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Inequalities in human well-being in the urban Ganges-Brahmaputra Delta: implications for sustainable development

Sylvia Szabo
Rituparna Hajra
Angela Baschieri
Zoe Matthews

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ABSTRACT

Discussions on post Millennium Development Goals (MDGs) unanimously agree on the need to focus on sustainable development, finishing the job of ending extreme poverty and the importance of supporting urban development. Urbanization has the ability to transform societies and cities are the primary engine of economic growth and development. On the other hand, there is an increasing number of people living in poverty in urban environments and inequalities are increasing. Sustainable and inclusive urban development will accelerate progress towards Sustainable Development Goals (SDGs) and contribute to the end of extreme poverty. Urban growth in Bangladesh is very rapid and it is crucial to develop policy initiatives to monitor the existing inequalities in the region in order to maintain current socio-economic trends. The present study analyses the level and determinants of selected welfare measures and assesses the extent of inequalities in human well-being in the urban Bangladeshi Ganges-Brahmaputra Delta. Using the 2010 Household Income and Expenditure Survey (HIES), this paper aims to provide some reflections on current inequality trends, thus contributing to the progress towards sustainable development of the country.

KEYWORDS

Inequalities; human well-being; urbanisation; sustainable development; Ganges-Brahmaputra Delta.

EDITORIAL NOTE

Sylvia Szabo is a Research Fellow in the Division of Social Statistics and Demography, University of Southampton, UK.

Rituparna Hajra is a Research Fellow in the School of Oceanographic Studies, Jadavpur University, India.

Angela Baschieri is a Reader in Demography and Human Development in the Division of Social Statistics and Demography, University of Southampton, UK.

Zoe Matthews is a Professor of Global Health and Social Statistics, Co-director of Global Health, Population, Poverty and Policy (GHP3) and Director of the PGR Programmes in the Division of Social Statistics and Demography, University of Southampton, UK.

Corresponding author: Dr Sylvia Szabo, s.m.szabo@southampton.ac.uk.

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INEQUALITIES IN HUMAN WELL-BEING IN THE URBAN GANGES-BRAHMAPUTRA DELTA: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT

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1. INTRODUCTION

According to the latest UN figures, approximately 54% of the world's population live in areas classified as urban (UN, 2014c). Different world regions experience challenges related to either rapid rate of urban growth or urban lifestyle and health risks associated with living in cities. While populations in more developed regions are approximately 78% urban, in less developed regions, the equivalent proportion is 49%. At the same time, in the least developed countries (LDCs) 31% of population live in urban areas, which is projected to increase to 50% by 2050 (UN, 2014c). In densely populated Asian cities, the negative impacts of rapid urban growth include high rates of pollution translating into ill-health, overcrowding and housing deprivation (UNHABITAT, 2012).

Discussions on the post MDG agenda unanimously agree on the need to finish the job of ending extreme poverty and the importance of supporting urban development. As a part of the consultative process regarding the future development agenda key stakeholders, including UNHABITAT and Cities Alliance, advocated for a single Sustainable Development Goal (SDG) on urbanisation (SDSN, 2013). It was argued that alternative approaches of incorporating urbanisation into the SDG agenda might lead to failure in addressing the key developmental impacts of urban processes (SDSN, 2013). As a result of these discussions, the newly proposed SDGs comprise a specific goal on cities and a number of indicators, which will allow monitoring of progress towards sustainable urbanisation. Recognising the importance of intra-urban inequalities, the suggested indicators make reference to inclusive urban development and set specific targets for the least developed countries and vulnerable groups (UNSC, 2015).

In Bangladesh, urban to rural migration has been the main contributor to urban growth, and accounted for around 70% of urban growth in the city of Dhaka (Rana, 2011). At the same time, Bangladesh is one of the most vulnerable countries in the world in terms of the impacts of climate change (Leal Filho, 2011). Among the top 39 cities exposed to natural hazards, Bangladesh's Dhaka is listed as the 7th most vulnerable city, while Chittagong in south-eastern Bangladesh is in 37th place (UN, 2012). The risk of floods, cyclones and other natural disasters including sea level rise, is particularly high in the Ganges-Brahmaputra Delta region, where environmental hazards along with poverty and lack of employment opportunities constitute push factors for migration (Mallick and Vogt, 2012, Alam, 2008).

While rural poverty is still predominant in the region, similar to the trends in other developing countries, urban poverty and intra-urban inequalities have been on the rise (Hossain, 2008, Banks et al., 2011, Khan, 2008). Rapid growth of cities and peri-urban areas has resulted in increased slum dwellings and greater complexity of urban areas. Despite considerable progress in health indicators (Sanderson, 2012, Chowdhury et al., 2013), large intra-urban disparities continue to exist and are based on income, assets, social status and access to resources.

Given the evidence regarding the negative impacts of poorly managed or unplanned urban growth, ensuring inclusive urbanisation is crucial in order to advance sustainable development of communities and countries. As part of the consultative process leading to the conceptualisation of Sustainable Development Goals (SDGs), organisations working on urban issues, such as the International Council for Local Environmental Initiatives (ICLEI), advocated for creation of a single SDG on sustainable urbanisation, which would involve building accountable institutions, poverty alleviation, ensuring ecological footprint and promoting sustainable production and consumption patterns. Acknowledging the key role of urbanisation for human development, goal 11 in the proposed SDGs aims to "make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2014a). In light of the growing recognition of urbanisation as part of broader development processes (Cohen, 2006, Allen et al., 2002, UN, 2014b, UNICEF, 2010, Khan et al., 2011) and consequently human well-being, it is crucial to investigate the extent of existing intra-urban inequalities in rapidly urbanising economically and environmentally vulnerable countries and regions.

