Digital Healing: Public Sentiments towards Electronic Health Services in Bangladesh

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Abstract

The study aimed to assess the public perception about the prevalence, satisfaction, and challenges of electronic health (e-health) services in Bangladesh. An online survey with a self-administered structured interview was conducted with 150 respondents to collect general perceptions from both rural and urban people. The study revealed that the prevalence of e-health services was moderate in Bangladesh. During the Covid-19 pandemic, people accessed online vaccine registration (58%), telemedicine (23%), and downloaded Covid test reports (17%). The study did not find association between e-health services and the participants' age, gender, living condition, and marital status based on the results of the Chi-square test and the Mann-Whitney U test (p > 0.05). The Spearman correlation analysis confirmed that individuals were moderately satisfied with their access to e-health services (r = .536), the availability of updated Covid-related information on websites (r = .585), and government advertisements (r = .547). Participants reported major challenges in the form of high internet costs, lack of awareness, insufficient internet speed, and an information gap regarding e-health services in Bangladesh. Findings would be an important guideline to the mass people, health experts and practitioners, policymakers, and government health authorities.

Introduction

With the rapid advancements in information and communication technology (ICT), a new form of service delivery called electronic service (e-service) has emerged, revolutionizing conventional processes worldwide (Shaw, 2009; Cordella & Tempini, 2015). Experience from developing countries shows that ICT has a significant role in the improvement of e-health through quality, accessibility, and affordable service (Hoque et al., 2014). The usage of ICT in health services can ensure better health facilities for patients, doctors, nurses, and health staff (Khalifehsoltani & Gerami, 2010). The Sustainable Development Goals (SDGs) Goal 3 prioritizes good health and well-being with a special emphasis on universal access to healthcare facilities, family planning & education, a quality healthcare system, and affordable medicines & vaccines (United Nations, 2022).

In 2010, the Bangladesh government introduced ICT in the health sector to spread quality service to the doorstep of all citizens. In March 2020, a paperless electronic management information system (e-MIS) was introduced in the Tangail district in the areas of family planning, reproductive, child, and maternal health service. The government set a target to ensure paperless health services in all the district levels of Bangladesh by 2022 (United Nations, 2022a). The Covid-19 pandemic brought a new horizon from in-person to online systems in education, health, business, shopping, etc. (Chang & Meyerhoefer, 2021; Tomasik et al., 2021). World Health Organization (2021) declares 'The Global Strategy on digital health 2020−2025' for improving health services by ensuring affordability, accessibility, sustainability, and inclusiveness. With the influx of pandemics, Covid-19 impacted the mental and physical health of people in Bangladesh (Yeasmin et al., 2020). In the quick-tempered global health crisis in the pandemic, e-health services can bridge the gap between universal healthcare services all over the world (United Nations, 2022a).

The government of Bangladesh also provided web portals to disseminate daily updated information on Covid-19 such as the government Corona portal (https://corona.gov.bd/), Ministry of Health & Family Welfare (MOH&FW) (https://mohfw.portal.gov.bd/), Surokkha (https://surokkha.gov.bd/), Institute of Epidemiology Disease Control and Research (IEDCR) (https://iedcr.gov.bd/), International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) (https://www.icddrb.org/). Access to Information (A2I) reported that the Government provided 15

digital health services all over the country and Telemedicine received higher demand from the people during the pandemic (Hasan, 2020). However, since the outbreak of Covid-19 on 8 March 2020, the health sector experienced multitudinous challenges to offer e-service to Bangladeshi citizens (Choyon, 2021). The major challenges include mismanagement, corruption, deficiency in budgetary allocation, fake Covid certificates, incorrect Covid test results, etc. (Quadery et al., 2021).

E-health services have gained prominence in the healthcare sector, offering various benefits such as improved accessibility, convenience, and efficiency (Mathews et al., 2019). However, the understanding of public perception regarding e-health services in Bangladesh remains limited. It is crucial to explore the attitudes, usage patterns, and challenges faced by individuals in order to identify barriers and develop strategies for the effective implementation of e-health services in the country. The rapid advancement of technology and the increasing reliance on digital platforms have created new opportunities for healthcare delivery. Bangladesh, like many other developing countries, has recognized the potential of e-health services to enhance healthcare accessibility, especially during the Covid-19 pandemic. However, the success of e-health initiatives relies heavily on public acceptance and utilization.

Understanding the public perception of e-health services in Bangladesh is essential for several reasons. Firstly, it provides valuable insights into the level of acceptance and readiness of individuals to adopt these services. Secondly, identifying the challenges faced by the public can help in designing targeted interventions to address these barriers. Moreover, exploring the relationship between demographic factors and the utilization of e-health services can inform policy-making and resource allocation. Therefore, this cross-sectional survey aims to investigate the public perception of e-health services in Bangladesh, examining factors such as awareness, utilization, satisfaction, and challenges. The findings will contribute to the existing body of knowledge, guide the implementation of e-health initiatives, and ultimately improve healthcare delivery in the country.

Literature review

E-health services, also known as electronic health services, refer to the use of ICT in the delivery of healthcare services. These services encompass a wide range of applications and technologies that facilitate the exchange of health-related information, diagnosis, treatment, and management of health conditions. E-health services can include various components such as telemedicine, electronic medical records (EMRs), health information exchange (HIE), mobile health (mHealth) applications, remote monitoring devices, online health portals, and digital communication platforms between healthcare providers and patients. These technologies enable healthcare professionals to provide medical services remotely, share patient information securely, deliver healthcare education and awareness, and enhance overall healthcare accessibility and efficiency.

