



Climate Change

Climatic Shock and Health Demand-Supply Nexus in the Sundarbans Delta Region in India

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General Note



Article is recommended to print as color version in recycled paper. *Save Plants, Save Climate.*

ABSTRACT

Gaps in knowledge regarding how far the climatic shocks and related consequences are responsible for sub-optimal nutritional achievement and therefore what types of anti-vulnerability strategies can narrow the vulnerability to under-nutrition and poverty, and strengthen the resilience of socio-economy as a response after impacts of climate change are discussed in this paper to build sustainable adaptation strategies. The present work tried to test the hypothesis that frequent climatic shock is likely to enable health shocks through perception and practice of households in the presence of inaccessibility, inadequacy and acceptability barriers which act in the economy as chronic shocks. The work will see whether shocks can be mitigated with existing capacity alterations in a cost effective manner to break the vicious circle of poverty-malnutrition-morbidity in the Sundarbans.

Data has been collected from frequent climatic shock prone, geographically adverse deltaic and non-deltaic villages of the Sundarbans delta region of India which is characterized by abject poverty. Information from 338 households has been collected with structured questionnaire. Along with that Focus Group Discussions and In Depth Interviews are conducted at various stakeholder levels.

It has been found that wide sub-optimal utilization of health and nutrition service delivery due to either poor perception or limited understanding of caregivers from demand side as well as sub-optimal service delivery and accountability on the part of the providers coupled with frequent climatic shocks demanding more care create worse being of inhabitants. Incorrect perception about vulnerable impact of healthcare expenditure during climatic shock increases the probability of destitution among families with morbid or undernourished children is another example of climate, health and resilience spiral which requires intervention to change perceptions instead of KAP and bringing success is very challenging.

Keywords: Climatic shock, Undernutrition, Morbidity, Demand, Supply

1. INTRODUCTION

Communities and households face several shocks of climate change and mitigate risk depending on asset portfolio and livelihood choices (Heltberg *et al.* 2009). Gaps in knowledge regarding how far the degree of shocks are responsible for sub-optimal nutritional achievement and therefore what types of anti-vulnerability strategies can narrow the vulnerability to under-nutrition and poverty, and strengthen the resilience of socio-economy as a response after impacts of climate change are discussed in this paper to build sustainable adaptation strategies. Complex interactions between undiversified livelihoods, extreme climatic events and health of the children in a poverty-stricken area make inhabitants more vulnerable to future poverty (Mukherjee 2014).

Vulnerability to under-nutrition - poverty nexus and resilience analyses are dealt in diverse groups of literature. Some of those are—climate change impact, disaster management and sustainable development (Malone 2009). From the lens of climate change and disaster management literature, vulnerability depends on nature and frequency of exposure to shock, nature of coping and spatial feature of the place (IPCC WG2 2007:883; Cutter 1996). Resilience measures the ability of a society or an economy to absorb shock while retaining the basic structure and the way of functioning (IPCC WG2 2007:880). According to proponents of sustainable development, vulnerability is characterized by lack of capabilities or lack of capitals (Sen 2000). In that sense, resilience can be built with proper macroeconomic stability, reduction of unemployment and social development (Briguglio *et al.* 2008).

Chronic childhood under-nutrition and related morbidities like diarrhoea, fever and acute respiratory infections are major public health problems in developing countries, especially in South Asia, with major welfare consequences (Black *et al.* 2008). Under-nutrition and associated morbidities among children under the age of five are responsible for 35 per cent of deaths and 11 per cent of the global disease burden (*ibid.*). The prevalence is higher in the Indian subcontinent as per one recent UNICEF study (UNICEF 2010). However, the concentration of under-nutrition and illness among poor children in India raises the concern for policy makers to stress on equity in nutritional status through improvement in service delivery (uptake as well as provision) to sustain economic growth and development in the long run (Kanjilal *et al.* 2010a). Keeping in mind the agenda, the present article is a case study to investigate the demand and supply side determinants of chronic under-nutrition and morbidity among children under the age of five in one vulnerable pocket of India—the Sundarbans delta region in West Bengal.

Climate change is one chronic shock and gradual change in climatic conditions is articulated through different forms like hurricanes, storms, floods, which are limited duration transient shocks (Naidoo 2009). Extreme climatic shocks make poor inhabitants more vulnerable to other idiosyncratic shocks like health shocks as poor people have less ability to cope with these (Tanner & Mitchell 2008). Earlier literatures related to health of the people living in similar areas throughout the world view vulnerability of worsening of health as a complex phenomenon. According to them, vulnerability of a poor population increases as climatic shock brings health shocks, and the likelihood of worsening of health status differs by inhabitants' adaptive capacities to chronic shocks (Cutter *et al.* 2003; Morrow 1999). Influence of climatic shock as a result of climate change to livelihood and then on health through various pathways is very common in areas like Latin American sub-continent as well as in some parts of south Asia like Vietnam and Bangladesh (Enarson 2000; Omitsu & Yamano 2006; Tanner & Mitchell 2008; Tinh & Hang 2003; Roy *et al.* 2015).

As found in one vulnerable area—the Amazon region—protein energy under-nutrition, intestinal parasitic infections, acute respiratory infection and iron deficiency are higher among poor and marginalized children whose families are victims of chronic climate shock (UNICEF 2009). Therefore, under-nutrition and related morbidities are major consequences of climatic shock associated with climate change (World Bank 2008; Naidoo 2009). When climate events destroy lands, houses, household resources or crop, the affected population becomes food insecure (Gregory *et al.* 2005; Mukherjee *et al.* 2012). Food insecurity ultimately causes under-nutrition through reduction in calorie intake. In addition to this climatic shock, disease outbreaks cause lots of suffering along with food shortage (Shea 2007).

It is also evident that in climatic shock-prone areas, home management of child health shocks is different from other areas (Skoufias *et al.* 2011). So, caregivers' practice requires special knowledge, otherwise children suffer more as care-giving options are limited in shock prone areas (*ibid.*). In poverty stricken areas with insecure livelihood, girls experience early child-bearing and without adequate nutrition and supplementation they remain or become undernourished which is indicated in earlier studies (Morales *et al.* 2004). Therefore they give birth to low birth weight baby who become chronically undernourished in future (*ibid.*). Anecdotal evidences suggest that in the Sundarbans, the most common opportunity cost of lower socioeconomic resilience is care to children. In addition, in the Sundarbans, demand for health care is very low and supply of health care is sub-optimal (Kanjilal *et al.* 2010b). As found in other climatic shock-prone areas in India, climatic shock generates demand for efficient health infrastructure as well as more human resource where the system runs with sub-optimal capacity even in normal situations for providing effective service (WHO).

Against this backdrop, it can be inferred that, in a region characterized by chronic poverty, customary culture, poor health-seeking behaviour, inadequate and inefficient service delivery, frequent climatic shocks aggravate health and nutritional deterioration of the children (DFID 2004; Waterston & Lenton 1995; World Bank 2008). However, focus on vulnerability to undernourishment and interacting shocks has got less attention in social science research (Polack 2010).