In this context, the main purpose of this study is to empirically assess the degree of wealth-based inequalities in human well-being in urban areas, with a focus on the Ganges-Brahmaputra Delta in Bangladesh. Understanding these inequalities is crucial because the presupposed human well-being gap between the rich and the poor in urban areas can hamper development progress of the region and the country as a whole, despite considerable achievements made by Bangladesh in human development (Chowdhury et al., 2013). In the analysis, we focus on three specific aspects of well-being, i.e. health, education and overall consumption. We use data from the most recent Bangladesh Population and Household Census as well the 2010 Household Income and Expenditure Survey (HIES). These data are analysed applying standard inequality measures, such as Atkinson index, concentration index and concentration curves as well as logistic regression modelling. The next section provides a

brief overview of urbanisation trends at the national level. Section three describes and discusses data and methods used. In section four we discuss the results of the analysis examining the extent of intra-urban inequalities in selected well-being indicators. The final part of the paper contains conclusions and policy recommendations in the context of the recent debates pertaining to the SDG agenda.

2. URBAN GROWTH AND URBANISATION OF POVERTY IN BANGLADESH

While still predominantly rural, in the last 60 years Bangladesh experienced rapid urban growth which has had a number of important consequences in terms of the country's human development. According to UN data (UN, 2014c), in 1950 only 4.3% of the population were urban as compared to over 33.5% in 2014. During this period the urban population grew rapidly, exceeding 53 million by 2014. At the same time, the rural population, while still considerably larger, increased approximately 3 times reaching almost 105 million in 2014. The annual rate of urban growth was particularly high between 1975 and 1980, when it exceeded 10%, slowly stabilizing in most recent years with an average urban growth rate of around 3.6% between 2010 and 2015. Figure 1 illustrates the trends in both urban and rural population growth, including projections to 2050.

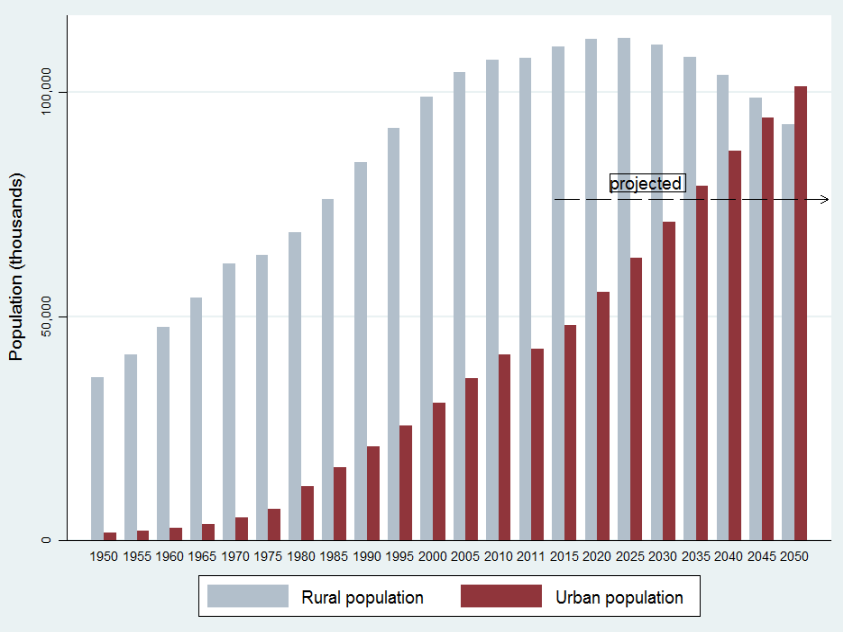


Figure 1: Trends in urban and rural population growth in Bangladesh (1950-2050)

Source: United Nations World Urbanisation Prospects (2014).

When comparing trends in aggregate indicators of human well-being, it can be noted that Bangladesh has achieved considerable progress. According to the most recent MDG report for Bangladesh, the country is now well on track in achieving most MDGs and has already met some specific targets, including the reduction in under-five mortality rate and targets related to communicable diseases (GED, 2013). Recent research found that Bangladesh has performed comparatively better than other countries with similar economic conditions, which could be partially explained by investments in rural development, engaging female workers in service delivery and family planning campaigns (Asadullaha et al., 2014). A study published in The Lancet confirmed that Bangladesh accomplished exceptional progress in health indicators despite the country's economic poverty (Chowdhury et al., 2013).