In Bangladesh, the first e-health project was launched in 1998 led by a nonprofit institute, Swinfen Charitable. In the same year, the Ministry of Health and Family Welfare (MoHFW) took the first initiative for e-health services (Ahmed et al., 2014). The first use of telemedicine started with the establishment of Telemedicine Reference Centre Limited (TRCL) (Nessa et al., 2008). However, the existing e-health system of Bangladesh was implemented in FY 2003–2010 under the Health, Nutrition, and Population Sector Program (HNPSP) (Avento & Sultana, 2013). The Directorate General of Health Services (DGHS) took initiatives to improve Management Information systems (MIS) through ICT and ensure access to computers & the internet for all Upazila and district health complexes (Ministry of Health and Family Welfare, 2008). Digital Bangladesh 'Vision-2021' envisioned to

implementation of paperless government health services at national, sub-national, and grassroots levels by 2016 (CPD, 2007). Bangladesh had mammoth progress in e-health and received the 'United Nations Digital Health for Digital Development Award' in 2011 (Ministry of Health and Family Welfare, 2012).

Covid-19 emerged in Wuhan, China in December 2019, causing global health concerns (Wang et al., 2020; Brooks et al., 2020). It is a transmittable virus called SARS-CoV-2 (Shereen et al., 2020). The World Health Organization advised prompt action against the pandemic (World Health Organization, 2020). Healthcare services, including e-health, faced vulnerabilities worldwide, including in Bangladesh (Islam & Rahman, 2022). Bangladesh swiftly embraced e-health, implementing telemedicine guidelines in July 2020 (Bangladesh Medical & Dental Council, 2020). The government launched a comprehensive Covid-19 vaccination program on February 7, 2021, facilitating registration through the Surokkha App (Abedin et al., 2021). As of January 26, 2022, 36.23% of the population received 156,416,604 vaccine doses (Trading Economics, 2022).

Bangladesh government inaugurated a national telehealth service in 2006 known as 'Shasthyo Batayon' by dialing 16263 aiming at offering affordable services in terms of efficiency, cost, and timeliness in service. The 'Shasthyo Batayon' (16263) offers services for people in the areas of consultation, prescription via texting, referral services, and emergency requirements. The government made this service toll-free for all and people had satisfactory enrollment in the Shasthyo Batayon. After the first detection of Covid-19 case detection on March 8, 2020, Shasthyo Batayon received 10 million calls till 31 August 2020, and 83% of calls belonged to Covid-19-related issues. Most of the calls were from Dhaka (41.3%), Chottogram (17.1%), and Khulna (10.4%). Most of the males (65%) accessed the national telehealth service whereas female recipients were 35% (Ahmed et al., 2020). Ahmed et al. (2022) showed that people have similar kinds of responses in the service of national health service of government such as, fever, cough, sore throat, runny nose, etc. 41% of people was repeat callers, which bears that people are satisfied with Covid-19 related service of the government.

The Bangladesh government opened Covid-19 vaccine registration for frontline workers, health workers, and those aged 40 and above through the 'Surokkha' app (Alam et al., 2023). A nationwide mass vaccination program began on February 7, 2021, accessible through the Surokkha website, with birth certificates or National Identity Cards required for registration (Mahmud et al., 2021; Roy et al., 2022; Roy et al., 2023). Studies show high satisfaction rates with the vaccine management system and the online registration process (Islam et al., 2021). A survey conducted among urban marginalized populations indicates satisfactory awareness of the vaccine and the Surokkha app for registration (Care Bangladesh, 2021).

During Covid-19, the government gave an opportunity to access the Covid test certificate from the website (https://covid19reports.dghs.gov.bd/) by giving a designated phone number used during testing. Rahman et al. (2020) show that the government of Bangladesh initially followed a gradual approach to widening Covid testing service. Initially, this service was highly centralized, and district-level hospitals offered testing opportunities. While accessing the service, people who have a social reputation, wealth, and good relations with doctors got priority in receiving Covid tests and reports. Due to the lack of facilities, poor and underprivileged people could not access Covid testing opportunities and they remain undetected. This inequality shows dissatisfaction among the poorer section of society.

The e-health service faces numerous challenges, including computer shortages, slow internet speeds, lack of broadband connections, limited health workforce knowledge, staffing issues, power supply disruptions, rural inclusion, and partnership management difficulties (Joarder et al., 2020). During the Covid-19 pandemic,

telemedicine emerged as a crucial e-health service accessed through phones or the internet. However, trust issues, limited access to emergency services, network problems, and distance barriers hindered its effectiveness. Participants believed that e-health services fell short of meeting patient requirements. Additionally, the cost of internet access posed a significant obstacle, particularly for economically vulnerable individuals during the pandemic.

Rural communities faced challenges in accessing e-health services due to network availability (Rahman et al., 2020). Successful implementation of telemedicine was hindered by limited infrastructure, lack of awareness, administrative staff reluctance, and inadequate patient monitoring (Chowdhury et al., 2021). Inadequate e-health training facilities contributed to the underdevelopment of existing e-health services (Ahmed et al., 2014). The government of Bangladesh encountered various challenges, including shortages of Covid test kits, ensuring social distancing, healthcare vulnerabilities, inadequate resources, and lack of coordination (Haque, 2020). Limited infrastructural development, including power supply, electricity, and network connectivity, further hindered e-health services, particularly in rural areas (Rural Health Information Hub, 2022).

Despite the growing recognition of the potential benefits of electronic health (e-health) services in Bangladesh, there is a notable knowledge gap regarding the public perception of these services. Limited research has been conducted to comprehensively assess the prevalence, satisfaction, and challenges associated with e-health services in the country. This knowledge gap creates a barrier to understanding the factors influencing the acceptance and utilization of e-health services among the Bangladeshi population. To address this gap, our proposed study aims to assess the public perception of e-health services in Bangladesh, focusing on the prevalence, satisfaction levels, and challenges faced by individuals. The findings will provide a comprehensive understanding of the public perception and shed light on the prevalence of e-health service utilization, satisfaction levels, and challenges faced by individuals. This information will be valuable for policymakers, healthcare providers, and stakeholders in designing strategies to improve the acceptance, effectiveness, and accessibility of e-health services in Bangladesh.

