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Protecting Coastal Households from Catastrophic Health Expenditure: An Empirical Investigation

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An effective health measure is a pre-requisite for minimizing the losses of lives of coastal people and also mitigates the health sufferings from the devastating effects of climate change. Universal Health Coverage (UHC) plays a vital role to tackle health problems with the full spectrum of services of good quality according to need and at an affordable cost to coastal people. This study explores the determinants of UHC and examines their effectiveness in the coastal society. To fulfill the research objective, the study followed a cluster sampling technique and carried out household interviews through questionnaire survey which covers the provision of coinsurance, Telemedicine, Medicare, social insurance, Medicaid, payment for UHC and capitation. The study used the gravity model to generate empirically supported assessment. Most of the determinants of UHC are statistically significant at convenient levels with expected sign. The findings of the study justify the relevant determinants of UHC and provide guideline to meet the target of good health and human well-being of SDGs.

Keywords: Health care service, Universal Health Coverage, Health Economic, Coastal Bangladesh

1. Introduction

The impacts of climate change are estimated to be severe in the coastal region prone to flooding, drought, salinity, cyclone and storm surge, heat waves and other extreme weather events (UNDP 2006; IPCC 2007a, Michel & Pandya 2009; World Water Assessment Program 2009; Zhang et al. 2013; Wang et al. 2014). Climatic variability could damage crops, disrupt farming and outbreak of catastrophic diseases (Morton 2007; Wheeler 2011; CIESIN 2010; Aguirre &Tabor 2008). For instance, sea level rise (SLR) and flooding will lead to spread salinity and contaminated fresh water, degrade agricultural land, loss of nursery area for fishing, poultry and livestock (Castello et al. 2009). Drought is threatened for human health through food insecurity, nutrition and deficiency of animal protein (Brown &Funk 2008).As consequences, coastal people suffer more from chronic and acute malnutrition, low birth weight, stunted growth, disturbance of breast feeding, skin disease, diarrhea, dysentery, jaundice, sleeping disturbance, high blood pressure, asthma, pneumonia and aclampsia.

This study seeks to answer the question: What are the important determinants of UHC? Does the distance of the health care centre from residential location make an important role to enhance UHC? And what is the management approach of UHC? It is expected

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that no previous studies previously answered such type of research questions. Based on these research questions, the author has explored the determinants of UHC, examines their effectiveness of UHC in the coastal society and develops a management approach of UHC.

The author has given an introduction followed by literature review of the study in the first two sections. Section 3 covers general features of the study area and methodology. Section 4 includes results and discussion. Section 5 gives conclusions and policy implications of the study. The format is logical but it would be pertinent to have Figure 1 which represents the pathway framework of climate change and climate induced diseases.

2. Climate Change and Public Health: An Overview

2.1 Temperature, Heat and Cold Waves and Public Health

Global average temperatures are projected to increase between 1.8^0C and 4.0^0C by the end of this century (IPCC 2007b). The temperature increase in the coastal region has been greater than the global average of 0.74^0C over the past 100 years (Du et al. 2004). Climate change in coastal region is expected to raise overall temperature distribution and contribute to an increase in the frequency of extreme heat events (Sharma 2012). The temperature rise will directly affect the health of coastal people and it is likely to generate heat related stress, increase heat stroke, short-term mortality, heat cramps, heat exhaustion and sleeping sickness (Kovats&Ebi2006). Rising temperature will also affect the spread and transmission rates of vector-borne, food-borne and rodent-borne diseases. As consequences, malaria, Chikungunya, tick-borne encephalitis and dengue fever will become increasingly spread in the coastal region (Costello et al. 2009; Kovats, Campbell & Matthies 2005). Like the high temperature, heat and cold waves are also common in the coastal region during the hot summer season and winter season. Heat and cold waves are directly linked withhealth. Heatstroke cardiovascular mortality, respiratory illness, asthma and pneumonia are generated from heat and cold waves. The following section discusses about the different climate induced diseases.

2.2 Salinity and Public Health

Salinity is the most common and devastating natural hazard in any coastal region. It is well established that high salinity levels in drinking water have numerous direct and indirect impacts on health (Khan et al. 2011). It includes dysentery, hypertension, blood deficiency, eclampsia, abdominal distension, nausea, etc. In addition, salinity reduces plant growth of crops and yield through ion toxicity and osmotic stress (Munnas2005). High salt concentration may stop root growth and shoot growth of crop plants which are very harmful to crop production (Rahman, Lund & Bryceson 2011). Under this condition, crop production becomes very risky and the cropping intensity is much lower (Iqbal2015a). Salinity is threatened for food security which leads to develop malnutrition and related diseases.