At the same time, however, the rapid pace of urbanisation in Bangladesh coupled with often poor planning meant that large urban populations have remained deprived of basic means of subsistence and their livelihoods are recurrently at risk (Rana, 2011). While the overall urban poverty has been falling, the absolute numbers of the urban poor have increased dramatically (Banks et al., 2011). In addition, research highlighted that in Bangladesh, as in other low income countries, the official urban poverty line is likely to be underestimated (Banks et al., 2011). A recent report by UNICEF (2010) points out that according to the urban slum survey (2005) approximately one third of urban population live in slums. The report also highlights that other sources estimate the number of slums dwellers to be as high as ten million (UNICEF, 2010). The key challenges in slums or informal settlements are often related to the lack of tenure. This prevents households from benefitting from formal services, generates grounds for polarization and contributes to a continuing cycle of poverty (UNICEF, 2010). The analysis of 2009 Multiple Indicator Cluster Survey (MICS) data revealed that many socio-economic indicators in slum areas are at dramatic levels. For example, only 9% of households living in slum areas have access to an improved sanitation facility and drop out ratio from primary school is as high as 8% (UNICEF, 2010). Comparatively, 54% of the overall urban population have access to improved sanitation and the equivalent drop out ratio in urban areas is 1% (UNICEF, 2010).

The majority of Bangladesh's geographical area has been classified as a delta region (Ericson et al., 2006). In poor deltaic regions, such as the Bangladeshi Ganges-Brahmaputra Delta, environmental and social vulnerabilities tend to be highly intertwined. These

vulnerabilities can constitute both causes and consequences of rapid urbanisation, and have an impact on human well-being at the micro level. Coastal cities are likely to be affected by flooding, cyclones and other environmental consequences of climate change. Without a support net and explicit inclusion in relevant policy provisions, the poorest urban households are at a double risk of aggravating their already dire living conditions. Research found that amongst 11 Asian cities, Dhaka was most vulnerable to the impact of climate change (Banks et al., 2011). A study amongst low income urban residents in Khulna confirmed that geographic location as well as specific socio-economic contexts and environmental threats shape the way households perceive most important challenges to their livelihoods (Jahan et al., 2012).

3. DATA AND METHODS

In order to investigate the extent of inequalities in the study area, we use micro level data from the 2010 Household Income and Expenditure Survey (HIES). HIES is a nationally representative survey conducted periodically by the Bangladeshi Bureau of Statistics (BBS). The sample size for the study area comprises 3,300 urban households. Key variables of interest are household level and individual level indicators of human well-being and include utilization of reproductive health care by household members, educational attainment and overall consumption. We classify household wealth based on wealth quintiles constructed using Principal Components Analysis (PCA). PCA is a commonly applied data reduction technique applied to generate asset indices, which are considered to approximate household wealth (Filmer and Pritchett, 2001, Rutstein and Johnson, 2004). The specific assets included in the index are dwelling wall material, access to key services, such as sanitation, water, electricity and internet, having a separate dining room, and selected assets (motor, fridge, TV, fan and computer). The list of variables included in the PCA together with their descriptive statistics is provided in Appendix A. The first component is used to predict the values of the index.

With regard to the outcome variables, we selected indicators which measure key aspects of human well-being, i.e. consumption, health and education. This selection has been motivated by World Bank's measurement of human well-being, which underlines the understanding of "well-being" as a multidimensional concept (World Bank, 2005). These three aspects are also the key components of the human development index (albeit, given the

availability of data and level of analysis, the specific indicators used differ) (UNDP, 2013). The indicators used in the present study have been selected based on two main criteria: The first criterion was the existing evidence based on these indicators, while the second criterion was data availability. More specifically, with regard to health, we focus on indicators of access to health (antenatal and postnatal care) and health outcomes (gastric diseases). Despite considerable progress made in healthcare coverage and healthcare outcome, Bangladesh still compares poorly with its neighbours when it comes to maternal health indicators, such as antenatal care (Chowdhury et al., 2013). In addition, we measure inequalities in health outcomes using the indicator of the most commonly reported disease, i.e. gastric diseases (including ulcers). According to the Bangladesh Bureau of Statistics (BBS, 2011), amongst the respondents who suffer from chronic and long term diseases approximately 24% had gastric problems with little difference between genders and place of residence. Household consumption and individual educational attainment are treated as continuous variables, while individual access to reproductive health care services health and health outcomes variables are binary. Following the definition by the UNDP (2011), we consider educational attainment of adults who are 25 or older. Total household consumption comprises of food and non-food expenditure as classified by the BBS. Expenditures are standardised into monthly time periods and reported in Bangladeshi taka.

The statistical analysis is divided into three main parts. First, we report descriptive statistics for outcome variables and key explanatory variables used in the analysis. We then apply multiple linear and logistic regression modelling using both adjusted and unadjusted models. Socio-economic controls, such as age and sex, are incorporated in the models in order to examine whether the magnitude and significance of regression coefficients changes when household and individual level characteristics are accounted for. Model selection is conducted using standard post estimation criteria, including R^2 and F-test for linear models, and Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) for logistic models.

Finally, we investigate wealth-based inequalities by means of standard inequality measures, such as concentration indices (CIs), concentration curves, Atkinson index and unadjusted regression coefficients. The concentration curve illustrates the extent of inequalities by plotting the shares of the well-being variable against the quintile of the wealth variable (O'Donnell et al., 2008). It is then compared against the 45 degree line, which represents

perfect equality. The concentration index is defined as “twice the area between the concentration curve and the line of equality” (O'Donnell et al., 2008, p.95). The values of the concentration index range from -1 to 1, with 0 indicating perfect equality. In the case where the response variable represents a negative outcome, e.g. undernutrition, the negative value of the concentration index indicates that poorer groups are at disadvantage (O'Donnell et al., 2008). Mathematically, the concentration index can be specified as follows:

$$C = 1 - \frac{2}{n\mu} \sum_{i=1}^{n} h_i (R_i - 1).$$

where n is the sample size, μ is the mean level of health (or other well-being) variable, h_i is the well-being indicator for person i and R is the rank of the socio-economic status (O'Donnell et al., 2008).