Currently, different studies are focusing on the impact of chronic climate shock through manifold extreme climatic events on child health and recognize the need for integration of related climate change issues in health-poverty reduction strategies (Polack, 2010). Furthermore, another great concern of policy makers is south Asia and sub-Saharan Africa—the hub of most number of undernourished children— which are showing higher prevalence of under-nutrition (World Bank 2008). Since among south Asian countries, India alone contains the largest proportion of undernourished children below the age of five and in different vulnerable pockets of India, frequent climatic shocks put inhabitants into health risks; thus, in-depth research is required to investigate the health impact of the reinforcing nature of multiple shocks in such vulnerable areas (O'Brien et al. 2004; UNICEF 2009). The present work will try to test the hypothesis that frequent climatic shock is likely to enable health shocks through perception and practice of households in the presence of inaccessibility, inadequacy and acceptability barriers which act in the economy as chronic shocks. The work will see whether shocks can be mitigated with existing capacity alterations in a cost effective manner to break the vicious circle of poverty-malnutrition-morbidity in the Sundarbans.

The Study Area

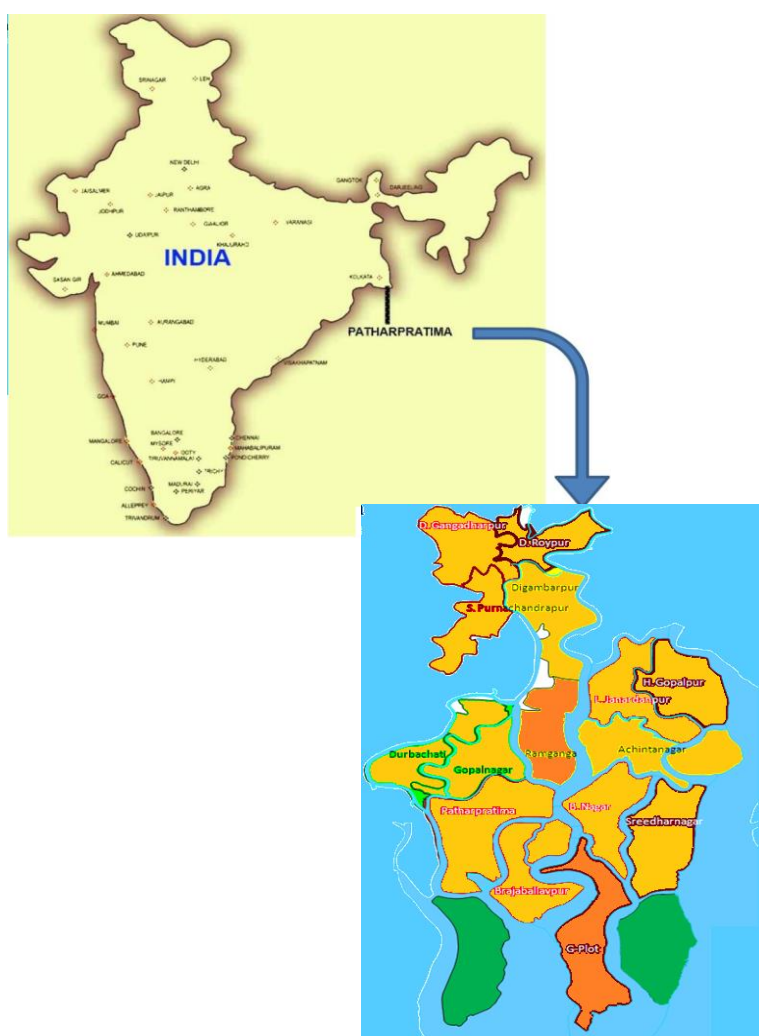


Figure 1 The Study Area

The area for the research study – the Sundarbans delta region in India - was selected based on percentage of poor and marginalized population, geographic location (deltaic or nondeltaic), availability of transport and village infrastructure as it was hypothesized that poor and marginalized people become more vulnerable after climatic shock and shock induced livelihood insecurity, physical inaccessibility and treatment seeking compared to other population subgroup (Figure 1). The Patharpratima block of the Sundarbans region under the administrative jurisdiction of South 24 Parganas district of West Bengal is the study area. The area consists of 162300 male population, 154618 female population, among which 24 percent is Scheduled Caste and 1 percent is Scheduled Tribe population (Census 2001). The selected Gram Panchayets (lower administrative level) from the block - G Plot is the deltaic GP and Ramganga is the non-deltaic GP. In the selected village Rajrajeswarpur of Ramganga GP, 52 percent population and in the another selected village Krishnadaspur of G Plot GP 60 percent population belongs to SC and ST category as per projected population calculated on 2001 Census figure. The Sundarbans delta region of India is characterized by chronic poverty, insecure livelihood, geographical adversities and extreme climatic events. The geovolatility of the Sundarbans makes it special not only with respect to livelihood and survival of its people but also in terms of people's health and nutritional status.

A typical resident of the Sundarbans carries an extra load of ill-health and health risks compared to others living within the same district. As it has been found, the children are the worst sufferers; most of them are chronically malnourished and, hence, perennially suffer from disproportionately higher burden of respiratory and gastro-enteric troubles (IIHMR, 2010; Guha et al. 2015). In brief, with about 4 million people currently estimated to live in the region, this neglected population has become a major reservoir for a wide spectrum of health conditions that are not always well recognized by the existing formal health sector (ibid.). In 1973, 'Sundarban Development Board' was founded to attend the misery, illiteracy and poor health of the inhabitants, and also for repairing the embankments and transport system. Although quite a few have been implemented, there are still a wide gap between targets and achievements. In this backdrop, my study is a little initiative to quantify the inequalities in under-nutrition and morbidity with respect to absolute and estimated contextual vulnerabilities to weakening of resilience through a pilot study to help the policymakers in designing future enterprise.

2. MATERIALS AND METHODS

To test the study hypothesis, I have collected information on the household level using a structured questionnaire covering socioeconomic and demographic profile of household members; impact of climatic shock on household assets, consumption sacrifice, perception regarding economic status fall, livelihoods, physical infrastructure, and perceived and actual healthcare access; mother and child's health seeking behaviour and nutritional status of children. Also information is collected on what is the amount of healthcare expenditure to cover treatment of their children, whether households' perception about economic status fall differs from actual economic status fall. I have also collected the anthropometric information of children through height and weight measurement.

The data collection is done following stratified random sampling technique where the block is stratified into two strata- deltaic region and non-deltaic region. From deltaic region, I have selected G-Plot gram panchayet which is one of the most vulnerable GPs in the Patharpratima block with respect to geographic location - connection with block headquarter, availability and accessibility of transport. The GP is very much threaten by impacts of climate change induced climatic shock which caused disappearing of one village Gobardhanpur inside the sea 10-12 years ago. "The southern part of Sitarampur has disappeared, while the northern part is slowly getting swallowed up as the land gets eroded by the onslaught of the sea." – The Hindu, Feb 24, 2008. Among 9 villages in G Plot GP, I selected Krishnadaspur based on the criterion of higher marginalized population. Comparatively, Ramganga GP is located in the main land and straight connected to the other developed blocks of the district. So it is comparatively well off with respect to access dimension. Among 10 villages of this GP, I selected Rajrajeswarpur village based on the same criterion.