Methodology and data

Research design

The study followed a cross-sectional survey to measure public perception on e-health services amid Covid-19 in Bangladesh. This research is called cross-sectional because data are collected from a single point in time from the participants having variables of interest (Cummings, 2018).

Research method and data collection tools

This study utilized an online survey method to collect data through self-administered semi-structured interviews conducted via digital platforms. The questionnaire was designed using MS Word, and responses were collected through various social media channels such as email, Facebook, WhatsApp, and Messenger. All data collection activities were conducted while adhering to social distancing measures and Covid-19 protocols. Additionally, telephone interviews were conducted for individuals who were not familiar with computers, the internet, and MS Word files. The telephone interviews took approximately 30–40 minutes to complete per participant.

Sampling and respondents

The study's use of non-probability purposive sampling was justified by targeting a specific group of individuals who exclusively received government health services electronically. This sampling approach allowed for the collection of data from individuals with a specific experience, ensuring relevance to the study's objectives. The random selection of 200 individuals and the subsequent inclusion of 150 participants demonstrated the feasibility of obtaining a sufficient sample size. Additionally, the data collection phase spanned three months and included participants from various regions of Bangladesh, enhancing the generalizability of the findings. The voluntary participation of respondents without any incentives or remuneration further strengthens the study's credibility and reduces the likelihood of biased responses.

Data analysis techniques and validity

The use of the Statistical Package for Social Science (SPSS) version 25 to analyze the data was ppropriate and commonly used in social science research. The determination that the data was not normally distributed, based on the Kolmogorov-Smirnov and Shapiro-Wilk tests ($p < 0.05$), indicated the need for non-parametric statistical tests in this study. Univariate statistics, such as frequency and percentage, were used to describe the demographic profile of the sample, providing a clear understanding of the participants' characteristics. To examine relationships and differences in the data, the study employed non-parametric tests, specifically the Chi-square test, Mann-Whitney U-test, and Spearman correlation, where applicable. These tests are suitable for analyzing non-normally distributed data and were chosen appropriately to assess the research objectives. The Likert scale was used to measure participants' responses, ranging from 1 to 5, with different labels indicating levels of satisfaction. Additionally, for some questions, a Likert scale with points 1–3 was used to measure high, medium, and low responses. The use of Likert scales is a common practice in social science research to assess attitudes, opinions, and perceptions. The study calculated Cronbach's alpha coefficient to determine the reliability of the Likert scale data. A value greater than 0.60 suggests an acceptable level of internal consistency for Likert scale items. Data were calculated with a 95% confidence level, implying that the estimated results are expected to fall within the calculated confidence intervals. The study also considered a 5% level of error (0.05) to minimize the probability of making a Type I error. Overall, the methodology employed in data analysis and measurement provides a robust framework for evaluating the research questions, given the non-normal distribution of the data.

Results

Socio-demographic profile of the participants

Table 1 presents the demographic and socioeconomic profile of the respondents (n = 150). In terms of living area, the majority of participants resided in urban areas (72.0%), while 28.0% were from rural areas. In terms of gender, 60.0% of respondents were male, and 40.0% were female. Regarding marital status, the study included a higher proportion of married participants (73.3%) compared to unmarried individuals (26.7%). The age distribution showed that the largest group was in the 18–30 age range (40.0%), followed by 31–40 (24.7%), 41–50 (19.3%), 51–60 (11.3%), 61–70 (3.3%), and 71–80 (1.3%). In terms of educational qualification, the majority of respondents (73.3%) had a bachelor's degree or higher, while primary level education accounted for 4.0% of participants. In terms of occupation, the study included participants from various backgrounds, with the largest group being in services (29.3%), followed by students (22.0%) and professionals (10.7%). The average monthly income varied, with 8.7% having an income less than BDT 10,000, and 24.7% earning BDT 90,000 and above.

Table 1

Demographic and socioeconomic profile of the respondents (n = 150)

Socio-economic characteristics	n (%)
Living Area	
- Urban	108 (72.0)
- Rural	42 (28.0)
Gender	
- Male	90 (60.0)
- Female	60 (40.0)
Marital Status	
- Married	110 (73.3)
- Unmarried	40 (26.7)
Age	
- 18−30	60 (40.0)
- 31−40	37 (24.7)
- 41−50	29 (19.3)
- 51−60	17 (11.3)
- 61−70	5 (3.3)
- 71−80	2 (1.3)
Educational Qualification	
- Able to sign	1 (.7)
- Primary level	6 (4.0)
- JSC	6 (4.0)
- SSC	7 (4.7)
- HSC	20 (13.3)
- Bachelor and Above	110 (73.3)
Occupation	
- Services	44 (29.3)
- Farmer	2 (1.3)
- Household	15 (10.0)
- Labor	16 (10.6)
- Fishermen	2 (1.3)

Socio-economic characteristics	n (%)
- Porter	1 (.7)
- Wood maker	2 (1.3)
- Business	14 (9.33)
- Retired employee	3 (2.0)
- Students	33 (22.0)
- Professionals	16 (10.66)
- Unemployed	2 (1.3)
Average monthly income (BDT)	
- < 10000	13 (8.7)
- 10000–20000	19 (12.7)
- 20000–30000	17 (11.3)
- 30000–40000	19 (12.7)
- 40000–50000	18 (12.0)
- 50000–60000	7 (4.7)
- 60000–70000	9 (6.0)
- 70000–80000	5 (3.3)
- 80000–90000	6 (4.0)
- 90000 and above	37 (24.7)

Prevalence of e-health service

Table 2 presents the prevalence of e-health services among participants. The table outlines the various websites accessed by the participants, with different percentages reported for each website. The Ministry of Health and Family Welfare (MOH & FW), Institute of Epidemiology, Disease Control and Research (IEDCR), and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) were accessed by a relatively smaller percentage of participants. However, Surokkha, a prominent website, was accessed by a significant 43.7% of participants. Similarly, the e-health services provided by the government during the Covid-19 pandemic were also examined. Telemedicine (dialing 16263) was utilized by 22.6% of participants, online vaccine registration by 58.3%, and Covid test report download by 19.1%. The table also indicates the sources from which participants obtained e-health information, with television and social media being the most common sources, followed by community people and newspapers. The data highlights the diverse sources and platforms through which individuals accessed e-health services and sought information during the Covid-19 pandemic.