Conversely to the concentration index, the Atkinson index accounts for the variation in sensitivity to inequalities across the income distribution (De Maio, 2007). The values of the index range from 0 to 1, with 0 indicating perfect equality. As pointed out by de Maio (2007, p.850), the interpretation of the index can allow estimating the percentage of the income needed in order to achieve “an equal level of social welfare as at present if incomes were perfectly distributed”. The next section reports the results of the analysis, while the discussion of the results is provided in the final section.

4. RESULTS

4.1. DESCRIPTIVE STATISTICS

Table 1 provides summary descriptive statistics for key variables used in the household level analysis (outcome variable: HH consumption). Additional descriptive statistics for individual analysis are reported in Appendix B. With regard to outcome variables, as can be noted, the mean monthly household consumption in the study area was approximately BD taka 16,102 (approximately USD 207), with the minimum value of BD taka 702 (USD 9) and maximum value of BD taka 215,048 (USD 2,768). The mean educational attainment of adults aged 5 or older was 5.7 years of education. 56.3% of interviewed women in the urban Ganges-Brahmaputra Delta reported access to antenatal care, while only 21.4% reported access to

postnatal care. 3.5% of all respondents said that they suffered from a gastric disease in the last 12 months. Concerning explanatory variables used in the analysis of household consumption, the mean age of household head was 44 years and 11.6% of household heads were females. Approximately 8.6% of all households reported that they received remittances. The majority of interviewed households we located in Dhaka division (60.7%), followed by 18.7% of all households located in Chittagong and 12.4% in Khulna.

Variable	mean	minimum	maximum	n
Outcome variables				
HH consumption	16,102	702	215,048	3,300
Educational attainment	5.7	0	19	7,235
Access to antenatal care	56.3	-	-	3,986
Access to postnatal care	21.4	-	-	3,986
Gastric diseases	3.5	-	-	14,880
HH level explanatory variables (outcome variable: consumption)	mean	minimum	maximum	n
HH characteristics				
Education of HH head	5.9	0	19	3,300
Age of HH head	44.1	11	100	3,300
HH head is female	11.6	-	-	383
HH size	4.4	1	17	3,300
HH received remittances	8.6	-	-	284
Region				
Barisal	4.59	-	-	151
Chittagong	18.66	-	-	616
Khulna	12.43			410
Sylhet	3.66	-	-	121
Dhaka	60.66	-	-	2,002

Table 1: Descriptive statistics of outcome variables and key explanatory variables used in the HH level analysis (outcome variable: HH consumption).

4.2. RESULTS OF MULTIVARIATE ANALYSIS

The regression results are reported in Table 2. Model 1 shows the effect of household wealth on overall consumption level when accounting for household level characteristics and place of residence. The wealth effect remains strong and highly significant ($p<0.01$). Education and age of household head are all significant at 1% significance level. For example, a ten-year increase in educational attainment of the household head is associated with a 3% increase in

the overall consumption expenditure. Similarly, receiving remittances is associated with an increase in consumption of around 15%. Household size is also positively associated with overall household consumption level, which might be explained by the fact that in larger households more household members are contributing income. In terms of regional differences, households residing in Chittagong are most likely to have highest levels of consumption expenditure, while residing in the costal divisions of Barisal and Khulna is associated with lowest levels of household consumption.

Model 2 summarizes the determinants of education at individual level. As can be noted, there are stark wealth based inequalities when it comes to educational outcomes of adult household members. The expected educational attainment for individuals from wealthiest households is 7.9 times higher compared to individuals from the poorest households ($p<0.01$). Household size is negatively associated with educational attainment, which is also likely to be related to the fact that poorer and less educated couples tend to have larger families (NIPORT et al., 2011). Furthermore, the results show that gender is an important predictor of educational attainment; being female is negatively associated with educational attainment. These results are in line with existing research and suggest a need for continuous scaling up of investment in girls and women, despite considerable progress made in this area in Bangladesh (NIPORT et al., 2011, Chowdhury et al., 2013). Finally, place of residence measured by region is also a significant predictor of education. In particular, compared to Dhaka and controlling for other factors in the model, residing in Khulna is negatively associated with educational attainment. On the other hand, *ceteris paribus,* those individuals who reside in Barisal or Chittagong are most likely to benefit from higher levels of education.

Results examining the determinants of healthcare utilization and health outcomes are presented in models 3, 4 and 5. Models 3 and 4 report the results for the determinants of reproductive healthcare utilization, while model 5 focuses on gastric diseases as the outcome variable. It can be noted that in all three models, household wealth plays an important role, and so do education and age of household head. More specifically, the odds of having access to antenatal care for women in wealthiest households are 2.56 times the odds for females from poorest households. Women from richest households are also significantly more likely to benefit from postnatal checkups (OR = 2.70, CI=1.63; 4.46). Being an older woman is negatively associated with both postnatal and antenatal care, which might indicate that

younger women have greater awareness of the need for reproductive healthcare and may have greater physical and financial access to healthcare facilities. *Ceteris paribus*, household size is negatively associated with postnatal care (OR=0.94, P<0.05), but not significant for antenatal care.