Sampling

Observing that deltaic population lives with much geographical adversities compared to non-deltaic population, delta and non-delta stratification under stratified random sampling is justified. After selection of Krishnadaspur and Rajrajeswarpur villages based on the Schedule Caste and Schedule Tribe population and degree of influence of climatic events, I estimated the sample size to test my hypothesis. The sample size calculation is based on three factors (i) the child (0-6 years) population in the block (ii) the desired level of confidence and (iii) the acceptable margin of error. I collected information for total 338 youngest living children from 338 households. Quantitative data was edited in the field and cleaned. Data analysis was done using State 11 package. Height and weight are measured using the height and weight measuring instruments as recommended by UNICEF.

3. RESULTS

Socioeconomic, demographic profile of the inhabitants and prevalence of gastro enteric morbidity and stunting in the study area

Inhabitants of the two study villages in the two GPs of the Patharpratima block live below the poverty line according to the World Bank definition of poverty line. I also have estimated their perception about their own economic status. According to Perceived Poverty Index the village of the deltaic GP has marginally higher population of most poor (35 percent in Krishnadaspur and 34.6 percent in Rajrajeswarpur). Based on trajectory of poverty perception, smooth pattern of persisting chronic poverty is highly evident within Krishnadaspur compared to Rajrajeswarpur. Whereas oscillated deepening of chronic poverty is higher in the village of non-deltaic GP (52 percent). But gradual deepening is higher among inhabitants of deltaic GP (26 percent). Two out of three families in deltaic village and half of the families in non-deltaic village spends 2000 to 3000 rupees for covering monthly consumption. Higher level of monthly consumption expenditure is visible among least poor community in non-deltaic village.

More than 80 percent families in deltaic village and 66 percent families in non-deltaic village are nuclear families. And, more than 90 percent families in deltaic village and 88 percent families in non-deltaic village live in kutcha houses. On average, houses of more than 60 percent families live in one-room house in deltaic village and most of the families in non-deltaic village (51 percent) live in two-room house. Most of them either cook in the open terrace or outside the house under a roof made up of dry leaves and crop residue. Almost 100 percent families in both the villages use biomass fuel for cooking. Near about all of them use hand pump as water source, but 59 percent families in deltaic village and 69 percent families in non-deltaic village uses sanitary latrine for defecation. In deltaic village Krishnadaspur, 45 percent households have power where 68 percent families in non-deltaic village Rajrajeswarpur have it. Most of them in both the villages have solar power as a substitute of electricity. Most of the families in the study area do farming either in own land, do share cropping or work as agricultural labourer in others land. From qualitative study, it is evident that due to seasonal nature of agricultural work, they also engage themselves in works related to electrical wiring, construction work, fishing, and participate in Village Theater.

It is evident from the charts below (Figure 2) that, prevalence of gastrointestinal problems and stunting is higher in deltaic village compared to non-deltaic village.

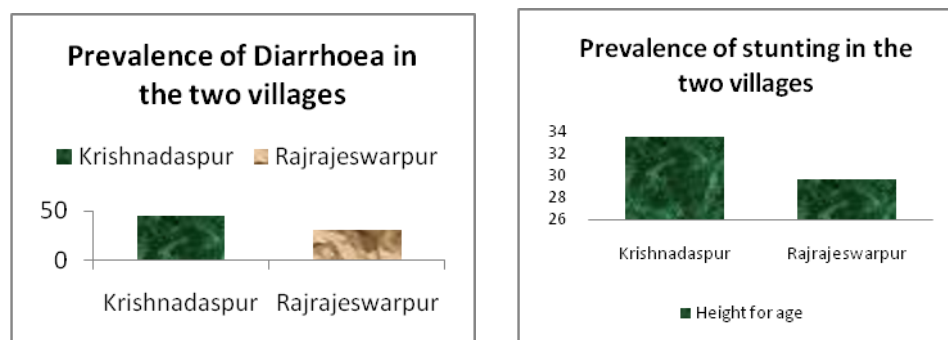


Figure 2 Prevalence of gastrointestinal problems and stunting in the study area

Impact of climatic shock

This segment deals with impact of cyclones and floods on household assets, physical infrastructure of the villages and treatment seeking of children which the inhabitants are experiencing every year for a longer period of time. Focus Group Discussion with earning members in both the villages helped us to understand how they project the cyclones and become aware. Weather forecast in radio, frequent low pressure during rainy season, stormy wind from east – any of these make them aware about coming cyclones. With stormy wind from east, river water level increases and enters the village breaking the embankments and the village goes under water within an hour. Government and relief societies help during that period but still the initiatives are inadequate. During that time most of roads becomes inaccessible, no transport can move.

Child health deteriorates during the period of natural calamities. Since food becomes scarce adults can survive with only one meal a day with poor quality food but children cannot. Water becomes scarce and contaminated and they told about one event on drinking water supply during climatic shock.

Case Study on Drinking water supply in Krishnadaspur Majher Colony

During Aila, all the sources of drinking water were devastated except one. People of this colony reported that the whole village survived with the drinking water from this source only. So after Aila, they celebrate the day as the birthday of that source every year. They take very good care of it. To stop misuse of water, they put some rules of water collection on a signboard near the source. One such regulation is collection of water using bottle is prohibited as narrow space of bottles wastes water during collection. Common people follow the rules.

Inhabitants of Krishnadaspur undergo sufferings due to climatic shock more compared to residents of Rajrajeswarpur village. Ninety six percent land and houses in deltaic village were completely devastated compared to non-deltaic village where the impact is visible on 83 percent households.

We asked the households to rate the degree of impact of climatic shock on household assets on a four/five point scale – not at all, does not matter, very little, fairly/more often, to a great extent. Ninety seven percent of deltaic village households and 83 percent of non-deltaic village households experienced great damage of housing, 84 percent of deltaic villagers lost their livestock to a great extent whereas 25 percent of non-deltaic villagers only suffer from such a deep impact. Land and/or crops of 58 percent deltaic villagers and 53 percent of non-deltaic villagers were damaged to a great extent. Drinking water source of 56.6 percent households in Krishnadaspur and 46.8 percent in Rajrajeswarpur was highly contaminated while lower degree of contamination is experienced by non-deltaic villagers (53.3 percent of non-deltaic villagers experienced very little or moderate degree of contamination whereas such degree of impact is visible among 43.4 percent households of deltaic village). When we asked about their perceptions about water contamination, household members said that after climatic shock drinking water coming from tube well become salty and muddy.