Table 2
Prevalence on e-health services

Types of services	(%)
Websites accessed by the participants	
- Ministry of Health and Family Welfare (MOH & FW)	9.0
- Institute of Epidemiology, Disease Control and Research (IEDCR)	9.6
- International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B)	12.9
- Surokkha	43.7
- Directorate General of Health Services (DGHS)	8.0
- Corona Info Bangladesh	16.7
E-health service of the government during Covid-19	
- Telemedicine (dialing 16263)	22.6
- Online Vaccine Registration	58.3
- Covid test report download	19.1
Source of e-health information	
- Television	23.0
- Radio	2.2
- Social media	29.5
- Newspaper	15.1
- Community people	24.3
- Local newspaper	2.2
- Local representatives	2.5
- Religious leader	1.0
- Miking	0.2
* Multiple responses were possible	

Table 3 displays the prevalence of e-health service sources based on location, sex, and educational qualification. In terms of living area, a higher percentage of urban residents (89.7%) relied on the Surokkha platform for e-health services, compared to rural residents (95.2%). Regarding gender, both males (91.1%) and females (91.5%) predominantly utilized Surokkha for their healthcare needs. Age-wise, the highest utilization of Surokkha was observed among individuals aged 18–30 (89.8%), while the lowest was among the 41–50 age group (96.6%). When considering educational qualifications, Surokkha was the primary choice for individuals with primary education (100%) and HSC (Higher Secondary Certificate) qualification (94.7%). Notably, the ICDDR, B (International Centre for Diarrhoeal Disease Research, Bangladesh) was a significant source of e-health services

for individuals with JSC (Junior School Certificate) qualification (83.3%). Overall, the table highlights the varying prevalence of e-health service sources based on location, sex, and educational qualification.

Table 4 presents an overview of the prevalence of e-health services by location, gender, and educational qualification during the Covid-19 pandemic. Urban areas had higher usage of online vaccine registration (99.0%) compared to rural areas (88.1%). Females showed a higher preference for telemedicine (42.1%) compared to males (33.7%). Among different age groups, individuals aged 18–30 had the highest rate of online vaccine registration (96.4%) and Covid test report downloads (48.2%). Those with JSC qualifications had the highest utilization of telemedicine (40.0%) and online vaccine registration (100.0%). HSC qualification holders had the highest usage of telemedicine (41.2%) and Covid test report downloads (47.1%). Overall, the analysis reveals variations in e-health service utilization based on location, gender, age, and educational qualification.

Table 3
Prevalence on the sources e-health services against location, sex, and education qualification

Sources of services (%)						
Indicators	MoH&FW	IEDCR	ICDDR, B	Surokkha	DGHS	Corona Info Bangladesh
Living Area						
- Urban	19.6	19.6	22.4	89.7	12.1	28.0
- Rural	16.7	21.4	38.1	95.2	28.6	52.4
Gender						
- Male	21.1	17.8	32.2	91.1	21.1	36.7
- Female	15.3	23.7	18.6	91.5	10.2	32.2
Age						
- 18−30	32.2	22.0	23.7	89.8	22.0	54.2
- 31−40	21.6	40.5	40.5	91.9	21.6	29.7
- 41−50	3.4	0	17.2	96.6	3.4	10.3
- 51−60	0	11.8	29.4	88.2	17.6	29.4
- 61−70	0	0	20.0	80.0	0	20.0
- 71−80	0	0	100.0	0	0	0
Educational qualification						
- Able to sign	0	0	0	100.0	0	0
- Primary	0	0	0	100.0	0	0
- JSC	0	0	16.7	83.3	0	16.7
- SSC	0	0	28.6	100.0	0	0
- HSC	42.1	10.5	26.3	94.7	31.6	36.8
- Bachelor and above	18.2	25.5	29.1	90.0	17.3	40.0
* Multiple responses were possible						

Table 4

Prevalence on the types of e-health services against location, sex, and education qualification

	Types of e-health service during Covid-19 (%)		
	Telemedicine	Online vaccine registration	Covid test report download
Living area			
- Urban	37.6	99.0	29.7
- Rural	35.7	88.1	35.7
Gender			
- Male	33.7	96.5	31.4
- Female	42.1	94.7	31.6
Age			
- 18−30	25.0	96.4	48.2
- 31−40	58.3	91.7	36.1
- 41−50	28.6	100.0	3.6
- 51−60	50.0	93.8	18.8
- 61−70	40.0	100.0	20.0
- 71−80	0.0	100.0	0.0
Educational qualification			
- Able to sign	0.0	100.0	0.0
- Primary level	0.0	100.0	0.0
- JSC	40.0	100.0	0.0
- SSC	28.6	100.0	0.0
- HSC	41.2	100.0	47.1
- Bachelor and above	39.3	94.4	34.6

* Multiple Responses were possible

Table 5 presents the results of the Chi-square test on the prevalence of e-health services during the Covid-19 pandemic. In terms of access to e-health information on websites, there were significant differences based on living area ($p = .048$) and the Directorate General of Health Services (DGHS) ($p = .015$). Urban areas showed higher access to Corona Info Bangladesh (52.0%) compared to rural areas (28.0%) ($p = .004$). Regarding access to e-health services of the government, there were significant differences in online vaccine registration based on living area ($p = .003$). The access to Covid test report downloads varied significantly based on marital status ($p = .001$). In terms of access to the source of e-health service information, there were significant differences in television access based on marital status ($p = .048$) and newspaper access based on living area ($p = .131$). Overall, the

analysis reveals variations in the prevalence of e-health services based on location, gender, marital status, and the source of information.