	Model 1 Consumption	**Model 2 Education**	**Model 3 Antenatal care**	**Model 4 Postnatal care**	**Model 5 Gastric diseases**
Variable	log β (SE)	β (SE)	OR (CI)	OR (CI)	OR (CI)
Wealth					
Poorer	0.19 (0.03)***	1.48 (0.33)***	1.23 (0.86; 1.76)	0.75 (0.45; 1.24)	0.68 (0.46; 0.99)**
Medium	0.35 (0.03)***	2.43 (0.28)***	1.61 (1.13; 2.30)***	0.83 (0.50; 1.37)	0.83 (0.57; 1.20)
Richer	0.47 (0.04)***	4.41 (0.32)***	1.65 (1.12; 2.42)**	1.49 (0.92; 2.41)	0.47 (0.30; 0.72)***
Richest	0.90 (0.05)***	7.93 (0.30)***	2.56 (1.72; 3.82)***	2.70 (1.63; 4.46)***	0.39 (0.26; 0.60)***
Baseline: poorest	0.00	0.00	1.00	1.00	1.00
Other HH characteristics					
Education[1]	0.03 (0.00)***		1.12 (1.09; 1.15)***	1.20 (1.15; 1.25)***	1.04 (1.01; 1.06)***
Age[1]	0.005 (0.00)***	-0.08 (0.01)***	0.92 (0.91; 0.93)***	0.96 (0.95; 0.97)***	1.05 (1.04; 1.05)***
Gender[1]	-0.03 (0.03)	-1.66 (0.10)***			1.39 (1.10; 1.76)***
Baseline: male	0.00	0.00			1.00
HH size	0.13 (0.01)***	-0.13 (0.10)**	0.95 (0.90; 1.01)	0.94 (0.89; 0.99)**	1.04 (0.98; 1.09)
HH received remittances	0.15 (0.04)***		0.96 (0.66; 1.41)	1.00 (0.68; 1.49)	1.30 (0.89; 1.89)
Baseline: HH did not receive remittances	0.00		1.00	1.00	1.00
Region					
Barisal	-0.13 (0.07)*	1.92 (0.46)***	0.91 (0.68; 2.24)	1.84 (1.29; 2.63)***	1.75 (1.28; 2.40)***
Chittagong	0.18 (0.05)***	1.08 (0.45)**	3.27 (2.48; 4.32)***	4.26 (3.17; 5.73)***	1.62 (1.20; 2.19)***
Khulna	-0.13 (0.04)***	0.68 (0.30)**	1.44 (1.14; 1.83)***	1.14 (0.83; 1.57)	0.66 (0.48; 0.92)**
Sylhet	-0.03 (0.04)	0.52 (0.44)	2.27 (1.55; 3.31)***	4.49 (3.04; 6.64)***	2.28 (1.63; 3.18)***
Baseline: Dhaka	0.00	0.00	1.00	1.00	1.00
Constant	7.99 (0.05)***	5.93 (0.48)***	10.63 (6.21; 18.21)***	0.19 (0.10; 0.34)***	0.01 (0.00; 0.01)***
Wald chi[2]			468.7	430.1	626.3
p-value			0.000	0.000	0.000
AIC			2,242.2	1,730.8	598.1
R^2	0.645	0.400			
F-test	143.9	178.8			
p-value	0.000	0.000			
Number of observations	3,286	7,211	3,969	3,969	14,824

Table 2: Determinants of education and health: Results of five logistic regression models

Note: [1] Indicates that when a variable is at the household level (Model 1) coefficients are reported for household head. Significance levels *, **, *** are 90%, 95%, and 99%, respectively.

In terms of healthcare outcomes, the odds of having a gastric disease for individuals from wealthiest households are approximately 0.39 times the odds of individuals from

poorest households (or 61% lower). Gender is a significant predictor of gastric diseases. Controlling for other factors included in model 5, the odds of females having a gastric disease are 1.39 times the odds for males. Moreover, age and education are positively associated with the outcome. This is an interesting finding and could be explained by the fact that older individuals are less educated in the benefits of good hygiene. Finally, controlling for other variables, residing in Barisal, Chittagong and Sylhet (compared to Dhaka) is positively associated with the likelihood of having a gastric disease. Relevant post-estimation tests are reported at the end of Table 2.