Almost 50 percent of households in Krishnadaspur experienced decreasing land productivity to a greater degree, where more than 50 percent households earn their living by farming in own land, sharecropping or as agricultural labourers. In this manner, their livelihood becomes insecure with increase in salinity in agricultural land due to flood, and increase in barrenness due to draught. Such degree of impact is experienced by 39.3 percent households in Rajrajeswarpur. Mostly fishing was not or little affected as households argue that except during cyclone or flood fishing remains unaffected. Forty to fifty percent households informed that livestock rearing, honey collection not at all becomes difficult after climatic shock with the sense that though the roads approaching towards forest damage after climatic shock, they have no other option except honey collection or wood cutting. So 21.7 percent in non-deltaic village and 25.2 percent in deltaic village seems to be risk neutral. However, combating with chronic poverty with insecure livelihood to sustain their life trajectory they become resilient to the context and environment. Such insecure work opportunities and aggravated uncertainties due to climatic shock do not permit savings or asset accumulation (Begum and Sen 2004). Therefore with limited agricultural produce and insecure livelihood, inhabitants fail to purchase required food for their family and such situation makes their children undernourished.

Aila:

The most remarkable thunder storm followed by devastating flood in 2009 among cumulative experiences for a long period of time.

FGD with caregivers revealed that during flood, water comes inside their houses and destroys food storage so they remain without food for 2-3 days on average including children. Drinking water becomes scarce and water logging in the area pollutes the sources of drinking water supply. They told us that during "Aila" their houses and locality was under the water for 7-10 days. When the water drained out mud, decomposed fish and weeds inside the house polluted the environment a lot. Such environment makes children ill as during Aila number of children under the age of five suffered from diarrhea and some of them died. Morbidity with water contamination and poor hygiene practice which gets aggravated after climatic events and such context increases the probability of under nutrition severity (Mukherjee et al. 2012).

Impact of climatic shock on physical accessibility in Krishnadaspur and Rajrajeswarpur

Next I discuss the impact of climatic shock on physical accessibility. In deltaic village, 52 percent households reported that village roads were damaged to a great extent while 51 percent households in non-deltaic village reported their village roads were damaged to some extent. Similarly, the impact on transport facility in deltaic village is higher compared to non-deltaic village as 45.8 percent households reported immense barrier in Krishnadaspur and 35.7 percent in Rajrajeswarpur. Service delivery in Government facility hampered to some extent in Krishnadaspur as reported by 44 percent of households. But in Rajrajeswarpur, most of them reported that impact on service delivery was very little. Most of the households in both the villages reported that climatic shock influenced physical access to schools very little. Regarding impact on telecommunication, most of the households in deltaic village reported that there was no impact. In relation to impact on service delivery of Government facility, access to school and telecommunication – a moderate percentage of households told that limited or no access to these public services does not matter. Qualitative survey reveals that, limited or no access to Government health facility leads to treatment seeking from rural healthcare provider, homeopath or traditional healer. With respect to physical access to schools, households were talking about Anganwadi centres since children under the age of five visit AWCs to receive elementary education as they are also supposed to get quality food every day. Those households reported that they have very poor experience regarding service delivery of AWCs – discrimination, supply of poor quality supplementary food, rough and aggressive behaviour of few anganwadi workers (AWW) – demotivate them to send their children to AWCs. Therefore it does not matter whether AWCs remain accessible during rainy season or during and after climatic shocks. Regarding telecommunication, the deltaic village does not have telecommunication network during even normal time. So it does not matter whether extreme climatic events took place or not. But in non-deltaic village, it does not matter because even if telecommunication was damaged, facility and centres are accessible with better roads and transports compared to deltaic village.

Impact of climatic shock on child's treatment seeking in the study area

Then I talk about the impact of climatic shock on child's treatment seeking. Regarding impact of climatic shock on child's treatment seeking, we have asked whether Government facilities do not have or have limited human resource, transportation towards facility gets hampered, roads were damage or broken, shortage of medicines and equipments and increase in patient loads were experienced during shocks. In Krishnadaspur, reaction of 52 percent households was that they do not get any service delivery personnel in Government facility during climatic shock. Almost half of the interviewed households experienced the same degree of impact in Rajrajeswarpur. Problem of no or little transport facility is felt to a great extent during climatic shock is the experience of more than 40 percent households in deltaic village but such percentage is 23.5 in non-deltaic village. Damage of roads due to climatic events hindered child's health seeking to a great extent for 36.7 percent households in deltaic village while it is true for only 28.6 percent in non-deltaic village. Forty to fifty percent did not face shortage of medicines and equipments during climatic shock. Regarding patient load, 52.6 percent households in deltaic village and 49 percent households in non-deltaic village reported that patient load in Government facility does not increase during climatic shock as most of them visit rural unqualified providers in need of emergency or any care seeking. Though villages under study are selected on the basis of some prior information that differentiate them with respect to characteristics; detailed impact of climatic shock as above was never captured before which reflects how contextual uncertainty have differentiated impact on different geographic communities.

Undernutrition and morbidity among children in the study area

In this segment I represent the prevalence of undernutrition and morbidity by background characteristics of children. Background characteristics include household, mother and child level characteristics, and source of vulnerability. Along with these, other factors include five dimensions of access- *Acceptability, physical accessibility, affordability, accommodation and availability* (Balarajan et al. 2011, IIHMR 2010).

Influence of household, mother and child level characteristics – it represents the influence of child's background characteristics on morbidity and nutritional status

Influence on prevalence of gastrointestinal problems

Household characteristics- Incidence of gastrointestinal problems in last fifteen days preceding the survey in deltaic village is higher in lower expenditure tercile, joint families, crowded houses, where source of cooking fuel is biomass fuel (mostly crop residues), families who do not have sanitary latrine, do not possess electricity, main source of income is in kind instead of cash, families of agricultural labourers, fishermen, and women headed families who perform only household works.

In non-deltaic village also households' monthly expenditure is negatively associated with gastrointestinal problems. Children living in nuclear families are more sufferers. This is mainly because, improper care of children as mothers are also involved in agriculture, knotting baskets, brooms etc for alternative employment as depicted from Focused Group Discussion of young mothers and caregivers. Surprisingly, children living in pucca houses are suffering more as evident in deltaic village. Similarly, here also children living in crowded families are suffering more. Households using unprocessed biomass fuels e.g. wood, crop residue for cooking, earn through petty business, work as agricultural labourer, have sanitary latrine but do not follow proper hygiene practice show higher incidence of gastrointestinal problems during last fifteen days preceding the survey.

