Community's Willingness to Pay for Improving Public Healthcare Services: A Contingent Valuation Study in the Coastal Hazard-prone Areas of Bangladesh

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ABSTRACT: Health service improvement in the coastal remote areas of Bangladesh is very essential to tackle the adverse effects on community health caused by frequent natural hazards. This research was conducted to explore the coastal community's concerns about upgrading public healthcare facilities and determine their willingness to pay (WTP) for improving services at the Upazila Health Complex of Shyamnagar upazila of Satkhira, Bangladesh through the contingent valuation method (CVM). A binary logistic regression model was applied to find out factors influencing the variation in willingness to pay and the mean willingness to pay for healthcare improvement was estimated to be approximately Tk 60 using a probit model. The findings suggest that if the government can build public trust by ensuring the presence of qualified doctors and staff, adequate medical supplies, upgraded water, sanitation, and hygiene (WASH) facilities, and the provision of specialized diagnostic equipment such as X-ray machines and laboratory testing tools in the Upazila Health Complex, significant public support can be mobilized to raise funds for these improvements. The research outcome would help adopt appropriate health financing policies for improving the service quality and developing the overall facilities of public health institutions.

Keywords: Willingness to Pay (WTP); Contingent Valuation Method (CVM); Public Health; Healthcare Services; Coastal Community; Coastal Hazards

INTRODUCTION

Bangladesh as a whole is world's one of the most disaster-prone countries. But the coastal regions of the country are undoubtedly more hazard-prone and susceptible to the impact of climate change than the rest of the country because of its proximity to the Bay of Bengal and repeatedly occurring cyclonic events, storm surges, coastal erosion, monsoon wind, floods, and salinity intrusion (Islam et al., 2015; Haque et al., 2020). The adverse impact of climate change is increasing the frequency and intensity of the prevailing natural hazards if not creating new ones. Rising sea levels and exacerbation of cyclones and storm surges due to climate change are major contributors to the rapid intrusion of seawater inland and increasing salinity in the coastal regions (Chakraborty et al., 2019). While the occurrence of frequent cyclones makes the coastal community socioeconomically vulnerable, the spread of human disease and treatment costs have increased as a result of salinity intrusion and scarcity of potable water (Rakib et al., 2019). The potential risk for disasters along with substantial losses in terms of socioeconomic status, environment, culture, and health has escalated for coastal communities since the number of coastal populations at risk and their assets have significantly increased over the years compared to the level of vulnerability reduction in the meantime (Faisal et al., 2021; Mallick et al., 2017).

The natural environment and climate have a significant impact on human health. Regular and excessive usage of saline water accelerates the spread of acute respiratory illness and mosquito-borne diseases in coastal districts. The prevalence of high blood pressure and hypertension in the coastal community of Bangladesh has also been observed to be related to the frequent use of saline water for drinking and other purposes (Rakib et al., 2019; Shammi et al., 2019). After cyclone Sidr in 2007, the outbreak of diseases such as cough, cold, virus fever, diarrhea, eye problems, dysentery, skin disease, pain, paralysis, malnutrition, waterborne diseases, anemia, high blood pressure, jaundice, and severe

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headache was prominent in the affected districts (Kabir et al., 2014). Due to the remoteness and prevalence of natural hazards, the vulnerabilities in the public health institutions in the coastal areas pose a higher risk for the communities to be affected by both hazards and health issues. Hence it is very important to have an effective healthcare system for functioning in coastal remote regions. There have been several pieces of research on the problems and challenges in the health system in Bangladesh; vulnerability and adaptation of coastal communities in the face of the adverse effect of climate change and natural disasters (ICDDRB, 2010; Islam, 2014; Joarder et al., 2019; Muhammad et al., 2017; Sultana et al., 2019).

The health system in Bangladesh depends majorly on the government for finance, service delivery system, and overall management policies (Islam, 2014). Usually, the healthcare fees at private hospitals are high and in government hospitals, patients find difficulties in accessing proper medical care because of congestion and resource shortages. These are the main reasons why most of the people in the country do not go to hospitals when they get ill (Sultana et al., 2019). Inadequate public facilities, poor access to them, lack of essentials, an insufficient workforce, lack of planning and community empowerment at local levels, resource mismanagement, financial constraints, and continuously growing inequity in obtaining health services are the notable challenges in the healthcare system of the country (Joarder et al., 2019; Shahen & Ahmed, 2020; Sultana et al., 2019). People in remote areas frequently rely on unofficial health facilities such as drugstore pharmacists, midwives in rural areas, kabiraz, and other traditional healers because government hospitals are located far away. (Ahmed & Jakaria, 2009; Sultana et al., 2019). The improvement of the healthcare system would be an important measure for ensuring the health security of the coastal people and enhancing community resilience against natural calamities in the long term.

Enhancing the service quality in public healthcare institutions requires the achievement of the community's need-based improvements and additional funding will be required for that. The efficiency and quality of healthcare are found to be influenced by whether any health policy is defined considering the preference of the citizens who are going to benefit from that policy (Foster et al., 2010). Knowledge of patients' preferences for health resource allocation, health needs as well as their economic reasoning, combinedly helps improve the planning process of the health systems (Fernández et al., 2013). For raising funds to improve the service quality and overall facilities of the public healthcare system, it is necessary to assess the responsiveness of the community to financially contribute to the development of public health services. Therefore, assessing which attributes in the health system the affected communities prefer to improve and the economic valuation of their willingness to pay is essential.

This research has been conducted to explore the prevailing health issues among the community people, their choices for seeking healthcare, priorities for improving services and to assess the affected communities' preference for a financial contribution for improving healthcare services in a selected upazila of Satkhira. Satkhira is one of the highest vulnerable coastal districts of Bangladesh in terms of poverty and development, economic dependency, inequality, health conditions, children younger than five years old, and other vulnerable groups (Haque et al., 2020). Shyamnagar upazila of Satkhira was selected as the study area owing to its high exposure and vulnerability to saltwater intrusion and cyclonic storm surges and consequent high migration risk (Rakib et al., 2019) (Fig 1). For the analysis of this research, service improvement, and associated economic valuation have been considered for the Upazila Health Complex (UHC) only since it is the primary unit of the public healthcare system covering an upazila. WTP of the households and the factors affecting willingness are evaluated through an in-person questionnaire survey at Shyamnagar, following the dichotomous choice technique with follow-up questions of contingent valuation.