Table 6 presents the results of the Mann-Whitney U-Test, examining the relationship between age and e-health facilities. In terms of access to e-health information on websites, significant differences were found for the Ministry of Health and Family Welfare (MOH&FW) (p = .000), and Corona Info Bangladesh (p = .000). For access to e-health service of the government, a significant difference was observed for Covid test report download (p = .000). Regarding access to the source of e-health service information, significant differences were found for social media (p = .002) and newspaper (p = .040).

Table 5
The Chi-square Test on the prevalence of e-health services during Covid-19

Components	Living Area (%)			Gender (%)			Marital Status (%)		
	Urban	Rural	p-value	Male	Female	p-value	Married	Unmarried	p-value
Component 1: Access to e-health information on the websites									
- Ministry of Health and Family Welfare (MOH&FW)	19.0	17.0	.695	21.0	15.0	.347	13.0	35.0	.002
- Institute of Epidemiology, Disease Control and Research (IEDCR)	19.0	21.0	.785	18.0	23.0	.405	20.0	20.0	1.00
- International Centre for Diarrhoeal Disease Research, Bangladesh (ICCDDR, B)	22.0	38.0	.048	32.0	18.0	.060	24.0	35.0	.164
- Surokkha	89.0	95.0	.230	91.0	90.0	.819	93.0	85.0	.150
- Directorate General of Health Services (DGHS)	12.0	29.0	.015	21.0	10.0	.074	15.0	23.0	.248
- Corona Info Bangladesh	28.0	52.0	.004	37.0	31.0	.528	28.0	53.0	.006
Component 2: Access to e-health service of the government									
- Telemedicine (dialing 16263)	35.0	36.0	.951	32.0	40.0	.329	39.0	25.0	.110
- Online Vaccine Registration	93.0	88.0	.379	92.0	90.0	.636	96.0	80.0	.003
- Covid test report download	28.0	36.0	.341	30.0	30.0	1.00	23.0	50.0	.001
Component 3: Access to the source of e-health service information									
- Television	63.0	60.0	.697	57.0	70.0	.099	57.0	75.0	.048
- Radio	7.0	5.0	.691	6.0	7.0	.779	6.0	8.0	.641

Components	Living Area (%)			Gender (%)			Marital Status (%)		
	Urban	Rural	p-value	Male	Female	p-value	Married	Unmarried	p-value
- Social media	78.0	83.0	.451	80.0	78.0	.805	77.0	85.0	.301
- Newspaper	44.0	31.0	.131	42.0	38.0	.635	36.0	55.0	.031
- Community people	66.0	64.0	.866	69.0	60.0	.262	70.0	53.0	.046
- Local newspaper	5.0	10.0	.257	8.0	3.0	.261	5.0	10.0	.214
- Local representatives	10.0	6.0	.382	8.0	5.0	.504	5.0	13.0	.084
- Religious leader	5.0	2.0	.321	4.0	0.0	.098	1.0	8.0	.027
- Miking	2.0	0.0	.108	1.0	0.0	.413	1.0	0.0	.545

Table 6
Mann Whitney U-Test results on the relationship between age and e-health facilities

E-health facilities	Mean Rank		Sig. (2-tailed)
	Yes	No	
Component 1: Access to e-health information on the websites			
- Ministry of Health and Family Welfare (MOH&FW)	43.02	82.95	.000**
- Institute of Epidemiology, Disease Control and Research (IEDCR)	62.33	78.79	.063*
- International Centre for Diarrhoeal Disease Research, Bangladesh (ICCDDR, B)	76.15	75.26	.912*
- Surokkha	76.82	62.71	.247*
- Directorate General of Health Services (DGHS)	63.34	77.93	.125*
- Corona Info Bangladesh	58.09	84.74	.000**
Component 2: Access to e-health service of the government			
- Telemedicine (dialing 16263)	80.92	72.54	.259*
- Online Vaccine Registration	76.76	62.27	.250*
- Covid test report download	55.64	84.01	.000**
Component 3: Access to the source of e-health service information			
- Television	72.64	80.17	.303*
- Radio	55.89	76.75	.162*
- Social media	69.79	97.40	.002**
- Newspaper	66.70	81.53	.040**
- Community people	79.59	67.80	.114*
- Local newspaper	65.17	76.16	.461*
- Local representatives	52.75	77.13	.086*
- Religious leader	48.00	76.25	.199*
- Miking	115.50	75.23	.467*
Note: ** Significant relationship *No relationship			

Satisfaction on e-health service

Table 7 analyzes satisfaction with e-health services during the Covid-19 pandemic, specifically telemedicine, online vaccine registration, and Covid test report download. Overall, satisfaction levels were positive, with varying degrees of satisfaction reported for each component. In the telemedicine component, 11.3% of respondents were highly satisfied, and 50.9% expressed satisfaction. The accessibility of Covid-19 information on the government website was rated positively by 67.9% of respondents. However, there were mixed opinions regarding the website's

updated information and citizens' overall knowledge of electronic health services. The overall satisfaction level for telemedicine was 5.96%. Online vaccine registration had slightly lower satisfaction levels, with 7.3% highly satisfied and 53.3% satisfied. The accessibility of Covid-19 information on the government website was positive, but concerns were raised about overall information on electronic health services. The overall satisfaction level for online vaccine registration was 6.08%. For Covid test report download, 4.4% were highly satisfied, and 64.4% expressed satisfaction. The accessibility of Covid-19 information on the government website was generally positive. However, there were mixed opinions regarding updated information and citizens' overall knowledge of electronic health services. The overall satisfaction level for Covid test report download was 5.55%. While satisfaction was generally positive, areas for improvement were identified, including updated information and citizens' knowledge of e-health services. Continuous evaluation and enhancement are crucial to meet evolving needs and provide a seamless healthcare experience during challenging times.