Mother's characteristics- In delta region, incidence of gastrointestinal problems marginally varies by mother's age. But in non-delta region, children of middle aged (26-30 years) are suffering more. In delta region, children of literate or educated (up to primary level) mothers are suffering more compared to children of illiterate mothers. One reason is that sample contains higher percentage of mothers having children under the age of five within the age group of 26-30 years. But in non-deltaic village, children of illiterate mothers are suffering more. Not only questionable quality of primary education, but other contextual factors increase the vulnerability to be morbid in deltaic village. According to in depth interview of the key informant in deltaic village, physical inaccessibility due to geographical adversity is one main cause that retards the treatment seeking of children. Even they belong to educated family and understand the need of health seeking, they are unable to seek. In deltaic village children of undernourished mothers are suffering more. It proves that intergenerational transfer of undernutrition is visible in inaccessible village Krishnadaspur implying existence of undernutrition-morbidity vicious circle instead of the presence of ICDS centres and Sub Health Centres but nearby Primary Health Centre is in Indrapur which is 12-14 km far from Krishnadaspur takes minimum 1hour to reach there. As reported by mothers and caregivers, AWCs are ineffective with respect to service delivery though SHCs work properly especially in relation to ANC checkups of mothers and immunization of children. In non-deltaic village, prevalence of gastrointestinal problems varies marginally by mother's nutritional status. In both the villages if mother has limited connection with health provider her child suffers more. Quantitative study reveals that most of the children are delivered before expected delivery date. According to the view of one ICDS worker, it is because pregnant women do not eat properly and so the undernutrition of the children starts from the womb. "*poatira khayna to bachhata peter bhitor barbe kikore*". Above 40 percent of children whether delivered at or before 6th month, 7th month or 8th month were suffering more from gastrointestinal problems. In non-deltaic village suffering is less than 20 percent among them.

Child level characteristics

In both deltaic and non-deltaic village, older children between the age group of 12-35 months are suffering most as they come to the contact of outside more compared to younger children. In the villages, children aged 36-59 months are suffering more. Though we cannot reach any conclusion about suffering distribution with respect to age since it is a cross-sectional study, to unveil the true picture, we need to conduct cohort or longitudinal study. Suffering is higher among children of small and medium size (at birth) in both the villages. Girl children are suffering more in deltaic village whereas in non-deltaic village there is marginal difference in suffering between them. In both the villages, children who are delivered at home and who generally seek treatment from unqualified provider, reporting of gastrointestinal problems is higher with respect to them and it is higher in deltaic village.

Prevalence of stunting based on WHO growth standard

Household level characteristics

In deltaic village, stunting is higher among children belonging to joint families, living in semi-pucca or pucca houses, houses with more than two rooms, families which use crop residue as cooking fuel, has sanitary latrine, have electricity, where earning members remain seasonally employed in agriculture or non-agricultural activities and unemployed in rest of the periods.

In non-deltaic village, stunting is higher among children of moderate poor families, joint families, living in pucca houses, houses with more than one room, families which use crop residue or cow dung as cooking fuel, do not have sanitary latrine, do not have electricity, where earning members works as casual labour in non-agricultural field or self-employed, home based workers or unemployed.

Mother level characteristics

In deltaic village, stunting is higher among children of teenage mothers, mothers who are not formally educated, who are normally nourished, and have good contact with health facility.

In non-deltaic village, stunting is higher among children of teenage mothers, educated mothers, underweight mothers, and have good contact with health service delivery.

Child level characteristics

In deltaic village, children who are delivered premature, aged under five months or 24-35 months, larger children, who are delivered at home, and seek treatment from private qualified providers are more stunted.

In non-deltaic village, children who are delivered premature, aged under the five months of age, smaller children, boys, delivered at institution and seek treatment from private qualified providers are more stunted.

Intergenerational transfer of undernutrition is more in non-deltaic village. Along with this inaccessibility with respect to treatment seeking and child delivery is higher in deltaic village.

Physical accessibility, affordability, availability, acceptability and accommodation

Accessibility dimension from demand side perspective – 5 As – Acceptability, physical accessibility, affordability, accommodation and availability

Then I represent the morbidity and undernutrition of children in the study area by five dimensions of access.

Social acceptability –

Deltaic – Seventeen percent households with children suffering from gastrointestinal problems thinks institutional delivery is not necessary, 13.5

RMP:

RMP stands for rural medical practitioners who practice allopathic treatment without medical degree.

percent reported husband or family did not allow, 3.8 percent thinks family members attain better, and 4 percent said that it is not customary. With respect to treatment seeking of ailing children, 8 percent reported that they trust RMPs and 28 percent based on previous experience. Non-deltaic – Among households of under five children whose children were suffering from gastrointestinal problems fifteen days preceding the survey about 58 percent of them thinks institutional delivery is not necessary, 38.5 percent reported family or husband did not allow, regarding treatment seeking of children, 14.3 percent reported that RMPs are better than qualified providers, 10 percent of them visit due to their trust and 24.5 percent relies based on their own as well as neighbour's experience.

Deltaic – In deltaic village, stunting is evident among families who think institutional delivery is not necessary (12 percent), where family or husband did not allow the respondent for institutional delivery (4 percent) and who thinks that mother and child get better care at home (4 percent). Prevalence is higher among children where respondents reported that they prefer RMPs for treatment seeking because of their good experience in the past (28 percent), trust RMP more than any other qualified provider (10 percent), and they perceive that RMPs are better than qualified providers (2 percent) with respect to behaviour and promptness.

Non-deltaic – Here stunting is evident among 80 percent families who believe that institutional delivery is not necessary. Forty percent respondents who reported that family or husband did not allow, have stunted children. Ten percent of respondents have stunted children who said that home delivery is customary. Here also respondents prefer RMPs for similar reasons – 27.5 percent reported they have better experience in the past, 15 percent prefers due to trust, 7.5 percent prefers due to perception in favour of them.

Accommodation

Deltaic – In relation to treatment seeking of children who suffered from gastrointestinal problems fifteen days preceding the survey, 2.7 percent visit RMPs as they provide medicine along with treatment, and 22.7 percent said that they prefer because RMPs provide treatment and medicine on credit.

In non-deltaic village, 2 percent prefer them due to providing treatment and medicine and 12 percent prefer them due to provision of treatment and medicine on credit.

Stunting is higher among families who visit RMPs due to provision of service package (treatment and medicine) on credit in both the villages (34 percent in Krishnadaspur and 25 percent in Rajrajeswarpur).

Physical accessibility

Deltaic – Among families having morbid children during last fifteen days preceding the survey, 63.5 percent reported that there is no transport available when she was in need of the delivery of the child. Eighty four percent visit RMPs due to proximity. Mothers of 84 percent stunted children argue that non-availability of transport is the main cause of preferring home delivery of their children. Seventy percent mothers of stunted children prefer to seek treatment of their children from RMP due to proximity.

Non-deltaic – In Rajrajeswarpur, 7.7 percent mothers of morbid children faced the problem of transport at the time of delivery, and 77.5 percent prefer treatment of their children in RMP's clinic due to closeness of the clinic from their house. Thirty percent mothers of stunted children delivered at home due to non-availability of transport and 57.5 percent prefer RMPs for proximity.

Availability

Twenty seven percent mothers of the morbid children, 32 percent mothers of the stunted children in the deltaic village reported that they prefer home delivery as distance from health facility is too long in the sense that distance is not much but it takes time due to poor road condition. In non-deltaic village, only 15.4 percent mothers of morbid children revealed their preference of home delivery due to time and distance factor. Twenty eight percent mothers of morbid children in deltaic village and 14.3 percent in non-deltaic village reported absence of trained doctor in nearby health facility. Four percent mothers of morbid children in deltaic village and 6 percent in non-deltaic village experience absence of doctors in public facility when they went for seeking treatment in public facility. In Krishnadaspur, 24 percent mothers of morbid children and 34 percent mothers of stunted children reported that they visit RMPs because they are always available. In non-deltaic village, 20 percent mothers of morbid children and 27.5 percent mothers of stunted children visit due to their easy availability. Thirty two percent mothers of stunted children in deltaic village compared to 10 percent in non-deltaic village preferred home delivery due to distance and time taken to reach health facility. Twenty four percent of the same reported that non-availability of trained doctor nearby in deltaic village compared to 17.5 percent in non-deltaic village.