While the challenges in healthcare delivery and the coastal vulnerabilities in Bangladesh have been extensively examined, limited research has focused on the community's preferences for healthcare service improvements and their willingness to financially contribute to such improvements. This study addresses this critical gap by specifically assessing the willingness to pay (WTP) for healthcare service improvements in Shyamnagar Upazila, Satkhira, highlighting the local socio-economic influences. The findings of this study contribute to a better understanding of community-driven healthcare financing mechanisms in coastal regions, offering a unique perspective that integrates the local community's economic preferences with policy recommendations for sustainable healthcare funding.

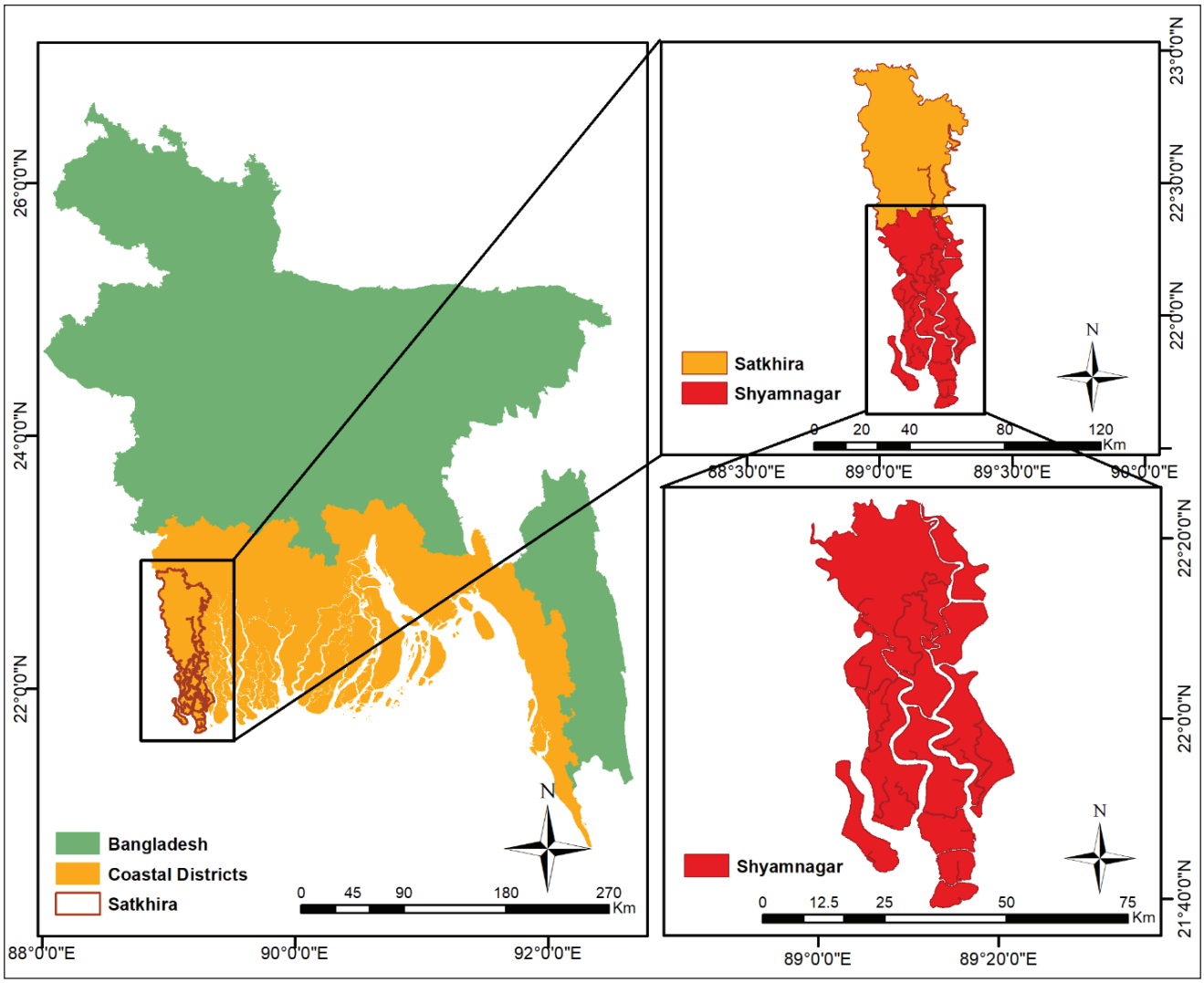

Figure 1: The Research has been Conducted at Shyamnagar Upazila of Satkhira

CONTINGENT VALUATION METHOD

Several market-based or nonmarket-based methodologies have been developed for the economic valuation of health services. The economic valuation techniques have been classified broadly into two groups, which are direct and indirect valuation methods (Mitchell and Carson, 1989). Contingent valuation (CV) is a direct hypothetical method that can be used for the valuation of both market and nonmarket goods. The method is particularly helpful for estimating the value that people place on services, amenities, and environmental resources that are not traditionally sold at an observable market price. In this method, a survey is conducted by presenting the participants with a hypothetical scenario of the intended resource or service and asking them to state their willingness to pay contingent on the described scenario (Hanemann, 2018). The four major techniques of eliciting the value of the respondents in a contingent valuation are open-ended format, bidding game, payment card, and dichotomous choice (Haab and McConnell, 2002). Each format measures the outcome differently and has its advantages as well as demerits. Selection of the suitable elicitation format is therefore subject to the purpose of the study and the use of data (Heinzen and Bridges, 2008). The dichotomous choice format of CVM has been well-established and widely applied in the valuation of environmental services. In this format, the respondents are asked to state their WTP for a described scenario of service by responding with 'Yes' or 'No' to an offered estimate of money. This elicitation format has been recommended by the

National Oceanic and Atmospheric Administration (NOAA) of the United States of America for its superiority and reliability (Arrow et al., 1993).