Table 8 presents the outcomes of a Spearman's correlation analysis examining the satisfaction levels of individuals receiving e-health services across various satisfaction domains. The analysis unveiled several noteworthy correlations. Firstly, a moderately positive correlation (0.536**) was observed between favorable experiences with e-health services and the accessibility of Covid-19 information on the government website. Secondly, the accessibility of Covid-19 information on the government website was found to moderately correlate (0.585**) with the presence of updated information on the website. Thirdly, a low positive correlation (0.313*) was identified between the availability of updated information on the government website and citizens possessing adequate information on electronic health services during the Covid-19 period. Moreover, citizens having sufficient information on electronic health services were moderately correlated (0.547**) with the appropriate advertisement of such services. Lastly, the proper advertisement of electronic health services displayed a low positive correlation (0.482*) with the government's implementation of adequate measures to promote e-health services. These correlations indicate the strength and direction of the relationships between different satisfaction areas. While moderate and low correlations suggest some associations, they do not necessarily imply strong dependencies.

Table 7
Satisfaction on e-health service during Covid-19

E-health services	HS (%)	S (%)	MS (%)	D (%)	SD (%)
Telemedicine					
- Service recipients have good experiences receiving e-health service	11.3	50.9	35.8	1.9	0.0
- The information related to Covid 19 is easily accessible from the government website	7.5	67.9	22.6	1.9	0.0
- The government website is full of updated information regarding Covid 19	5.7	45.3	35.8	11.3	1.9
- Citizens have enough information on electronic health services during Covid 19	1.9	28.3	37.7	22.6	9.4
- The government has advertised properly about electronic health services concerned to Covid 19	9.4	39.6	30.2	18.9	1.9
- The government has taken adequate measures during Covid-19 to promote e-health service	0.0	32.1	43.4	24.5	0.0
Overall	5.96	44.01	34.25	13.51	2.2
Online Vaccine Registration					
- Service recipients have good experiences receiving e-health service	7.3	53.3	35.8	2.2	1.5
- The information related to Covid 19 is easily accessible from the government website	8.0	52.6	35.0	4.4	0.0
- The government website is full of updated information regarding Covid 19	10.2	41.6	34.3	13.1	0.7
- Citizens have enough information on electronic health services during Covid 19	1.5	28.5	38.0	24.8	7.3
- The government has advertised properly about electronic health services concerned to Covid 19	7.3	27.7	33.6	29.2	2.2
- The government has taken adequate measures during Covid-19 to promote e-health service	2.2	25.5	51.1	20.4	0.7
Overall	6.08	38.2	37.96	15.68	2.06
Covid test report download					
- Service recipients have good experiences receiving e-health service	4.4	64.4	26.7	0.0	4.4
- The information related to Covid 19 is easily accessible from the government website	8.9	71.1	20.0	0.0	0.0

Note: ** HS = Highly Satisfied, S = Satisfied, MS = Moderately Satisfied, D = Dissatisfied, SD = Strongly Dissatisfied

E-health services	HS (%)	S (%)	MS (%)	D (%)	SD (%)
- The government website is full of updated information regarding Covid 19	8.9	35.6	37.8	17.8	0.0
- Citizens have enough information on electronic health services during Covid 19	0.0	31.1	35.6	26.7	6.7
- The government has advertised properly about electronic health services concerned to Covid 19	8.9	33.3	35.6	22.2	0.0
- The government has taken adequate measures during Covid-19 to promote e-health service	2.2	31.1	46.7	17.8	2.2
Overall	5.55	44.43	33.73	14.08	2.21
Note: ** HS = Highly Satisfied, S = Satisfied, MS = Moderately Satisfied, D = Dissatisfied, SD = Strongly Dissatisfied					

Table 8
Spearman's Correlation (Multiple) on service recipients' satisfaction regarding e-health services

Areas of satisfaction	Service recipients have good experiences receiving e-health service	The information related to Covid 19 is easily accessible from the government website	The government website is full of updated information regarding Covid 19	Citizens have enough information on electronic health services during Covid 19	The government has advertised properly about electronic health services concerned to Covid 19	The government has taken adequate measures during Covid-19 to promote e-health service
Service recipients have good experiences receiving e-health service	1.000	.536**	.461*	.163*	.161*	.194*
The information related to Covid 19 is easily accessible from the government website	.536**	1.000	.585**	.226*	.263*	.266*
The government website is full of updated information regarding Covid 19	.461*	.585**	1.000	.313*	.232*	.317*
Citizens have enough information on electronic health services during Covid 19	.163*	.226*	.313*	1.000*	.547**	.441*
The government has advertised properly about electronic health services concerned to Covid 19	.161*	.263*	.232*	.547**	1.000	.482*

Areas of satisfaction	Service recipients have good experiences receiving e-health service	The information related to Covid 19 is easily accessible from the government website	The government website is full of updated information regarding Covid 19	Citizens have enough information on electronic health services during Covid 19	The government has advertised properly about electronic health services concerned to Covid 19	The government has taken adequate measures during Covid-19 to promote e-health service
The government has taken adequate measures during Covid-19 to promote e-health service	.194*	.266*	.317*	.441*	.482*	1.000