2.3 Water Logging and Public Health

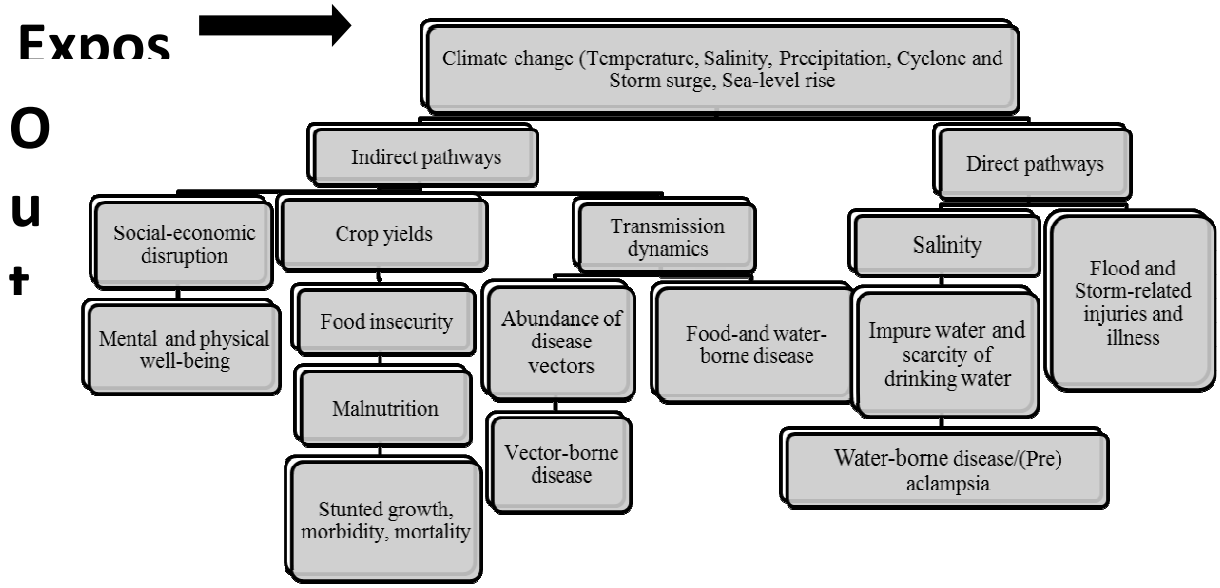
Water logging is the common feature in the coastal region due to sea level rise, flash floods, river floods, rainwater floods, storm surge floods, tidal flooding and unplanned dam. Water logging in a coastal region represents abnormal or unwanted submergence of land occurring less frequently, which can damage crops and property, disrupt people's normal living conditions, communications and economic activities and endanger the lives of people and their livestock (Brammer 2004). Safe and reliable access to pure drinking water and proper nutrition are essential for good health. But it is difficult to get pure drinking water and proper nutrition under the water logging condition. Water logging increases exposure to food insecurity, chronic mental illness and contaminated water and provides habitat for mosquitoes, leading to increase of waterborne and vector-borne diseases.

2.4 Cyclone, Storm Surge and Public Health

Cyclone and storm surge are atmospherically forced oscillation of water level in a coastal or inland water body (Iqbal2015b). Impacts of the cyclone and storm surge are devastating. It destroys human habitat, hampered livelihood conditions and generate risk of injury, casualty and mortality. Furthermore, coastal flooding, marine over wash event, wave height and salinity in the coastal region are associated with storm surge and cyclone (Lee 2013; MoP & UNDP Bangladesh 2009; Karim & Mimura 2008). Storm surge and cyclone bring saline water in the low-lying coastal region. Livestock, crop, poultry and fishery cultivation are difficult under this condition. As a result, it is hard to get an optimum calorie intake and animal protein for the coastal households.

It is expected that the effects of climate change on health will affect more coastal people in the next decades and put their lives and well-being at increased risk (Costello et al. 2009). A Pathway framework for climate change and its probable outcomes on human health in coastal region are given in Figure. 1.