CVM has been well accepted for environmental valuation and is also widely used in the field of healthcare valuation (Klose, 1999; Wolff et al., 2020). Shono et al. (2014) analyzed consumers' preferences for assessing public demand and financial perspectives of public health in low-income and middle-income countries by applying the CV method. This method was applied in Taiwan to determine what is the value to the mothers of protecting themselves and their children suffering from cold (Sehreen and Masud, 2019). Estimation of WTP for different aspects of public health services and determination of the contributing factors have been done considering distinct approaches in several countries (Al-Hanawi et al., 2020; Jeetoo and Jaunky, 2022; Jofre-Bonet and Kamara, 2018). In Bangladesh, CVM has been used to estimate specific attributes of WTP for health quality improvement (Pavel et al., 2015). Among Bangladesh's informal workers in urban areas, WTP for health insurance has been determined by Ahmed et al. (2016). A few of the limitations of CVM include hypothetical bias, where respondents may overstate their willingness to pay, and also the possibility of strategic bias influencing answers. The method can also suffer from the embedding effect and protest responses. However, these shortcomings can be managed through careful survey design and follow-up questions. CVM was suitable for our research due to its relatively straightforward approach and the capacity to directly capture the preferences and economic values of community and therefor has been chosen to elicit the coastal community's WTP to obtain better public health services in the research setting..

MATERIALS AND METHODS

Setting and Target Population Selection

The target population for this study was the patients visiting Shyamnagar UHC, as they would be most concerned about better service from UHC as well and can describe the existing problem and scope of improving the facilities there from their experience. A pilot survey was conducted before the main survey with open-ended questions about the demographic characteristics, services, and problems of UHC, estimation of the amount of money that people will voluntarily pay among other things to find out the community's needs and priorities regarding health service financing as well as to generate a hypothetical valuation scenario for this research. In addition to that, Key Informant Interviews (KII) were done with the Upazila Health and Family Planning Officer (UHFPO) and a few other healthcare providers to obtain further insight into the state of existing service facilities and the scope of improvement given sufficient funds. After analyzing the data of the pilot survey, the questionnaire was revised into a semistructured one for the main survey. For the main survey, sample respondents were selected from among the households visiting UHC since the people who directly utilize healthcare services from UHC are assumed to be in the best position to describe the service experience as well and are also supposed to be better concerned about their improvement. For making the sample representative, respondents were selected at the UHC compound through systematic random sampling by choosing one between every two consecutive patients coming out of the UHC. The analysis of WTP has been done following the maximum likelihood estimation (MLE) procedure, which requires large samples to ensure robustness. However, studies having a sample size between 200 to 250 for eliciting willingness to pay through contingent valuation have demonstrated credible outcomes previously (Pavel et al., 2015; Shono et al., 2014). To enhance the reliability of the estimates and reduce potential biases, a larger sample of 340 respondents was chosen for this research. After data cleaning, 328 were retained for further analysis, further strengthening the reliability of the findings.

WTP Elicitation Survey

The primary data of the research was collected through an in-person questionnaire survey conducted at the UHC compound for the consecutive days between November 30 to December 6 of the year 2021. The hypothetical improved scenario of health service at UHC for contingent valuation was developed in light of the findings of the pilot survey. In the questionnaire, information was provided as realistically as possible about the current state of facilities and the proposed improved scenario at UHC, given the increase in the number of doctors and staff, supply of sufficient and good quality medicines, enhancement of water, sanitation, and hygiene (WASH) facilities, and arrangements for special diagnostic equipment. The payment method was described specifically. Since the number of visits to UHC for a household varies, therefore instead of a

monthly or yearly payment, the respondents were asked how much extra fee they would be willing to pay per visit to the UHC.

In this research, a dichotomous choice format was followed for asking the WTP expressing question. Eleven values between Taka 5 to Taka 100 were determined based on the monetary values of the pilot survey, and respondents were asked to respond in 'Yes' or 'No' to a point estimate of WTP, randomly selected from the list of those predetermined values. Although more advanced valuation methods like the double bounded dichotomous choice format of CVM or the Choice Experiment (CE) approaches are in there, for the ease of computation and implementation in the context of the target population and available resources of this research, a single bounded dichotomous choice format was opted. In addition, an open-ended follow-up valuation question was included in the questionnaire to check if there was any bias issue in the response.

The ethical approval for the research was granted by the Ethical Review Committee of the Faculty of Pharmacy, University of Dhaka, Bangladesh after thoroughly reviewing the research proposal and the questionnaire used for the final survey. As per the Ethical Review Committee's requirement, the interviewers administering the questionnaire survey were trained to obtain informed consent from the participants before conducting the interviews. All the participants of the survey were properly informed about the research objectives and the questionnaire before starting the interviews. Since a majority of the households in the study area could not read or write, the informed consent was written at the beginning of the questionnaire and read verbally to the respondents of the survey by the interviewers. The participants' responses were documented and interviews proceeded only after the respondents agreed to continue and terminated otherwise.

Empirical Model Specification

Econometric analysis of the data was done using both logit and probit models. Binary logistic regression was applied to determine the factors influencing the variation in WTP. Mean WTP was determined using a probit model. In the logit and probit models, the dependent variable has only two values representing the choice between two alternatives or the occurrence of an event. In this research, The dependent variable was the 'Response' of the households about whether they would pay the offered bid equivalent money or not. The responses were categorized as 1 and 0 for Yes and No respectively. Assuming the individual's income I, conditioning factors S, and the utility function to be (U: I, S), it was assumed that when the conditional indirect utility function for the proposed change will be higher than the conditional indirect utility function for the current system, a household would accept the offered bid for the proposed improved public healthcare services (Hanemann, 1984).

The logit model was used to identify the socio-economic variables and other factors that influence the dichotomous responses of WTP of the target population. Taking the natural logarithm of the odds ratio of the probability that an i^{th} household will pay (P_i) and the probability that the household will not pay ($1 - P_i$) for improved public health services, the logit model has been obtained as,

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \ln(e^{Z_i})$$

Here, Z_i refers to the logarithmic odds ratio in favor of paying for the improved public healthcare service. This model was used for this study for determining the factors influencing the WTP of a household. Therefore taking the error term into consideration the logit model stands,

$$WTP = Z_i$$
$$= \beta_0 + \beta_1 M1000 + \beta_2 AGE + \beta_3 GENDER + \beta_4 HH$$
$$+ \mathrm{B}_5 hD + \mathrm{B}_6 DW + \beta_7 BID + \varepsilon \ldots..(1)$$

Where WTP is the willingness to pay the proposed bid obtained from the response. And ε is the random disturbance term. 7 independent variables were considered in the model assuming they would influence the variation in the dependent variable and are explained here (Table 1).