Note

*** High Correlation ** Moderate correlation *Low correlation

Challenges of e-health service

The challenges to accessing e-health services in urban and rural areas, as presented in Table 9, highlight several key issues. In both settings, lack of publicity is identified as a significant challenge, with a substantial percentage of respondents reporting it as high. Delay in service and obtaining information also pose difficulties, particularly in urban areas. Lack of awareness among citizens is a major hurdle, especially in urban areas, where a significant majority perceive it as a high challenge. Citizens' unwillingness to utilize government services is another noteworthy concern, reported by a considerable portion of respondents in both urban and rural areas. Additionally, the carelessness of citizens regarding Covid-19 is an obstacle that needs to be addressed. Other challenges include the systematic complexity of e-health services, citizens' unfamiliarity with such services, lack of internet speed, and the cost of internet packages. These findings emphasize the need for targeted strategies to address the specific challenges faced in different areas to ensure equitable access to e-health services.

Table 9
Challenges to accessing e-health service in urban and rural areas (%)

Nature of challenges	Urban			Rural		
	High	Medium	Low	High	Medium	Low
Lack of publicity	50.9	36.1	13.0	42.9	40.5	16.7
Delay in service/getting information	46.3	47.2	6.5	33.3	50.0	16.7
Lack of awareness of the citizens	70.4	27.8	1.9	61.9	31.0	7.1
Citizens' unwillingness to government service	46.3	46.3	7.4	54.8	35.7	9.5
The carelessness of the citizen regarding Covid-19	62.0	36.1	1.9	59.5	33.3	7.1
Systematic complexity of the e-health service	43.5	50.0	6.5	45.2	50.0	4.8
Citizens are not used to e-health service	57.4	31.5	11.1	64.3	23.8	11.9
Lack of internet speed	69.4	27.8	2.8	57.1	38.1	4.8
Cost of internet package	73.1	25.0	1.9	73.8	21.4	4.8
Note: Multiple responses were possible						

Discussion

The objective of the study was to evaluate how the general public perceives the prevalence, satisfaction, and challenges associated with electronic health (e-health) services in Bangladesh. The study encountered some challenges and limitations that include a limited sample size, which may not fully represent the diverse population of Bangladesh, potential response bias in self-reported data, reliance on participants' subjective perceptions, the absence of longitudinal data to track changes over time, and the inability to establish causal relationships due to the cross-sectional nature of the study design. Additionally, the study may not have accounted for all potential factors that could influence the prevalence, satisfaction, and challenges of e-health services, such as socioeconomic status or regional disparities. Despite these limitations, this cross-sectional online survey presented interesting and useful findings on three main areas such as prevalence, satisfaction, and challenges the participants faced.

Surokkha emerged as a prominent website, accessed by 43.7% of participants, indicating its effectiveness and popularity. Additionally, online vaccine registration was utilized by 58.3% of participants, while telemedicine services were used by 22.6%. Nazmunnahar et al. (2023) reported that service recipients had a positive response to accessing the Surokkha app, and the study revealed that 90% of the population was covered under vaccination. Furthermore, Rahman et al. (2022) found that 83.52% of individuals showed positive responses toward accessing vaccination registration through a website. Another study by Rahman et al. (2021) indicated that a significant majority (86.24%) of people were aware of vaccine registration through a website. These findings highlight the effectiveness and reach of online platforms in providing crucial healthcare services and information during the pandemic. Khan et al. (2021) demonstrated the expansion of telemedicine services in Bangladesh due to the growing number of users, which ensured access to healthcare facilities while maintaining social distancing

measures. This highlights the importance of telemedicine in bridging the gap between urban and rural areas, particularly during a crisis like the Covid-19 pandemic.

Participants in our study reported social media (29.5%) and television (23%) as the major primary sources of e-health services during the pandemic. These platforms played a significant role in disseminating information and providing access to healthcare services. Our findings align with previous studies such as Rahman et al. (2022), which showed that social media (33.41%) and TV & Radio (25.61%) were the primary sources of Covid-related health information. Similarly, Islam & Rahman (2022) identified social media and television as major sources of e-health information during the pandemic in Bangladesh. Moreover, Kazak & Ozkaraman (2023) demonstrated that health authorities utilized multiple sources like social media (Twitter, Facebook, Instagram, etc.), television, newspapers, and radio to inform the general public about e-health. It is important to note that there are contrasting findings as well. For instance, Ara et al. (2020) reported that people mostly received e-health information from public meetings (85%), followed by the Internet and television (15%). These diverse findings underscore the varied channels through which individuals sought e-health services and information during the pandemic. Overall, satisfaction levels were positive, with varying degrees of satisfaction reported for telemedicine, online vaccine registration, and Covid test report download. While satisfaction was generally positive, areas for improvement were identified, including updated information and citizens' knowledge of e-health services. Our study findings are consistent with several previous findings. For example, Islam & Rahman (2022) presented a positive level of satisfaction by the participants with accessing telemedicine, online vaccine registration, and Covid test report download. Ráti & Kemény (2023) showed similar findings that service recipients had satisfactory responses toward e-health services during Covid-19. Reyda et al. (2023) found that people were well-acquainted with telemedicine service and they had a moderate level of satisfaction regarding telemedicine service in Bangladesh.