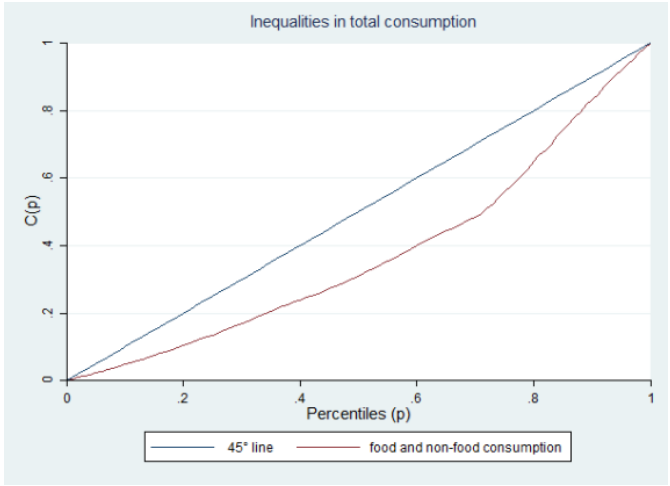
4.1. INEQUALITY MEASURES

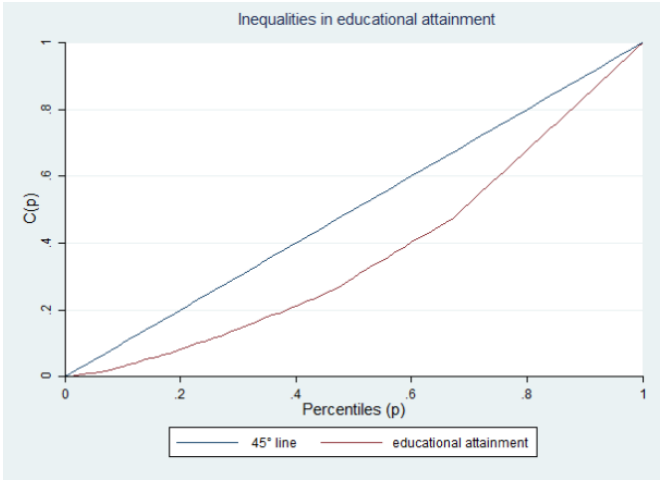
Table 3 provides a summary of intra-urban inequalities in human well-being by means of descriptive statistics disaggregated by wealth. As can be observed, for all well-being variables there is a quasi linear decline in human well-being based on household wealth. For example, educational attainment varies from 1.5 years for those in the poorest wealth quintile to 9.2 for individuals in the richest wealth quintile. Similarly, stark differences exist in access to reproductive health care. While on average access to antenatal care is 56%, amongst the poorest households only 40% of women are able to benefit from antenatal care. The pattern is less pronounced when looking at gastric diseases, however even in this case the proportion of poorest individuals suffering from gastric diseases is higher as compared to the aggregate average.

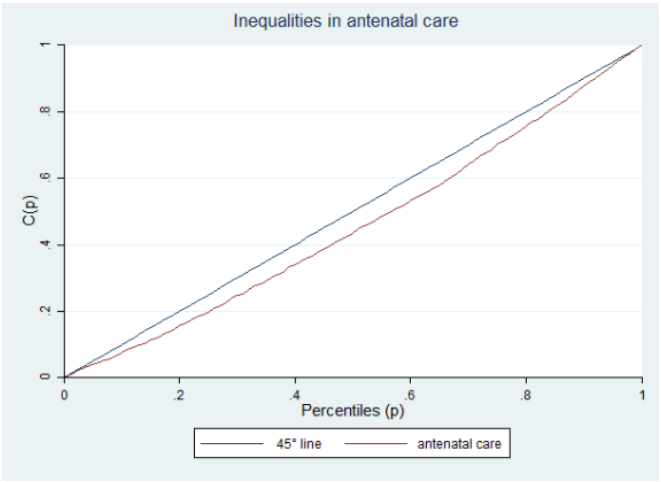
Dimension of poverty	**Wealth Quintile**					**Total (n)**	
	Q1	**Q2**	**Q3**	**Q4**	**Q5**		
HH consumption (mean, BD taka)	7,576	9,548	11,252	14,270	28,340	16,102	3,300
Educational attainment of adults (mean, number of years)	1.5	3.0	3.9	5.9	9.2	5.7	7,235
Antenatal care (% with access)	40.4	47.5	52.7	57.4	67.6	56.3	3,986
Postnatal care (% with access)	9.6	9.3	11.1	21.2	38.9	21.4	3,986
Gastric diseases/ulcer (% suffering from)	5.1	3.7	4.4	2.7	3.0	3.5	14,880

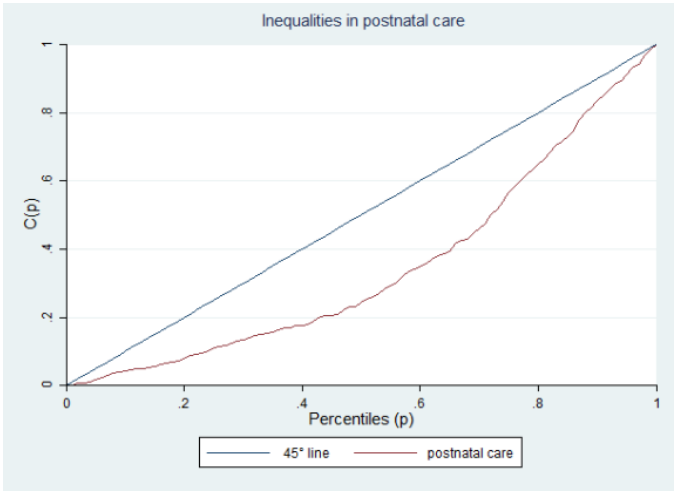
Table 3: Inequalities in human well-being continue to be stark in the urban Ganges-Brahmaputra Delta.