Affordability

Among mothers of morbid children, 58 percent in deltaic village and 84.6 percent in non-deltaic village perceives institutional delivery is costly. Almost 23 percent of them in Krishnadaspur and 39 percent in Rajrajeswarpur reported RMP services are less costly. Twenty four percent mothers of stunted children in Krishnadaspur and 60 percent in Rajrajeswarpur perceives institutional delivery is costly. Ten percent mothers of stunted children in Krishnadaspur and 27.5 percent in Rajrajeswarpur reported that RMP services are less costly.

FGD with earning members in the villages revealed the people's perception which expressed that due to poor economic status, they are unable to take proper care of their children with respect to treatment seeking and other. Frequent climatic shock, geographical adversities induced physical inaccessibility, absence of qualified provider due to poor infrastructure, higher health expenditure on medicine due to lack of supply, and on transport due to unavailability of boat at night – all retards the care seeking even during emergency and so increases the likelihood of morbidity and further undernutrition.

In summary, impact of social unacceptability is higher in non-deltaic village where availability of service package is more necessary in deltaic village. Impact of physical inaccessibility is higher in deltaic village where physical infrastructure gets destroyed more due to climatic shocks. Residents of remote areas in non-deltaic village prefer home delivery due to the same reason. Limited availability of service delivery affects mothers of stunted children more compared to those of morbid children to opt for home delivery and health seeking from unqualified provider. Affordability dimension is affecting the care giving of morbid children in non-deltaic village more compared to those in deltaic village or care giving of stunted children.

Effectiveness of supply side

In this section I analysed how much the supply side environment is affecting the undernutrition and morbidity of children in the study area.

Most of the households in both the villages seek treatment for their children from unqualified providers. The percentage sought treatment from unqualified providers is 80 percent in Krishnadaspur while 67 percent in Rajrajeswarpur. About treatment seeking of their children, approximately, 1 percent households went to public provider, 19.4 percent in Krishnadaspur and 27.9 percent in Rajrajeswarpur sought from ground level public provider, 2.2 percent in Krishnadaspur and 11.4 percent in 2.2 percent in Rajrajeswarpur sought from homeopath, 2.2 percent in Krishnadaspur and 5 percent in Rajrajeswarpur went to BPHC and 0.7 percent in Krishnadaspur went to DH.

Next I will converse about the effectiveness of supply side environment during climatic shock. We asked the households whether cost of treatment increases during climatic shock in the clinic of unqualified provider. Thirty five percent of them in Krishnadaspur and 40.4 percent of them in Rajrajeswarpur reported that RMPs sometimes charge more during extreme climatic events. In Krishnadaspur, about 31.5 percent experienced cost increase frequently whereas in Rajrajeswarpur it is 27 percent. Experience of cost increase to a great extent due to seeking treatment of children from RMP's clinic is much higher in Krishnadaspur (17.9 percent) compared to Rajrajeswarpur (6.6 percent). We also asked in what field households incurred expenditure due to treatment seeking of their children. i.e. out of pocket expenditure for healthcare (It involves cost incurred during treatment seeking due to medicines, diagnostic test and transport). Most of the households in Krishnadaspur (55 percent) incurred cost to purchase medicines and to do diagnostic tests and in Rajrajeswarpur, most of them incurred cost to pay doctor's visit (66.2 percent). The second most item in Krishnadaspur is doctor's fees and Rajrajeswarpur is purchase of medicines and tests.

Next shows the Integrated Child Development Service effectiveness. Exploring the impact of ICDS programme, it is evident that visit of frontline anganwadi worker or AWW is lower in Rajrajeswarpur (68.5 percent) compared to Krishnadaspur (75.9 percent). AWWs visit caregivers only monthly or once in two months (58.4 percent in Krishnadaspur and 54.2 percent in Rajrajeswarpur). Receiving supplementary nutrition from anganwadi centres or AWCs everyday is higher in Krishnadaspur (77.3 percent) than in Rajrajeswarpur (57.9 percent). Supplementary food is getting shared (which is only allotted for children in the centre) and sharing within more than three household members is higher in Rajrajeswarpur (47 percent against 38 percent) compared to Krishnadaspur where food sharing is higher between two members (57 percent against 45.3 percent). With regard to mother's perception regarding whether gathering child's food becomes difficult during climatic shock, it is evident that in Rajrajeswarpur most of them perceives that they felt no difficulty (28 percent against 19.5 percent in Krishnadaspur) or sometimes (39.1 percent compared to 32.3 percent in Krishnadaspur). Forty eight percent of them in Krishnadaspur perceive that the difficulty is felt more often or to a great extent than 33 percent in Rajrajeswarpur.

Next part represents morbidity and under nutrition of children by ICDS effectiveness. In deltaic village, prevalence of gastro-enteric problems (42.9 percent) is higher among children where no visit by AWW takes place, frequency of AWW visit is once in two months (55.3 percent), and who receive food from AWC weekly (73.3 percent). But prevalence of stunting (37.8 percent) is higher among children where AWW visits once in a month (39.7 percent), and caregivers do not allow the baby to eat the food supplied from ICDS even if they collect (75 percent). We also asked whether the food collected from AWC is shared between others and we found that where the food is shared with more than one child or two, prevalence of gastro-enteric problems (61.1 percent) or stunting (41.6 percent) is higher among them. Higher percentage of gastrointestinal morbidity is visible among households who more often face food insecurity due to climatic shock compared to others (59.3 percent). Stunting is higher among them who not at all perceive any food insecurity due to climatic shock (51.7 percent).

In non-deltaic village, gastrointestinal morbidity is higher among children where AWWs do not visit (48.1 percent), visit once in two months (31.9 percent), households never allow children to eat that food (26.7 percent), food is shared between more than two children/person (49.1 percent), and where mothers perceive that they more often face food insecurity due to climatic shock (60.9m percent). Stunting is higher among children where AWW visits (33 percent), visits monthly (36.5 percent), does not go to collect food from AWC (30.8 percent), food is shared with one child/person (46 percent), and where mothers perceive that they not at all face food insecurity during climatic shock (45 percent).

According to focused group discussion, provision of supplementary food is not provided in similar quality and frequency in all the centres. Caregivers said that one centre provides egg with khichdi three times a week whereas another provides less but the quality of khichdi is very poor.

The in depth-interview of anganwadi worker in Rajrajeswarpur village reveals the fact that though they are trying hard to generate awareness inside the community, responses are heterogeneous in nature. They teach about how to prepare the food, when to start complementary feeding, the frequency of feeding but mothers use very less quantity of ingredients to cook and so the food becomes nutrient deficient. Though mothers are educated to a certain level, they mostly go outside with other family members to reap or harvest paddy or knot baskets/brooms as alternate livelihoods which affect their childcare and feeding.

