly, the number of mHealth initiatives has increased rapidly since the first initiative in 1998. As reported in a recent study,<sup>13 35</sup> currently

there are 26 mHealth projects run by public or private institutions with the aim of providing health services and/or managing health information. The primary form of services provided by most of these mHealth projects are tele-consultation, which includes remote diagnosis through video conferencing and imaging, advice on disease management, prescription and/or referral to specialised doctors or hospitals. In addition, mHealth services include providing health awareness and information, such as national vaccination schedules, through text messaging (ie, SMS). Although the level of using such services is currently very low, the rate is expected to increase to some extent when technology based young people become household decision makers.

Despite huge initiatives on health information and communication technologies implemented by the government of Bangladesh, the mHealth system still faces various challenges and constraints.<sup>36</sup> Some of these include defining the service, standards across different organisations, financial viability, availability of technical staff, lack of common standards for health information and communication technologies leading to difficulties in data management and sharing among different databases and interoperability.<sup>31</sup> Low speed internet connection in many remote areas and high cost of infrastructure and integrated software development are also barriers to the implementation of mHealth services.

Given that the challenges of mHealth services discussed in this paper can be solved, the enthusiasm of the pro-technology generation (generation Y), together with the process of achieving 'Digital Bangladesh,' will result in progress towards favourable attitudes regarding mHealth, which may become a game changer for health-care in Bangladesh.

### Limitation of the study

The findings of this study are based on data from the remote rural area of Chakaria only. However, Chakaria is very similar to other rural areas in Bangladesh, particularly in terms of education, and access to and use of ICT.<sup>26</sup> Therefore, it is anticipated that other rural parts of the country would have similar attitude towards mHealth services as those observed in Chakaria. However, the urban areas are different from the rural areas in terms of such characteristics. Therefore, the findings cannot be generalised to the urban population of Bangladesh. The second limitation is that most of the questions related to knowledge of and intention towards mHealth in the questionnaire were yes/no based, and hence further questions are required for assessing correctly the outcome measures, which were not included in our questionnaire. Furthermore, the status of mobile phone ownership may influence the responses related to the use of mobile phone for healthcare service, however, few questions for cross checking the response were

included, which minimised the influence. Finally, the interview was often conducted in the presence of other family members, and although the interviewers were particularly careful that the responses were not influenced by the others present, they may still have influence the response on mHealth services to some extent.

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