Figure 1: Pathway framework: exposure and outcome



Source: Prepared by the author based on WHO2012

Climate induced diseases will be more vulnerable if we have not taken measures to reduce it under the different climatic varying conditions. Under this circumstance, universal health coverage can play an important role to ensure health care facility to all coastal people and tackle the health care burden. Universal Health Coverage (UHC) plays a vital role to tackle health problems with the full spectrum of services of good quality according to need and at an affordable cost to coastal people. Health systems oriented toward UHC, immensely valuable in human right, produce an array of benefits: in times of crisis, mitigate the effect of shocks on communities; in times of calm, foster more cohesive and productive economies (Summers 2015). It improves coverage across the populations that require help, improves access to preventive and promotive primary health care services and ensure the financial sustainability. Thus, UHS works as an essential pillar of economic growth and development.

It is important thing that how can a country or provincial government or city government achieve UHC for its general people. According to Bredenkamp&Buisman2015, some common challenges are emerging to achieve UHC: how to ensure coverage of the informal sector so as to make UHC truly universal; how to design a benefit package that is responsive and appropriate to current health challenges, yet fiscally sustainable; and how to ensure 'supply-side readiness'. Coastal Bangladesh has also suffered such kinds of challenges to implement UHC for its people. Generally, coastal people get health facility through the provision of primary health care (PHC) service. It is very much worse for the coastal people who are suffering frequently from climate induced diseases and who live in the remote coastal areas as health care facilities and services are often less complete, farther away and therefore more costly to reach than in urban hospitals and physician. To get rid of such circumstances, UHC is a new and suitable approach for improved health care facilities in this region. It is a pre-requisite for minimizing the

losses of lives of coastal people and also mitigates the health sufferings from the devastating effects of climate change.

Political commitment, health care financing, workforce of health care service and digitization facility are the common and essential components to implement UHC. But the nature, dimension, scope and trend of UHC are different in different countries. For example, the United States provides UHC coverage for the ageing people and poor families along with benefits, e.g., Medicare, Medicaid through private health insurance (Moffitt & Slade 1997; Rice 1987). Similarly, Thailand introduced UHC to the reproductive health services along with capitation contract model (Tangcharoensathien et al. 2002).

The situation, perception and concept about UHC in Bangladesh are very new. To implement and meet the demand for human-well being and good health of SDGs, Bangladesh adopted National Health Policy 2011 to achieve UHC by 2032. As a first step towards achieving the UHC, three Upazilas of Tangail district have been brought under a pilot program called the Health Insurance Skim (MoF2015). Increasing the level of funding for health, reduce out-of-pocket expenditure of the poor and ensure the health service for the poor are the main objectives of this pilot program. Bangladesh not yet finalize the effective UHC program and peoples' perception based determinants of UHC for the coastal people as they are under potential risk of climate induced diseases along with poverty.

3. Brief Literature Review

The study entitled "Progress towards universal coverage: the health system of Ghana, South Africa and Tanzania" by Mills et al. (2012) pointed out that the protection against the health care cost and improve equity of access to health care lies at the core of many health sector financing initiatives. Market driven solution to UHC is essential for the enhancement of the health sector (Paschall2008). Ageing people, poor household, unemployed, children and underprivileged community get benefits when they are under the umbrella of UHC. They get the benefits from UHC when the UHC is guided by Medicare, Medicaid, capitation, private health insurance company or state health company, social efficiency, regulation, pragmatic reform, health policy, health sector financing initiatives, user fees, awareness, political commitment, campaign, health service delivery and adequate health workforce. Government intervention, the role of employers and corporate sector, NGOs and development partners contribute more to enhance the UHC program for all or a specialized group (Rice 1987; Moffitt & Slade 1997; Meessen et al. 2011; Adams et al. 2013).

The people of the developed countries get health coverage, protection and benefits from the approach of UHC (Schramm 1992; McGill 2012; Andrus et al. 2008; Lewit & Baker 1995; Veugelers & Yip 2003). As a consequence, this approach gets popularity within the developed countries. Recently, few least developed countries (LDCs) and Asian Countries, e.g., Sri Lanka, Thailand and Philippines are introduced UHC. In addition, few sub-Saharan African countries also introduced the UHC to meet the

demand of SDGs. Tanzania, Rwanda and Ghana are the best typical example of introduction of UHC in their society (Lu et al. 2012; Mills et al. 2012).