Continuous evaluation and enhancement are crucial to meet evolving needs and provide a seamless healthcare experience during challenging times. Lack of publicity, delays in service, lack of awareness among citizens, citizens' unwillingness to utilize government services, and the carelessness of citizens regarding Covid-19 were reported as significant challenges. Other obstacles included the complexity of e-health services, citizens' unfamiliarity with such services, lack of internet speed, and the cost of internet packages. These findings underscore the need for targeted strategies to address the specific challenges faced in different areas and ensure equitable access to e-health services. The cross-sectional analysis showed that urban residents had a higher prevalence of accessing the Surokkha platform for e-health services and online vaccine registration, while challenges related to lack of publicity and delay in service and information were reported in both urban and rural areas. Females exhibited a greater preference for telemedicine compared to males, and satisfaction levels with e-health services showed variations between genders, including differences in accessing specific services. Different age groups exhibited variations in accessing specific e-health services, with younger individuals, particularly those aged 18–30, demonstrating higher utilization of online vaccine registration and Covid test report download. Different educational qualifications influenced the choice of e-health service platforms, with individuals holding JSC qualifications showing significant utilization of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B), while those with primary education and HSC qualifications primarily relied on the Surokkha platform.

Interestingly, the study found contrasting results compared to previous research. Ahmed et al. (2020) reported a higher enrollment of males in telemedicine services, while Abedin et al. (2021) showed lower online vaccine registration numbers in rural areas. Additionally, different age groups and educational qualifications influenced

the choice of e-health service platforms, with variations observed in utilization patterns. These findings suggest the importance of considering demographic factors and tailoring interventions to address specific needs and preferences. Previous studies have highlighted various aspects related to e-health services in Bangladesh. Rahman et al. (2020) identified that individuals with good relationships with doctors and health professionals had privileged access to Covid testing, resulting in lower engagement with Covid test reports. Ahmed et al. (2022) found that the Shasthyo Batayon telemedicine service received a significant number of repeat callers seeking medical advice for common ailments. Islam et al. (2021) reported high satisfaction rates with the online vaccine registration system due to its fast-track application process. Similarly, the study conducted by Care Bangladesh (2020) demonstrated satisfactory responses to online vaccine registration, with a majority of participants having knowledge of how to apply online for the service. Conversely, Cousins (2020) found that higher charges for Covid tests resulted in a lower number of enrollments and dissatisfaction among the population.

Challenges related to inadequate knowledge of e-services, economic vulnerability, cost concerns, internet speed, and network facilities were consistently reported across multiple studies (Rahman et al., 2020; Islam & Rahman, 2022; Chowdhury et al., 2021; Rural Health Information Hub, 2022). Rahman et al. (2022) also reported major challenges in the area of digital healthcare facilities, lack of preparedness, and limited public awareness. Addressing these challenges, including improving awareness and ensuring reliable internet access, is essential for the successful implementation and utilization of e-health services in Bangladesh.

Conclusions and policy implications

The study has a key objective to assess public perception on e-health services amid Covid-19 in Bangladesh. Overall findings show that the public has a moderate perception on the e-health service of the government. Most of the people availed of telemedicine and online vaccine registration during Covid-19. People mostly received e-health information by accessing the website of Surokkha, Corona Info Bangladesh, the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B), and the Institute of Epidemiology, Disease Control and Research (IEDCR). The major sources of e-health information are social media, community people, television, and newspaper. Both urban and rural people significantly received telemedicine, online vaccine registration, and Covid test report download. People have a moderate level of satisfaction regarding access to available e-health information, e-health service, government advertisement about telemedicine, online vaccine registration, and Covid test report download. There are lots of challenges affecting e-health services that include the cost of internet packages, lack of awareness of the citizens, lack of internet speed, the carelessness of the citizen regarding Covid-19, lack of usefulness, lack of publicity, citizens' unwillingness to government service, etc.

Based on the findings discussed, the following areas have policy implications that can help guide policymakers in enhancing e-health services, addressing challenges, and ensuring equitable access to healthcare services in Bangladesh:

- Investment in e-health platforms: The popularity and effectiveness of online platforms like Surokkha highlight the need for continued investment in e-health platforms. Policy interventions should focus on supporting and expanding these platforms to ensure wider access to crucial healthcare services and information.
- The study findings also have great policy implications as per the 8th five-year plan (2020–2025) such as the government envisioned promoting e-health services through increased health facilities in healthcare,

partnership with private partners, telehealth promotion with the use of ICT, universal health care policy formulation, etc. (Government of Bangladesh, 2020).

- Awareness campaigns: The reliance on social media and television as major sources of e-health services indicates the importance of awareness campaigns through these channels. Policymakers should prioritize public awareness campaigns to disseminate information about e-health services, their benefits, and how to access them, reaching a wider audience and bridging the knowledge gap.
- Bridging the urban-rural divide: The higher prevalence of accessing e-health services in urban areas and challenges faced in both urban and rural areas underscore the need to bridge the urban-rural divide. Policymakers should implement targeted strategies to ensure equitable access to e-health services, particularly in rural areas, to overcome barriers related to lack of publicity and delays in service.
- Tailored interventions for different demographics: The variations in utilization and satisfaction among different demographics highlight the importance of tailored interventions. Policies should consider demographic factors such as gender, age, and educational qualifications when designing and implementing e-health services, ensuring that they meet the specific needs and preferences of different population segments.
- Improving internet infrastructure: The challenges related to internet speed and network facilities emphasize the need to improve internet infrastructure. Policymakers should prioritize efforts to enhance internet connectivity and affordability, ensuring reliable and high-speed internet access across the country to overcome barriers to accessing e-health services.
- Data security and privacy: The study findings underscore the importance of robust data security and privacy measures. Policies and regulations should be implemented to protect the personal health information of individuals using e-health services, ensuring confidentiality and instilling trust in the system.

Declarations

Ethical Approval

Ethical approval was taken from the Bangladesh University of Professionals (BUP).

Consent: Written permission and consent were taken from all respondents. Written consent was taken from BUP to publish this paper.

Competing interests

Authors' contributions

All authors, Md Robiul Islam, M. Rezaul Islam, and Abdur Rahman, have made equal contributions to this paper.

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Data will be Available upon request

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