Table 1: Descriptions of the Variables used in the Logit Model

Variable	Description	Type	Expected Sign
RESPONSE	Accepting the proposed bid (1 = Yes; 0 = No)	Dichotomous	
MI	Total monthly income of the family expressed in 1000 taka	Continuous	+
AGE	Age of the respondents	Continuous	+/-
GENDER	Gender of the respondents (1 = Male, 2 = Female)	Nominal	+/-
HD	Damaged by hazards (1 = Yes; 0 = No)	Dummy	+/-
HH	Health issues from hazards (1 = Yes; 0 = No)	Dummy	+
DW	Availability of safe drinking water (1 = Yes; 0 = No)	Dummy	+/-
BID	Bid Value (amount in Taka offered to respondent)	Continuous	-

The elasticity of likelihood that a household would want to pay for improved public health services depending on a given factor has been calculated from the partial derivatives of the logistic cumulative distribution function or as the discrete change in probability when a target variable goes through a discrete change following Greene (1993). Thus, how the unit change in a target variable affects the WTP for improved public healthcare services was determined.

To calculate the mean willingness to pay (MWTP) for public health service improvement, the probit model for this study was obtained by regressing the willingness variable by the offered bid variable following previous research (Hanemann, 1984; Kabir, 2019). The intercept is then divided by the coefficient corresponding to the offered bid variable. Assuming the willingness to pay of a household to be a function of offered bids, the specified probit model stands,

$$Prob(Y = 1 \mid Offered\ Bid)$$

$$= \alpha + \beta\ (Offered\ Bid) + \varepsilon \quad \text{.....(2)}$$

The mean WTP (μ) from the given model,

$$\mu = -\frac{\alpha}{\beta} \quad \text{.....(3)}$$

Here, α is the constant term and β is the coefficient of the offered bid variable.

The aggregate willingness to pay (AWTP) was obtained by multiplying MWTP with the target population which is the annual number of outdoor patients visiting UHC (TOP) for this study. The measure in taka,

$$AWTP = MWTP * TOP \quad \text{.....(4)}$$

RESULTS

Summary of Existing Health Issues and Healthcare Services

Being exposed to coastal hazards, 20.4% of the households in the research have experienced health issues directly resulting from any natural hazards. A few of them experienced injuries and the most mentioned health issues were waterborne diseases and skin irritation during the flood. Other than fever and common cold high prevalence of waterborne diseases like diarrhea, dysentery, and skin diseases were observed, often associated with saline water usage (Fig. 2).

The scarcity of safe water was a notable problem found during the study. Considering only drinking water, 4.9% of households do not have access to safe water throughout the year. 18.3% of them stated to get water for a few months, mostly during the rainy season by storing the rainwater. Even among the households having access to safe drinking water for a few months or the whole year, a significant 39% of the sample population directly or indirectly uses saline water for other household purposes. 42.5% of these households using saline water stated to have health issues due to saline water usage.

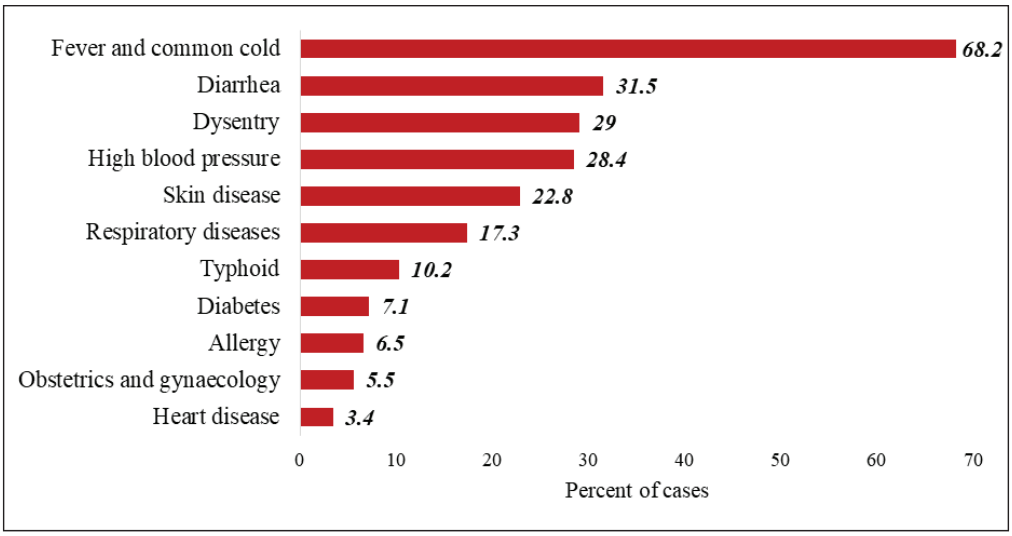

Figure 2: Common Health Issues Prevailing among the Households

Salinity and unavailability of fresh water lead to the dependency of the community on various alternative sources of drinking water. The most common water sources were rainwater harvesting for 34.3% of the households and pond water filtration mentioned by 30.6% of the households. The other sources of drinking water included purchased water, tubewell, water treatment plants, and unfiltered pond water.

The respondents mentioned various formal and informal sources as their primary choice for healthcare support. 32.3% of respondents preferred UHC as the primary source for healthcare seeking. Other than UHC a significant portion of the households prefers consulting with the shopkeepers of the local pharmaceuticals or the village doctors first and then going to the nearby healthcare centers if suggested by them. The other mentioned sources were private hospitals, Union Health and Family Welfare Center (UHFWC), Community Clinics (CC), local kabiraj, district hospitals, and healthcare from NGOs (Fig. 3).

49% of the sample population does not prefer UHC and mentioned several causes for that. The reasons for not preferring UHC and suggested improvements for it are shown in (Table 2).