Along with reforms, act and regulation, few attributes and socioeconomic-demographic (SED) variables are the determinants of UHC in many countries. Estimated results of different models are also supporting this proposition and suggested that UHC is affected significantly by various determinants. But it is noticed that very few studies considered distance of the health care centre from respondents' residential location as an important determinant of UHC and explain the role of UHC under the conditions of climate induced diseases in the coastal region. The research questions and problem statement of this study were not addressed by the past studies. This study tried to fill up or reduce the research gaps on this issue. The research questions of the study were not previously answered. Suggested policies of the study are derived from its research questions and objectives. The study seeks to answer these unexplored research questions which didn't address yet in the recently published credible journal articles.

4. Selection of the Study Area, Methodology

4.1 General Features of Study Area

Geographic and climatic characteristics have long been concerned issues of human health, mortality, morbidity, the length of life and human well-being (Pavlovic et al. 2000). Due to the vulnerability to climate change, natural hazards and human health, southwest coastal region (Khulna, Satkhira and Bagerhat) is considered the study area of this study. This region is part of an active delta of large Himalayan Rivers. Disadvantaged geographic location and its flat and low-lying topography enhance the vulnerability in this region. This area is located between latitude from $22^0 16' 00.3'' N \, to \, 22^0 58' 56.2'' N$ and longitude from $88^0 58' 01.1'' E \, to \, 89^0 56' 00.7'' E$ of the southwest coastal region (Iqbal2015b). Surrounding rivers and Bay of Bengal control the flow of water and level of salinity at different seasons in this region. In addition, the Bay of Bengal is known as a breeding ground for tropical cyclone. This region is vulnerable to cyclone, storm surges and floods due to its location in the path of tropical cyclones, wide and shallow continental shelf and the funneling shape of the coast (Das 1972). Most of the impact of climate change on physical, ecological and social system will affect human health via changes in food yields, freshwater flows and quality, stability of infectious disease patterns, air quality, social cohesion, family income and livelihoods (Costello et al. 2009; McMichael & Lindgren 2011).

4.2 Methodology

4.2.1 Selection of Variables through Focus Group Discussion (FGD)

This research organized three FGDs which consist of (7-8) participants of each occurred in (8-11) October, 2016 at different locations of the southwest coastal region of Bangladesh. The participants were selected in a non-random fashion. The objective of the FGD was to detect the relevant determinants of UHC derived from the participants' choice of all FGDs. Provision of capitation, Telemedicine, Medicaid, Medicare, social

insurance, payment for UHC, monthly income, campaign for UHC, educational attainment, no. of a family member, workforce of health care service of hospital or clinic and distance of hospital or health care center from residential location is considered as the main determinants of the UHC for the coastal people of Bangladesh. The following part discusses briefly about the suggested determinants of UHC.

Capitation: Capitation is defined as managed care contracts with physicians. Most health maintenance organizations (HMOs) and point-of-service (POS) plans pay their network physicians on a capitation basis. Under this provision, the plan pays the physician's practice a fixed fee generally for per visit based on share basis by the insurer and the insurance company.

Telemedicine: Telemedicine is a kind of e-based or information communication technology (ICT) supported treatment system. Under this provision, it is possible to provide health care service by the specialized doctors.

Medicaid: Medicaid is a part of social security of a country. Certain vulnerable and needy individuals get medical assistance under the provision of Medicare.

Medicare: Medicare is a nationwide social health insurance program with co-pays and deductibles for the aged and certain disabled person. It includes hospital insurance, supplementary medical insurance, new prescription drug benefits etc.

Social Insurance: Social insurance is state owned insurance. It is responsible to ensure security for all countries of a given period of time. It can protect people from loss of earnings or savings due to high OOP expenditure, retirement, death or disability. Under this provision, it is possible to avoid adverse selection problem.

Payment for UHC: Payment for UHC is a price mechanism system. It is determined by the certain percentage of annual income of the patients. Under this provision, it is possible to protect free rider problem and market failure.

Monthly Income: It indicates the household monthly income. It is the main building block of household characteristics.

Campaign for UHC: Campaign for UHC is associated with a series of actions or events that shows the benefits of UHC through placards, role play, rally, demonstration and advertisement through print and electronic media.