According to her, undernutrition starts from the womb as intra-household food allocation disfavors the younger daughter-in-laws. Most of them suffer from reproductive morbidities and no treatment seeking hampers intrauterine growth of the children. Mothers are unable to produce breast milk enough as they drink very little quantity of milk and they hardly follow the norm of drinking water before or after breastfeeding. So even though they exclusively breastfed their children for first six months, the children are undernourished.

She also said that view of beneficiaries of ICDS regarding its effectiveness is difficult to change. She argues that due to poor SES, people expect that ICDS support 24x7 is required but they do not understand that ICDS is designed to serve a part and rest of the care and feeding is to be done at home. Her suggestion to increase the effectiveness, she needs co-operation from NGOs and CBOs to increase the care during pregnancy and lactation period through proper intervention and monitoring otherwise child health and nutritional status cannot be improved.

Focused group discussion with caregivers revealed that in Krishnadaspur, children living in hard to reach parts are unable to go to AWCs to eat the supplementary food - khichdi. FGD with earning members in Rajrajeswarpur and caregivers in Krishnadaspur expressed high level of frustration about the questionable quality of supplementary food. They said that in khichdi, rice and pulse remains very little and not boiled properly, egg is provided once in a week ("*chal dal sidhho hoy na, ektufota thake, dim to sat dine ekdin dey*"). In Krishnadaspur, they are satisfied with the supplementary nutrition provided by SSDC. The caregivers in hard to reach areas raised the need for more AWW; all of them in both the villages want diligent workers to serve effectively so that every child can get service.

Community Perception and involvement

This part explores how much community members feel for other members, their togetherness and interest to accomplish collective goals. These factors are important because community led interventions and solutions can better improve the scenario as solution from within the community level is always contextual compared to centrally driven strategies. Since, child health and nutrition problem related solution should count every child so individual level intervention will accelerate the reduction of inequity much faster compared to average based solutions.

As per key informant interview in the two villages – in Krishnadaspur, he strongly agrees with the view that if the community faces a collective problem, members can develop and carry out solutions to the problem when it arises. Because, this community has good mechanism to gather together and discuss problems the community is facing and most of the community members are trustworthy. He firmly agrees with the view that all the members are committed to same collective goals, people even women and the poor with differing views are able to equally contribute their views on community plans and activities. But as per Focused Group Discussions with mothers and earning members it is highlighted that young mothers are unable to take decisions about their children's health and nutrition due to disempowerment and hardly anybody or group listen to the poor as mentioned regarding the quality of supplementary food supplied by AWCs. The village leader also agrees to the view that the people in the community share similar ideas of what is best for the community members and community leaders represent the interest of the poor people and women. He disagrees with the view that the community frequently evaluates how well plans and projects have worked. He also disagrees with the view that people are self-centred, thinks only about their own interest or are not concerned with the larger community. In addition to this, he strongly disagrees that people in this community have poor skills and resources compared to other communities.

In Rajrajeswarpur, he strongly agrees that this community is committed to collective goals, community members develop and solve any problem the community faces, public institutions with participation of community frequently evaluates how well plans and projects have worked, community people are trustworthy. He also strongly argues that people in this community look out more for their own interest and less concerned about the interest of the poor people and women. He agrees with the view that when the community faces any problem, these community members gather together and discuss the solutions and poor people in this community are equally able to contribute their views and opinions on community plans

and activities. But he disagrees with the view that women has equal voice on community matters and strongly disagrees with the view that community members share similar ideas regarding the best of the community.

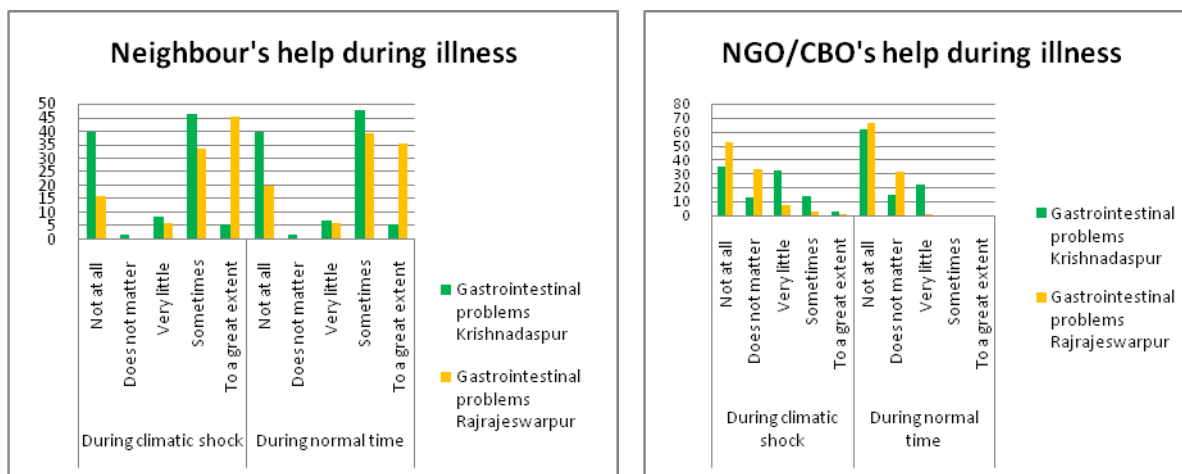


Figure 3 Community participation regarding treatment seeking of children during climatic shock as well as normal time in the study area

To understand how much the community is responsive to child health seeking needs during climatic shock as well as normal time, it is evident from figure 3 that families of morbid children who required treatment during gastrointestinal episodes, 39.5 percent of them in Krishnadaspur and 15.7 percent in Rajrajeswarpur reported that neighbours do not help regarding treatment seeking during climatic shock. Almost 40 percent households in Krishnadaspur and 20 percent in Rajrajeswarpur stated that they do not get any help during normal time also. Forty six percent in Krishnadaspur and 33.5 percent in Rajrajeswarpur sometimes get help from neighbours during climatic shock. Forty seven percent in Krishnadaspur and 39 percent in Rajrajeswarpur sometimes get support during normal time. Regarding help from NGOs and CBOs, more than 50 percent households in Rajrajeswarpur and 35 percent in Krishnadaspur – whose children suffered from gastrointestinal problems – did not get any support from NGOs/CBOs during periods of climatic events. More than 60 percent of such households (61.8 percent in Krishnadaspur and 66.7 percent in Rajrajeswarpur) do not get help even during normal time.

Qualitative study revealed that in Krishnadaspur one NGO –SSDC provides health and nutrition service, generates awareness about childcare and serves during climatic shock. But side by side it is difficult for them to provide care provider during all the episodes of emergency. In addition to this they also added that it is difficult for the neighbours to help in person or economically since they are also poor and vulnerable.