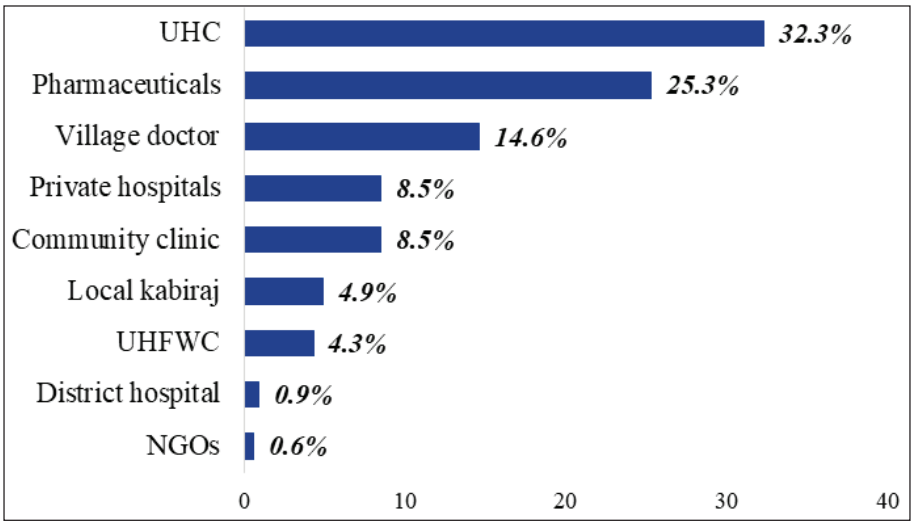

Figure 3: Primary Choices of Households for Seeking Healthcare

Table 2: Reasons for not Preferring UHC and Suggested Improvements for it

Reasons for not preferring UHC	N (%)	Suggested Improvements	N (%)
Doctors are not always available	51.2	Increased number of doctors and staff	23.6
UHC is very far away	46.3	Sufficient medicine provision	23.5
Medicines are unavailable	44.4	Improved WASH facilities	17.1
Complexities in getting treatment and medicines	38.8	Availability of diagnostic equipment	15.2
Specialized diagnostic services are not available	22.5	Improved building structure	6.9
Consulting at pharmaceuticals is sufficient	20.6	Arranging facilities for emergency operation	5.6
Private hospitals provide better care	15.0	Increased ambulance service	5.1
Treatment from a village doctor or local kabiraz is convenient	5.0	The presence of specialized doctors	2.3
Unhygienic condition of UHC	2.5	Increased bed number	0.7

Households' WTP at Offered Bids

Among the 328 respondents, 193 respondents said yes to the offered bid values for obtaining an improved public healthcare system which is 58.8% of the total sample. 135 respondents consisting of 41.2% rejected the offer. The range of minimum and maximum offered bids being between 5 and 100, the mean value of offered bids for the respondents accepting the offered bids was 36.22. Whereas the mean value was 58.63, much higher in the case of the households who rejected the bids. The distribution of the number of 'Yes' responses was found to decrease with the increased bid values (Fig 4).

In the descriptive statistics, variations of sociodemographic variables among the households willing to pay and those unwilling to pay the offered bids were observed. The percentage of educated responders in primary, secondary, and higher than secondary levels was higher among the households willing to pay (Table 3).

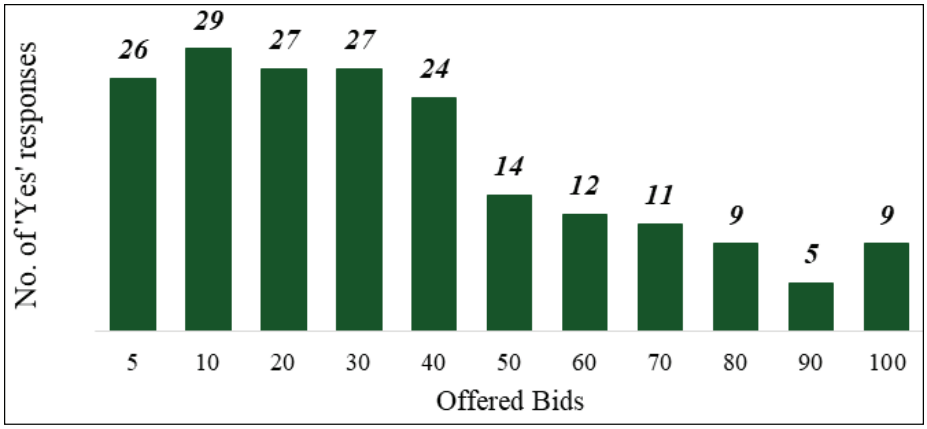

Figure 4: Frequency Distribution of Yes Responses for Offered Bids

Table 3: Demographic and Socio-economic Characteristics of the Households

	Households willing to pay at offered bids		Households unwilling to pay at offered bids	
Variable	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Gender				
Male	160	82.9	89	65.9
Female	33	17.1	46	34.1
Age	Mean= 39.88		Mean= 41.97	
18 to 30	57	29.5	32	23.7
30 to 45	77	39.9	50	37.0
45 to 60	45	23.3	38	28.1
Above 60	14	7.3	15	11.1
Level of Education				
No formal education	42	21.8	44	32.6
Primary	45	23.3	25	18.5
Secondary	67	34.7	42	31.1
Higher than secondary	39	20.2	24	17.8
Family Members				
Less than 5	70	36.3	48	35.6
5 to 10	115	59.6	77	57.0
More than 10	8	4.1	10	7.4
Household's Monthly Income	Mean=17930.05		Mean=14840.75	
Upto Tk 10000	65	33.7	46	34.1
Tk 11000 to Tk 15000	53	27.5	46	34.1
Tk 16000 to Tk 20000	43	22.3	29	21.5
Tk 21000 to Tk 25000	9	4.7	5	3.7
Above Tk 25000	23	11.9	9	6.7

Among the 135 households unwilling to pay the initially offered bids, 78 were there who wished to pay for UHC's service improvement but could not afford to pay the asked amount. While 17.4% of the sample did not wish to pay any additional money at all mentioning it either to be the sole responsibility of the government or their unreliability of the program's effectiveness. The distribution of the households is shown in (Table 4).

Table 4: Distribution of Households Based on Their Choices to Pay

		Percentage (%)	Total
Households willing to pay	Willing to pay at offered bid	58.8	**82.6%**
	Willing to pay less than offered bid	23.8	
Households unwilling to pay	Consider it as government's responsibility	15.9	**17.4%**
	Consider the program to be ineffective	1.5	

Factors Influencing WTP

Estimation of the factors influencing WTP was done by applying the logit model based on the theoretical model mentioned earlier. 7 explanatory variables were considered in total for the analysis after doing t-tests for continuous variables and the chi-square ($\chi 2$) test of independence. And out of them, 5 variables were observed to have significant influences over WTP at less than 5% probability level which were: monthly income of the family, age of the respondent, gender of the respondent, availability of safe drinking water, and offered bid. Household damage by hazards, and health issues from hazards, these 2 variables were found not significant at a 5% probability level. However, the non-significant variables also have effects on the log-likelihood of the logit model (Table 5).