Educational Attainment: It indicates the household's educational status. In most of the cases, the head of the household has either primary education [basic education at home] or illiterate.

Family Member: Family member means the size and composition of the household.

Workforce of Health Care Service of Hospital or Clinic: The people who involved in health care service are known as the workforce of health care service. The health workforce determines the health service quality and dictates the pace of the overall

health system development. They work as gatekeeper and navigator for quality health care service.

Distance of Hospital or Health Care Center from Residential Location: Far distance of hospital or health care center from a residential location makes difficulties to get good health care facilities due to availability of transport, availability of physicians, scarcity of medicine and budget. Far distance requires more time to hospitalize the patients.

4.2.2 Questionnaire Development and Sampling Technique

The questionnaire survey was conducted from 23 September, 2016 to 10 December, 2017 at different villages of Mongla, Rampal, Morrelgonj and Sharankholaupazilas of Bagerhat district, Batiyaghata, Damuria and Dakopeupazilas of Khulna district and Shyamnagarupazila of Satkhira district. The surveys involved (n=570) households for interview followed by a structured questionnaire through the cluster sampling technique.

4.2.3 Model Specification

This study used the gravity model to detect the relevant determinants of UHC for the coastal people and quantify the parameters. The gravity model was first applied by the Jan Tinbergen in 1962 used an analogy with Newton's universal law of gravitation to describe the patterns of bilateral aggregate trade flows between two countries (Iqbal& Islam 2014). After that, a large number of studies used the gravity model for empirical assessment of occurrence of trade between two countries in the field of international trade. This study may be first attempted to apply the gravity model in the health economics due to its applicability, simplicity and acceptability to all in the field of social science research. It is suitable for the cross-section data and estimates the impacts of outcome variable associated with other control variables. It works well when distance and growth are considered as the variables. It is expected that the study can generate good empirical results compared to that of the result of other studies as we have the control variables such as distance, growth of health workforce and others. The general form of the gravity model is given as follows:

$$I_{ij} = \frac{P_i^{\alpha} P_j^{\beta}}{d_{ij}^{\zeta}} = (P_i^{\alpha} P^{\beta}{}_j) d_j^{-\zeta}; \alpha, \beta, \zeta \approx 1 \quad (1)$$

Where I_{ij} indicates interaction between two parties, e.g., health care service receiver i and health care service providers; P_i and P_j represent family members of households and workforce of health care service respectively; d_{ij} shows the distance of the location of household and health care center.

Based on the equation no. 1, the proposed gravity model of this study takes the following form:

$$\ln(Y_{ij}) = \beta_0 + \ln \beta_i X_i + U_{ij} \quad (2)$$

The above mentioned variables/attributes in sub-section 3.2 are used in the Gravity model to detect the relevant determinants of the southwest coastal region. Table 1 describes the used variables/attributes in the gravity model with hypothesize relation to the outcome variable.

Table 1: Description of Variables /Attributes and Hypothesize Relation to the Outcome Variable

Variable /Attributes	Description	Hypothesized relation
uhc : Universal Health Coverage	Dummy (1: Yes; 0: Otherwise)	
cap: Capitation	Dummy (1: Yes; 0: Otherwise)	+
telm: Telemedicine	Dummy (1: Yes; 0: Otherwise)	+
meaid: Medicaid	Dummy (1: Yes; 0: Otherwise)	+
mecare: Medicare	Dummy (1: yes; 0: Otherwise)	+
soli: Social insurance	Dummy (1: yes; 0: Otherwise)	+
pauhc: Payment for UHC	Continuous	-
hmoi: Household monthly income	Continuous	+
camuhc: Campaign for UHC	Continuous	+
eda: educational attainment	Continuous	+
fam: Family member	Continuous	±
whcs: Workforce of health care service	Continuous	+
dis: Distance of hospital	Continuous	±

UHC is a new concept for the people of the southwest coastal region of Bangladesh. Respondents of this study were familiarized with the concept of UHC when FGD and questionnaire survey occurred. Proposed variables and attributes are selected from the perception and desire of the participants of the FGD.

4. Result and Discussion

To detect the relevant determinants of UHC for the coastal people, gravity model was developed using SPSS software. Results for all 570 respondents from the gravity model are shown in Table 2. Most of the variables and attributes in the model are statistically significant at conventional levels (at 1%, 5% and 10% levels respectively) except few with expected sign.