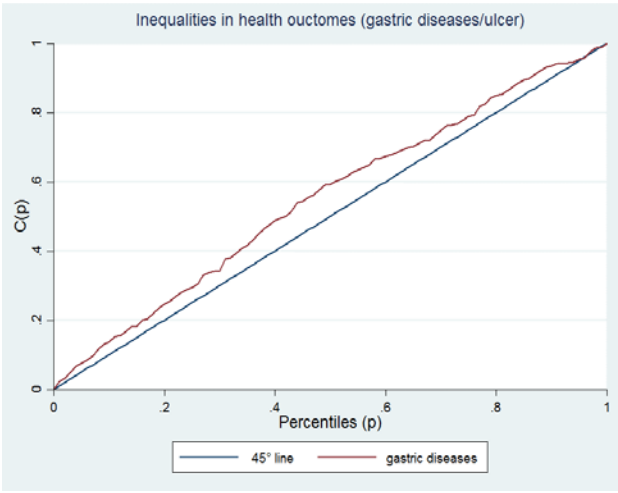
Figures 2.a – 2.e and Table 4 complement the analysis. Figures 2.a – 2.e illustrate intra-urban inequalities by displaying concentration curves for selected well-being indicators. As highlighted previously, the distance from the 45 degree line indicates the extent of existing inequalities. For the variables with negative values (such as food insecurity and gastric ulcer) the inequality line would lie above the reference line, while for the variables with positive outcomes (e.g. access to antenatal care) the inequality line will lie below the 45 degree reference line.











Figures 2a – 2e: Inequalities in household well-being in the urban Ganges-Brahmaputra Delta.
Note: C(p) Denotes cumulative proportion.

We observe that greatest intra-urban inequalities exist in access to postnatal care. On the other hand, relatively small inequalities can be seen when it comes to antenatal care and health and health outcomes measured by gastric ulcer. The increased equity of suffering from gastric ulcer across the wealth quintiles compared to our other indicators can be partially explained by the fact that person to person contact is thought to be the most common route of transmission of helicobacter pylori (van Duynhoven and de Jonge, 2001). Given overall poor sanitary conditions and overcrowding in the cities there is little difference among individuals on this indicator according to wealth.

Finally, the inequality measures summarized in Table 4 confirm stark inequalities in all human well-being indicators. Concentration indices suggest that the greatest inequalities exist in educational attainment and postnatal care. Complementarily, unadjusted and adjusted regression coefficients show that inequalities are greatest in educational attainment and access to reproductive healthcare. Concerning overall consumption, for the richest households the consumption is almost 3.6 times higher than for the poorest households (2.5 higher when controlling for additional socio-economic characteristics).

Dimension of poverty	**Indicator**	**CC**	**AI**	**Unadjusted β**	**Adjusted β**
Overall consumption	Food and non-food expenditure	0.242	0.117	1.28[1]	0.90[1]
Education	Educational attainment of adults	0.256	0.373	7.66	7.93
		CC	**AI**	**Unadjusted OR**	**Adjusted OR**
Health	Antenatal care (% with access)	0.090	0.437	3.08	2.56
	Postnatal care (% with access)	0.273	0.786	6.00	2.70
	Gastric disease/ulcer	-0.102	0.965	0.58	0.39

Table 4: Selected inequality measures in household well-being in Bangladesh?
Note: 1 β coefficient for logged outcome variable

5. CONCLUSIONS

In contrast to the current MDGs, the proposed SDG agenda recognises that sustainable development is conditional on inclusive and well-managed urban growth. Urbanization has the ability to transform societies and cities are the primary engine of economic growth and human development. Sustainable urban development will thus accelerate progress towards the achievement of the SDGs and contribute to the end of extreme poverty. Like other developing countries, Bangladesh is becoming increasingly urban. In Bangladesh, rapid urban growth is often accompanied by economic and environmental vulnerability, in particular in the delta region. In this context, the aim of this study was to investigate the extent of wealth-based intra urban inequalities in the Bangladeshi Ganges-Brahmaputra delta. The findings of our study show that stark inequalities exist in all aspects of human well-being, as measured by selected well-being indicators.

More specifically, the widest inequalities are found in educational attainment and access to postnatal health care, which is likely to be related to limited access to these services by the poorest urban dwellers. *Ceteris paribus*, for women from richest households the odds of benefiting from postnatal care are 2.7 the odds for women from the poorest households. Women from the richest households are also significantly more likely to benefit from antenatal care. Inequalities are less pronounced when looking at gastric diseases. However, even in this case the proportion of poorest individuals suffering from a gastric disease is higher than the aggregate average. In terms of regional differences, the results of this study show that households residing in Chittagong are most likely to have highest levels of consumption expenditure, while households residing in the coastal divisions of Barisal and Khulna are associated with lowest levels of consumption. Likewise, regional inequalities exist in educational attainment and access to reproductive health care facilities.

In the context of rapid urbanisation, access to basic services and necessities can be directly dependent on purchasing power (Bushamuka et al., 2005, UNHABITAT, 2012). For example, a program, conducted in Bangladesh entitled “NGO Gardening and Nutrition Education Surveillance Project” (NGNESP) showed that through

horticulture practices income of households increased substantially thus contributing to a greater ability to access food (Bushamuka et al., 2005). With regard to the results of the present study concerning the impact of remittances on human well-being, our findings are in line with existing studies, which showed that remittances had positive effect on overall consumption (Snyder and Chern, 2009, Pfau and Giang, 2009).

Disparities were also found in educational attainment as urban poor mostly spend their earnings to fulfil the most basic needs, such as food and shelter (Hossain, 2005). Hossain (2005) showed that more than 60% of the poor had no formal schooling and, at the time of the study, in 50% of households at least one school-age child was not attending school. Negative correlation between being female and having low educational outcomes was also found in previous studies. This may be attributed to the social context of Bangladesh which is often characterized by female seclusion and subordination as well as limited exposure to new information (Bushamuka et al., 2005) despite recent progress in gender equity (Chowdhury et al., 2013). Inadequate housing and use of polluted water in informal urban settlements and slum areas are a frequent cause of infectious diseases (Uddin and Jones, 2000, Alirol et al., 2011). Thus, relatively low inequalities in gastric diseases can be attributed to the overall poor sanitary conditions and overcrowding in cities (van Duynhoven and de Jonge, 2001).