Table 5: Logit Model Estimates of WTP and the Marginal Effects of the Influencing Factors

Logit model estimates of WTP		**Marginal effects of the influencing factors**	
RESPONSE	**Coefficient (SE)**	**Variable**	**dy/dx (SE)**
BID	-0.0324***	BID	-0.0077***
	(0.0048)		(0.0011)
MI	0.0272 **	MI	0.0065**
	(0.0119)		(0.0028)
AGE	-0.0194**	AGE	-0.0046**
	(0.0096)		(0.0023)
GENDER	-1.0658***	GENDER	-.2536***
	(0.3000)		(0.0714)
HH	-0.0248	HH	-0.0059
	(0.3369)		(0.0804)
HD	0.3947	HD	0.0957
	(0.3299)		(0.0812)
DW	0.8411***	DW	0.2048***
	(0.3045)		(0.0738)
_cons	2.6259		
	(0.7202)		
Number of obs	328		
LR chi^2 (7)	81.89		
Log-likelihood	-181.252		
Prob>chi^2	0.0000		
Pseudo R^2	0.1843		

*** and ** indicate coefficients of variables with significance levels of 1% and 5% respectively

The overall significance of the logit model has been measured using the chi-square ($\chi 2$) distribution. The obtained result of the logit model showed that the chi-square distribution (81.81) with 7 degrees of freedom is 0.0000 which is less than 1 percent. Hence the considered explanatory variables included in the model fitted the logit model at less than a 1 percent probability level. The joint null hypothesis of coefficients of the independent variables included in the model has been rejected and the data fitted the model very well.

The explanatory variables' marginal effects on a household's willingness to pay were calculated. It was found that at a 5% level of significance, with an increase of Tk 1000 in the monthly income of a household, its probability of accepting an offered bid increases by .65%. and with the same significance level, it can be said that the probability will reduce by .46% with an increase in 1 year age of the respondent. The probability of accepting an offered bid will highly vary with gender. From the model, it is observed that, at a 1% level of significance, the probability of accepting offered bids will be 25.36% less for female-headed households than the male-headed households. Another critically influencing factor found in the model is the availability of safe drinking water throughout the year. With a 1% level of significance, it is observed that the households having water security throughout the year are 20.48% more likely to accept the offered bids than the households not having access to safe drinking water throughout the year.

Mean and Aggregate WTP

The probit model estimates shown in (Table 6) are used to determine the mean willingness to pay for having improved healthcare services at the upazila health complex.

The coefficient of the constant term was found to be 1.7 and that of the bid value is -0.0285 Hence the estimated MWTP for improved healthcare services at the upazila health complex is Tk 59.59 per visit from the probit model.

Table 6: Estimates of the Probit Parameters

	Coefficient (SE)
BID	-0.0285***
	(0.0044)
_cons	1.700***
	(0.2440)
LR chi^2 (1)	48.53
Log likelihood	-197.931
Prob>chi^2	0.0000

*** indicates coefficients of variables with significance levels of 1%

The total population for this study was the number of outdoor patients visiting Shyamnagar UHC annually. Taking the average of the years 2018 to 2021, the estimated total population was 63787. The estimated total number of households having valid responses remains 52688 after subtracting the 17.4% protest zeros. The aggregate willingness to pay for this population is computed to be Tk 3139677 annually (Table 7).

Table 7: Aggregate WTP from Shyamnagar Upazila

Total population	Sampled HH	No. of HH with zero WTP	Percentage of HH with zero WTP	Expected number of households with a valid response	Mean WTP (in taka)	Aggregate WTP (in taka)
63787	328	57	17.4%	52688	59.59	3139677

DISCUSSION

The research brings about essential information on the overall health and healthcare scenario of the coastal communities highlighting their current healthcare-seeking behaviors, priorities for service improvement, and their WTP for improving public healthcare facilities in these backdrops. The community at Shyamnagar faces a common problem of insufficient and unsafe drinking water as most of the natural water reservoirs contain saline water. At the same time, a high prevalence of waterborne diseases other than the common cold and fever compounds the problem. High prevalence of waterborne diseases like diarrhea, dysentery, high blood pressure, and skin diseases respectively suggests that the usage of saline water for drinking and other purposes serves as a major influencing factor of community health in Shyamnagar. This association reinforces the strong relationship between the usage of saline water and water-related diseases in the coastal regions of Bangladesh as found in previous pieces of research (Asma & Kotani, 2021; Chakraborty et al., 2019; Saha, 2017).

Access to healthcare remains a challenge, with very few of the respondents seeking medical checkups at regular intervals. Special medical care is sought only when treating an illness goes beyond the capacity

of home remedies. Among the respondents, 32.3% preferred UHC to be their first choice for healthcare, but many opted for alternative sources due to various reasons. The notable reasons behind these choices were mostly the convenience of proximity, cheaper cost, and comfortable interaction with health service providers. Previous research (Pavel et al., 2015) has also noted the importance of doctor-patient relationship for increasing willingness to pay for healthcare improvement in Bangladesh. The most commonly requested improvements at the UHC were related to the availability of a sufficient number of caregivers and medicines. The urgently demanded improvements at UHCs were an increase in the number of caregivers, the availability of quality medicines, and the presence of specialized doctors, particularly pediatricians and orthopedists

The majority of the households responded positively to their willingness to pay an extra fee per visit to the UHC provided that the number of doctors and staff will be increased, sufficient and better-quality medicines will be supplied, WASH facilities will be improved and arrangements will be made for special diagnostic equipment. 82.6% of the households expressed their willingness to pay for improved healthcare services at UHC out of which 58.8% of the households stated their willingness to pay equal to or higher than the offered bid, and 23.8% wished to pay a reduced amount of money than the proposed bids to them. The rest 17.4% of the sample stated no interest in paying extra money for obtaining improved healthcare.

WTP of individual households was influenced by socio-economic factors mostly. The variation in WTP was found to be influenced significantly by the offered bid values of households' monthly income, age, and gender of the respondents. The influence of respondents' demographic and socioeconomic characteristics have also been found to affect the willingness to pay by Al-Hanawi et al. (2020) in Saudi Arabia, in addition to the quality attributes of public healthcare services. Other than socioeconomic aspects, having or not having access to safe drinking water throughout the year influenced the households' willingness to pay significantly. The households having consistent access to safe drinking water were found to be 20.48% more likely to accept the offered bids than the households not having access to safe drinking water throughout the year. A possible reason for this variation might be the greater awareness of health risks of the former group and consciousness about sustaining better health. Interestingly, no significant variation of WTP based on whether the households had directly experienced or not the effect of natural hazards, suggesting that the community's adaptation to recurrent hazards might influence their willingness to pay based on financial capacity rather than direct exposure to hazard damages.