4. DISCUSSION

Poor perception about child health and nutritional status, ineffective home visit of AWW, infrequent visits of them are more in non-deltaic village. Mother's poorly perceive about their children's health, and along with such perception most of them do not take their children to AWC everyday to receive supplementary nutrition. Even if they collect food for one child, share the same with one or two other members increasing the probability of undernourishment of the child. Most of them perceive that they are not insecure with supply of food during climatic shock episodes. But according to FGD, some of them argue that they really become insecure. In-depth interview with AWW reveals that though she suggests contingency plan to protect the child's care and feeding practice during climatic shock, mothers or caregivers do not feel the need and neglect the care even during normal time. *Even though they are literate or educated up to primary level, they do not follow proper feeding practice e.g continuation of breastfeeding along with complementary feeding during weaning period due to poor community level services delivered by ICDS centre.*

Thus non - deltaic village – less affected by impacts of climatic shock, less vulnerable with respect to livelihood insecurity, geographical adversity, and accessibility to care provider – are more vulnerable to undernutrition among children under the age of five with respect to supply side ineffectiveness and poor perception of mothers (crucial demand side determinant) compared to deltaic village. To improve child's nutritional status here, the effectiveness of ICDS centre should be modified according to area specific need. Some priority focus should be on –

1. Increase in the number of visits by AWW which should be done through strong monitoring system. It requires regular update of each child specific information in an electronic database
2. AWWs should record the advice digitally to keep record about the quality of need specific advices.
3. Digital recording of AWW level data monthly should comprise whether each and every child is visiting the centre everyday, whether they are eating the food in AWC, the amount of ration sanctioned per AWC and amount used everyday to prepare food per AWC, and quality of food should be checked with random visits.

Impact of climatic shock on infrastructures, assets, and livelihood is higher in deltaic village. But impact of service delivery is more or less same which shows massive ineffectiveness and negligence on the part of service delivery of health and nutrition. This leads to major dependence on rural unqualified provider in respect of care seeking and neglect on nutritional achievement since no private provider is there to watch, prevent and cure under-nutrition (one or two NGOs are working in some villages but not covering the whole).

Morbidity prevalence is higher among families who belong to poorest of the poor category, survives with subsistence level farming, fishing, honey or wood collection, livestock rearing or insignificant business and lives in poor environment. The evidence shows that mothers of some morbid children are literate up to primary level in deltaic village which indicates that firstly, education up to primary level is not sufficient to realize the need or degree of care giving and secondly impact of physical inaccessibility in this village is so strong that even mothers can feel the need, it is difficult for them to provide and increasing vulnerability to chronic poverty with time stops them to afford even lots of awareness generation campaigns take place. *Limited level of understanding coupled with inaccessibility and lack of purchasing power acts as barrier to care seeking. Mother's early child bearing and related premature delivery increases the vulnerability of morbidity and undernutrition among children more in deltaic village compared to non-deltaic village.* Secondly impact of physical inaccessibility in this village is so strong that even mothers can feel the need, it is difficult for them to provide and increasing vulnerability to chronic poverty with time stops them to afford even lots of awareness generation campaigns take place (Alwang *et al.* 2001; Morales *et al.* 2004; Imai 2010; Somkotra and Lagrada 2009).

In both the villages, prevalence of stunting is influenced by climatic, geographic and socioeconomic vulnerabilities. Among those, vulnerable impact of climatic shock is the most significant one. In other words, stunting prevalence is higher among children who live in most vulnerable area according to climatic shock proneness.

In non-deltaic village, the most significant vulnerability is ineffective service delivery comprising non-availability of medicine, overcrowding of health centres, preference of home delivery with help of dai or RMP, higher charge of RMPs during climatic shocks, relying on RMPs for care seeking. Children who are under 5 months of age, smaller at birth and girl children are more stunted strengthens the argument regarding the existence of intergenerational transfer of undernutrition and gender discrimination in deltaic village— another dimension of social vulnerability. Social acceptability of health seeking to unqualified provider is more in non-deltaic village where most of the households perceive that institutional delivery or care seeking from qualified provider is costly compared to home delivery or care seeking from RMP, and also family tradition prohibits to seek care from institution. With respect to healthcare expenditure, Krishnadaspur is more vulnerable to chronic poverty due to expenditure on medicine and Rajrajeswarpur becomes vulnerable due to higher doctor fees.

In respect of community responsiveness to help treatment seeking during normal time or in emergency, though villagers get moderate help from their neighbours, limited or very little attention is received from NGOs or CBOs.

Few policy suggestions for both the areas are -

- Generate the scope of work through making the site more attractive for tourists
- Reduce salinity in scientific way
- Regulate food and healthcare market through
 - Price ceiling of major food crops and monitoring it effectively
 - Make the essential medicines easily available
 - Provide training to RMPs and monitor them on regular basis to minimize the risk
 - Quality and effectiveness measure of ICDS and healthcare provider in fixed interval
 - Strengthening monitoring of ICDS centres
- Creating more involvement of community through active cooperation of SHGs, advocacies, sensitizations and campaigns.

Lower socioeconomic resilience and higher vulnerability due to chronic poverty causes limited access to food, limited availability of food in the market due to lack of production as a consequence of climatic shock induced productivity loss, high price due to shortage of supply – leads to lack of effective demand for food in both the deltaic and non-deltaic village. All these coupled with wrong perception about food insecurity, about subjective weakening of economic resilience even after consumption sacrifice, limits the demand for food among families of undernourished children in deltaic village. But in non-deltaic village, even there is perception of subjective economic status fall, wrong perception about food insecurity limits the demand among families of undernourished children. In addition to this, physical inaccessibility to care providers, higher cost of medicines and doctor fees leading to improper treatment seeking from traditional healers in both the villages and ineffective service delivery leading to poor childcare and feeding contributes to morbidity and undernutrition as found in other literature (Klein *et al.* 2007; Tanner and Mitchell 2008). Therefore social adaptation against low economic resilience, little community involvement leads to sub-optimal solutions to health and nutritional status and limited ability to adapt against socioeconomic, livelihood related vulnerabilities coupled with climatic shocks. This reduces the capacity to combat undernutrition.

5. CONCLUSION

Therefore, wide sub-optimal utilization of health and nutrition service delivery due to either poor perception or limited understanding of caregivers from demand side as well as sub-optimal service delivery and accountability on the part of the providers coupled with frequent climatic shocks demanding more care create worse being of inhabitants. Incorrect perception about vulnerable impact of healthcare expenditure during climatic

shock increases the probability of destitution among families with morbid or undernourished children is another example of climate, health and resilience spiral which requires intervention to change perceptions instead of KAP and bringing success is very challenging (Heltberg *et al.* 2009). Tables will be provided upon request.

SUMMARY OF RESEARCH

1. Perception is a major determinant of vulnerability to stunting and morbidity
2. Five dimensions of access is responsible for access to sub-optimal quality of care seeking from unqualified provider
3. ICDS ineffectiveness increases the vulnerability to undernutrition and morbidity among children
4. Limited community participation is another determinant

FUTURE ISSUES

I believe that many social scientists will focus on this aspect to suggest policies to reduce multifaceted vulnerabilities.

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