Given stark intra-urban inequalities in human well-being, it is crucial that both the post-MDG agenda and national human development plans account for the existing and anticipated consequences of urban growth. Therefore, investments in different sectors should be made keeping in mind the concept of “sustainable cities”. A sustainable city can be defined as organized system that enables all its citizens needs to be met without damaging the natural world or endangering the living conditions of other people, now or in the future (Girardet, 1999) Thus, a sustainable city is a place where people live with sufficient income and free of anxiety. In this context, the proposed in the SDG agenda goal on human settlements and cities is a welcome addition. The most relevant targets under this goal include those focusing on vulnerable groups and pro-poor initiatives. For example, target 11.1, which aims to “by 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums” (UNSC, 2015, p.29) is key as it can contribute to greater

quality of life amongst different social groups and thus help reduce wealth-based inequalities. Moreover, target 11.5, which focuses on the impact of disasters, with a specific reference to protecting the poor and those in vulnerable situations (UNSC, 2015) is particularly relevant to rapidly urbanising delta regions, such as the Ganges-Brahmaputra Delta.

In addition to the SDG on urbanisation, inclusion of an overarching goal on inequalities would constitute a positive development in the proposed SDG agenda. Here, target number 10.7, regarding migration management and the need to design and implement adequate migration policies is of relevance, albeit it relates primarily to international migration. Given the results of the present study, it would be recommended that the suggested list of indicators (UNSC, 2015), include an indicator (or indicators) allowing the monitoring of progress in reducing intra-urban inequalities in human well-being. Such indicator(s) could be listed under either SDG 10 (inequalities) or SDG 11 (sustainable cities). In order to ensure progress in sustainable development targets and specific indicators pertaining to urbanisation, it is crucial to establish effective monitoring and evaluation mechanisms within a wider accountability framework.

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APPENDIX A VARIABLES INCLUDED IN PCA ANALYSIS

Table A.1: Variables used in Principal Components Analysis

Variable	Coding	Mean
HH has electricity	1 - no, 2 - yes	87.8
HH has sanitary toilet	1 - no, 2 - yes	31.6
HH has access to improved water sources	1 - no, 2 - yes	96.6
Wall material	1 - natural, 2 - rudimentary, 3 - finished	natural – 10.9; rudimentary – 41.0, finished – 48.0
Dwelling possesses separate dining	1 - natural, 2 - rudimentary, 3 - finished	20.6
HH owns a computer	1 - no, 2 - yes	6.6
HH has internet access	1 - no, 2 - yes	2.9
HH has television	1 - no, 2 - yes	63.5
HH has a fan	1 - no, 2 - yes	81.8
HH has a fridge	1 - no, 2 - yes	30.5
HH has a motorcycle/ scooter	1 - no, 2 - yes	4.4

APPENDIX B ADDITIONAL DESCRIPTIVE STATISTICS

Table B.1: Descriptive statistics of key explanatory variables (outcome variable: educational attainment)

variable	mean	minimum	maximum	n
Outcome variable: **e*ducational attainment***				
Individual and HH level characteristics				
Education	5.7	0	19	7,235
Age	42.0	25	100	7,235
Gender: female	49.9	-	-	3,610
HH size	4.4	1	19	7,235
HH received remittances	7.8	-	-	564
Region				
Barisal	4.7	-	-	340
Chittagong	19.7	-	-	1,425
Khulna	12.6			912
Sylhet	4.2	-	-	304
Dhaka	58.8	-	-	4,254

Table B.2: Descriptive statistics of key explanatory variables (outcome variable: access to reproductive health care)

variable	mean	minimum	maximum	n
Outcome variable: access to reproductive health care				
Individual and HH level characteristics				
Education	5.1	0.0	19.0	3,986
Age	38.8	16	100	3,986
HH size	5.0	1	17	3,986
HH received remittances	10.3	-	-	411
Region				
Barisal	4.9	-	-	195
Chittagong	19.9	-	-	793
Khulna	12.9			514
Sylhet	3.7	-	-	147
Dhaka	58.5	-	-	2,331

Table B.3: Descriptive statistics of key explanatory variables (outcome variable: gastric disease/ulcer)

variable	mean	minimum	maximum	n
Outcome variable: Gastric disease/ulcer				
Individual and HH level characteristics				
Education	4.8	0.0	19.0	14,880
Age	26.6	0.0	100.0	14,880
Gender: female	50.1	-	-	7,455
HH size	5.1	1.0	17.0	14,880
HH received remittances	8.9	-	-	1,324
Region				
Barisal	4.7	-	-	699
Chittagong	20.0	-	-	2,976
Khulna	12.2			1,815
Sylhet	4.3	-	-	640
Dhaka	58.8	-	-	8,749

ESRC Centre for Population Change
Building 58, Room 2001
Faculty of Social and Human Sciences
University of Southampton
SO17 1BJ

T: +44 (0)2380 592579
E: cpc@soton.ac.uk
www.cpc.ac.uk

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