The mean WTP was estimated to be approximately Tk 60 per visit to the UHC from the probit model. While a study conducted in Bangladesh estimated the influence of individual attributing factors (Pavel et al., 2015) and another one conducted to determine the weekly willingness to pay for health insurance among the workers in informal sectors of urban areas (Ahmed et al., 2016), the estimate of our research could not be compared with the point estimates of their research outcomes due to the dissimilarities in the exact payment method or the valuation scenario. While this estimate is unique to our study's context, it offers a valuable starting point for future research in similar coastal regions. The estimated annual revenue equivalent to the aggregate WTP is approximately Tk 3140000 from the study area. However, the participants in general expressed concerns regarding the efficient utilization the additional fund for the health service and facility improvement echoing the findings from Gugushvili (2022), who suggested that policymakers must first build public trust if they hope to raise funding for public healthcare services.

The research findings hence suggest that ensuring transparency in how additional funds will be spent can help build trust and encourage further contributions from the public. To overcome the implementing challenges, the government and health care authorities should collaborate with community leaders and local stakeholders to meet local needs. Establishing a local oversight committee can enhance transparency and accountability in fund allocation. Moreover, policy makers must also consider socioeconomic disparities so that the payment systems are based on financial capacity, ensuring equitable health care access while securing necessary funds.

CONCLUSIONS

The outcome of this study highlights the urgent need for improving the standard of basic healthcare and ensuring quality treatment at the primary levels of public health institutions, especially in coastal areas. The main implication of this research is that the

coastal communities are not only concerned about the improvement of public healthcare services but also show a strong willingness to contribute financially to bringing these improvements. A significant portion of the population is open to participating in health financing, provided that the funds are used efficiently and transparently. Although several studies have been carried out on the valuation of health services following contingent valuation methods, this research was unique in the context of the coastal remote areas of Bangladesh and with its aim of exploring the association between WTP for improved public healthcare services and the impact of natural hazards. A simplified regression model has been used in this study to determine the factors influencing willingness to pay for public healthcare improvement. Even though a detailed analysis of each of the influencing factors and their valuation could not be done individually, this study effectively finds out the general four major improvements required by the coastal communities in the UHCs and estimates their overall monetary value. The major suggested improvements are the number of doctors and staff be increased, sufficient and good quality medicines be supplied, WASH facilities be improved, and arrangements to be made for special diagnostic equipment. The research can serve as a basis for a more detailed analysis of the gaps, needs, and scopes of improvement in the public health institutions serving the broader coastal region using more sophisticated empirical models in the future. This research outcome further emphasizes that to integrate community contributions into healthcare funding, it is crucial to develop policies that ensure the proper utilization of these funds, such as establishing local oversight committees and implementing suitable payment systems based on income levels. These measures will help foster community trust, ensure equitable access, and enable sustainable improvements in healthcare delivery in coastal Bangladesh.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study's conception and design. Filed investigation, data collection and analysis, and writing the original draft manuscript were performed by T.J.J. A.S.M.M.K. administered and supervised the project, and contributed to resource acquisition. M.A.K. contributed to data curation, validation, reviewing, and editing of the manuscript. S.M.K.H contributed to project administration, revising and editing the manuscript. All authors read and approved the final manuscript.

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Competing Interest

The authors have declared that they have no relevant financial or non-financial interests to disclose.

Data Availability

All relevant data are within the manuscript and its Supporting Information files.

Ethical Approval

The ethical approval for the research was granted by the Ethical Review Committee of the Faculty of Pharmacy, University of Dhaka (Ref. No. Fa. Ph. E/010/21), Bangladesh, after thoroughly reviewing the research proposal and the questionnaire used for the final survey. As per the Ethical Review Committee's requirement, the interviewers administering the questionnaire survey were trained to obtain informed consent from the participants before conducting the interviews. All the participants of the survey were properly informed about the research objectives and the questionnaire before starting the interviews. Since a majority of the households in the study area could not read or write, the informed consent was written at the beginning of the questionnaire and read verbally to the respondents of the survey by the interviewers. The participants' responses were documented and interviews proceeded only after the respondents agreed to continue and terminated otherwise.

REFERENCES

Ahmed, S., Hoque, M. E., Sarker, A. R., Sultana, M., Islam, Z., Gazi, R., Khan, J. A. M., 2016. Willingness-to-pay for community-based health insurance among informal workers in. 1–16. https://doi.org/10.1371/journal.pone.0148211.

Ahmed, T., Jakaria, S., 2009. Community-based skilled birth attendants in Bangladesh: attending deliveries athome. Reproductive Health Matters 17(33), 45–50.

Al-Hanawi, M. K., Alsharqi, O., Vaidya, K., 2020. Willingness to pay for improved public health care services in Saudi Arabia : a contingent valuation study among heads of Saudi households. 72–93. https://doi.org/10.1017/S1744133118000191.

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Radner, R., Schuman, H., 1993. Report of the NOAA panel on contingent valuation. Federal Register 58(10), 4601–4614.

Asma, K. M., Kotani, K., 2021. Salinity and water-related disease risk in coastal Bangladesh. EcoHealth. https://doi.org/10.1007/s10393-021-01517-z.

Chakraborty, R., Khan, K. M., Dibaba, D. T., Khan, M. A., Ahmed, A., Islam, M. Z., 2019. Health implications of drinking water salinity in coastal areas of Bangladesh. International Journal of Environmental Research and Public Health 16(19), 1–10. https://doi.org/10.3390/ijerph16193746.

Didar-Ul Islam, S. M., Bhuiyan, M. A. H., Ramanathan, A., 2015. Climate change impacts and vulnerability assessment in coastal region of Bangladesh: A case study on Shyamnagar upazila of Satkhira district. Journal of Climate Change 1(1,2), 37–45. https://doi.org/10.3233/jcc-150003.

Faisal, M., Saha, M. K., Sattar, M. A., Biswas, A. K. M. A. A., Hossain, M. A., 2021. Evaluation of climate induced hazards risk for coastal Bangladesh: a participatory approach-based assessment. Geomatics, Natural Hazards and Risk 12(1), 2477–2499. https://doi.org/10.1080/19475705.2021.1967203.

Foster, M. M., Earl, P. E., Haines, T. P., Mitchell, G. K., 2010. Unravelling the concept of consumer preference: Implications for health policy and optimal planning in primary care. Health Policy 97(2–3), 105–112. https://doi.org/10.1016/j.healthpol.2010.04.005.

Greene, W. H., 1993. Econometric analysis (2nd editio). Englewood Cliffs, NJ. Prentice Hall.