Table 2: Estimated Model for Determinants of UHC

Model	Unstandardized coefficients		Standardized coefficients	Sig. (*P*-value)
	β	Standard Error	Beta	
constant	11.987*	1.093		0.000
Cap	0.800*	0.215	0.212	0.000
Telm	0.657*	0.017	0.521	0.003
Meaid	0.453***	0.312	0.329	0.064
mecare	0.840**	0.127	0.472	0.053
Soli	0.297***	0.562	0.331	0.083
Pauhc	-0.785*	0.280	0.276	0.000
Hmoi	0.709	0.525	0.473	0.147
camuhc	0.896***	0.487	0.139	0.000
Edu	0.178**	0.677	0.420	0.034
Fam	0.090***	0.437	0.509	0.095
Whcs	0.562	0.219	0.365	0.176
Dis	0.784*	0.786	0.327	0.000
R^2(Goodness of fit)		0.430		
n (No. of obs.)		570		

*Significant at 1% (0.01); Significant 5% (0.05); and Significant 10% (0.10)

Based on the lower *P*-value and acceptance of alternative hypotheses, all variables and attributes are related to the UHC. One percent increase in the capitation, Telemedicine, Medicaid, Medicare, social insurance, campaign program for UHC, educational attainment, number of family member and distance will lead to increase positive perception of the coastal people on UHC program and vice-versa. On the other hand, one percent increase in payment for UHC will lead to decrease negative perception of the coastal people on UHC and vice-versa. The negative sign of payment supports the law of demand of macroeconomic theory. Telemedicine is the strongest predictor for UHC because of its highest standardized value of 0.521. On the other hand, campaign for the UHC is the weakest predictor for UHC because of its lowest standardized value of 0.139. Based on the estimated results, we can say that UHC for the coastal people is mostly influenced by the proposed variables and attributes of the model. But we cannot say anything about household monthly income and workforce of health care service as they have higher *P*-value and rejection of alternative hypotheses. It is because of inconsistent income level of the coastal household and inadequate and inexpert workforces of health care service. The value of goodness of fit indicates that 43% of the variation of the UHC is explained by the associated variables and attributes. Thus, it is possible to say that this model is well fitted and hence all the significant variables and attributes are working as the relevant determinants of the UHC for the coastal people.

So far as we know the gravity model is the first attempts to estimate the determinants of UHC in health economics. Thus, we have no scope to compare the estimated results with the other studies. This unique estimation process through the gravity model is able to answer the research question and fulfill the research objectives of the study.

5. Conclusions and Policy Implications

UHC is a very popular health protection mechanism in the developed countries. Few Asian countries and a few sub-Saharan countries are also introducing UHC for few selected communities or diseases. But it is debatable issue worldwide, which factors are the relevant and most important determinants of UHC. Like the other countries, Bangladesh also introduced UHC for the poor under a pilot project in Tangail district. For better implement of UHC, it is essential to detect research based determinants of UHC. Bangladesh should start UHC from its coastal region as coastal region of Bangladesh is the breeding ground of climate induced natural hazards. Public health is under threatened in this unexpected natural hazard condition. Frequent health care expenses further enhance the acute poverty in the coastal society. Under this situation, UHC works as a bridge between cost and health care coverage. It protects all people from financial hardship. Though we have no control over this event but some measure can improve the health care facilities and protect coastal people from the financial hardship during the catastrophic period. Based on the estimated results, this paper proposed preference based determents of UHC: fundamental determinants (e.g. Capitation, Telemedicine, Medicare, Medicaid, Payment for UHC and social insurance) and other socio-geographic determinants (e.g. Campaign for the UHC, education, family members and distance of hospital from the residential location of the coastal people). The previous studies did not handling these issues properly.

Strong political commitment and government intervention are highly required to implement the UHC for the coastal people. Government can provide support to initiate the UHC for the needy, unemployed, children under five, aged people and the poor. Electronic and print media can also work as a supportive partner of the government for campaign of the UHC.

Due to the time limitation, budget constraints and other logistic supports, this study is not free from certain lacunas. This study does not include the whole coastal region of Bangladesh and large respondents to participate questionnaire survey. Thus, this study recommends for further study to avoid such shortcomings and get better findings to formulate health policy that will cover UHC properly for the coastal people.

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