Gugushvili, D., 2022. Determinants of the willingness to pay higher taxes for better public healthcare services: Cross-national analysis. Journal of Social Service Research 48(3), 416–429. https://doi.org/10.1080/01488376.2022.2065407.

Haab, T. C., McConnell, K. E., 2002. Valuing environmental and natural resources: The econometrics of non market valuation. Edward Elger Publishing Limited, Glensada House, Montpellier Parade, Cheltenham.

Hanemann, W. M., 1984. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics 66(3), 332–341. https://doi.org/10.2307/1240800.

Hanemann, W. M., 2018. Valuing the environment through contingent valuation. The stated preference approach to environmental valuation: volume III: Applications: Benefit-Cost Analysis and Natural Resource Damage Assessment 8(4), 497–521. https://doi.org/10.1257/jep.8.4.19.

Haque, D. M. E., Mimi, A., Mazumder, R. K., Salman, A. M., 2020. Evaluation of natural hazard risk for coastal districts of Bangladesh using the INFORM approach. International Journal of Disaster Risk Reduction 48(February), 101569. https://doi.org/10.1016/j.ijdrr.2020.101569.

Heinzen, R. R., Bridges, J. F. P., 2008. Comparison of four contingent valuation methods to estimate the economic value of a pneumococcal vaccine in Bangladesh. International Journal of Technology Assessment in Health Care 24(4), 481–487. https://doi.org/10.1017/S026646230808063X.

ICDDRB, (2010). Non-Communicable Diseases in Bangladesh. In Evidence to Policy Series Brief (Vol. 2).

Islam, A., 2014. Health system in Bangladesh: challenges and opportunities. American Journal of Health Research 2(6), 366. https://doi.org/10.11648/j.ajhr.20140206.18.

Jeetoo, J., Jaunky, V. C., 2022. Willingness to pay to improve quality of public healthcare services in mauritius.

Joarder, T., Chaudhury, T. Z., Mannan, I., 2019. Universal health coverage in Bangladesh: activities, chal-

lenges, and suggestions. Advances in Public Health 2019, 1–12. https://doi.org/10.1155/2019/4954095.

Jofre-Bonet, M., Kamara, J., 2018. Willingness to pay for health insurance in the informal sector of Sierra Leone. 1–18.

Kabir, M. A., 2019. Estimating existence value of the royal bengal tiger conservation in the Sundarbans : a contingent valuation study of Dhaka city. Social Science Review [The Dhaka University Studies, Part-D], Vol. 36, No. 1, 36(1).

Kabir, R., Khan, H. T. A., Ball, E., Caldwell, K., 2014. Climate change and public health situations in the coastal areas of Bangladesh. 2(3), 109–116. https://doi.org/10.11114/ijsss.v2i3.426.

Klose, T., 1999. The contingent valuation method in health care. Health Policy 47(2), 97–123. https://doi.org/10.1016/S0168-8510(99)00010-X.

Mallick, B., Ahmed, B., Vogt, J., 2017. Living with the risks of cyclone disasters in the south-western coastal region of Bangladesh. Environments - MDPI 4(1), 1–17. https://doi.org/10.3390/environments4010013.

Martín-Fernández, J., del Cura-González, M. I., Rodríguez-Martínez, G., Ariza-Cardiel, G., Zamora, J., Gómez-Gascón, T., Polentinos-Castro, E., Pérez-Rivas, F. J., Domínguez-Bidagor, J., Beamud-Lagos, M., Tello-Bernabé, M. E., Conde-López, J. F., Aguado-Arroyo, Ó., Sanz-Bayona, M. T., Gil-Lacruz, A. I., 2013. Economic valuation of health care services in public health systems: a study about willingness to pay (WTP) for nursing consultations. PLoS ONE 8(4). https://doi.org/10.1371/journal.pone.0062840.

Mitchell, R. C., Carson, R. T., 1989. Using surveys to value public goods; the contingent valuation method (1st ed.). Washington, D.C., Resources for the Future.

Muhammad, F., Chowdhury, M., Arifuzzaman, M., Chowdhury, A. A., 2017. Public health problems in Bangladesh: issues and challenges. South East Asia Journal of Public Health 6(2), 11–16. https://doi.org/10.3329/seajph.v6i2.31830.

Pavel, M. S., Chakrabarty, S., Gow, J., 2015. Assessing willingness to pay for health care quality improvements. BMC Health Services Research 15(1). https://doi.org/10.1186/s12913-015-0678-6.

Rakib, M. A., Sasaki, J., Matsuda, H., Fukunaga, M., 2019. Severe salinity contamination in drinking water and associated human health hazards increase migration risk in the southwestern coastal part of Bangladesh. Journal of Environmental Management 240(March), 238–248. https://doi.org/10.1016/j.jenvman.2019.03.101.

Saha, S. K., 2017. Cyclone, salinity intrusion and adaptation and coping measures in coastal Bangladesh. Space and Culture, India 5(1), 12–24.

Sehreen, F., Masud, M. M., 2019. A contingent valuation approach to evaluating willingness to pay for an improved water pollution management system in Dhaka city , Bangladesh.

Shahen, M. A., Ahmed, R., 2020. Challenges for health care services in Bangladesh: An overview. IOSR Journal of Nursing and Health Science 9(1), 13–24. https://doi.org/10.9790/1959-0901011324.

Shammi, M., Rahman, M., Bondad, S. E., 2019. Impacts of salinity intrusion in community health : a review of experiences on drinking water sodium from coastal areas of Bangladesh. Healthcare 7(1), 50. https://doi.org/10.3390/healthcare7010050.

Shono, A., Kondo, M., Ohmae, H., Okubo, I., 2014. Willingness to pay for public health services in rural central java , Indonesia : methodological considerations when using the contingent valuation method. Social Science & Medicine 110, 31–40. https://doi.org/10.1016/j.socscimed.2014.03.025.

Sultana, S., Ahmed, S. I., Fussell, S. R., 2019. "Parar-daktar understands my problems better": Disentangling the challenges to designing better access to healthcare in rural Bangladesh. Proceedings of the ACM on Human-Computer Interaction 3(CSCW). https://doi.org/10.1145/3359270.

Wolff, E., Larsson, S., Svensson, M., 2020. Willingness to pay for health improvements using stated preferences: prevention versus treatment. Value in Health 23(10), 1384–1390. https://doi.org/10.1016/j.jval.2020.06.008.