Comparing healthiness across urban, peri-urban, and rural communities in Mymensingh region of Bangladesh

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Abstract

People in urban and peri-urban areas enjoy better physical access to health facilities compared to those living in rural area. However, healthier natural environment is commonly absent in urban and its adjoining peri-urban areas. Premising on the competitiveness of health determinants outlined by the World Health Organization (WHO), this study has embarked upon comparing healthiness of different communities in a region as well as to ascertain the factor(s) regulating their healthiness related outcome. Relying on pre-surveyed 1397 household data spreading over an urban, two peri-urban, and eight rural localities in Mymensingh region, Bangladesh, the study has evaluated the communities' healthiness in views of both the conventional perspective and using a set of health determinants. Illness and disease manifestation as well as socio-economic status of the households were analyzed statistically to get communities' overall healthiness scenario. Later, comparison among the communities and contribution of different indicators were sought using a combined score index. In this study's context, it has been found that urban is healthier than rural followed by peri-urban community. Here, rural areas lack education the most that should be improved; peri-urban areas need better income opportunity; and urban area requires better water-supply and waste management facilities to improve their respective health status in a community sense. There is not a commonly accepted health metrics for community's comprehensive health assessment toward which this study sets a pathway. Besides, using the combined health index developed here, specific interventions required to improve community's healthiness and minimize the gap among them can easily be identified.

Keywords

Healthiness, Health determinants, Conventional perspective, Community comparison, Bangladesh

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Highlights for public administration, management and planning:

- Healthiness status in this study indicates that urban is healthier than rural followed by peri-urban community.
- The major determinants affecting healthiness negatively are lack of education in rural areas, low income opportunity in peri-urban areas, and lack of water-supply and waste management facilities in urban areas.
- The combined health index is suggested to allow for identification of specific interventions required to improve community's healthiness.

1 Introduction

In recent decades, Bangladesh has achieved significant improvement in health indicators (Adams et al. 2018) where communicable diseases are reduced, and maternal and child health conditions are improved substantially (Rahman et al. 2018).

The country's health system is gradually shifting its emphasis on health promotion and preventative services equally (Islam & Biswas 2014). As a result, overall mortality and morbidity rates from non-communicable diseases (NCDs) have been reducing, although mortality (rate) from cardiovascular diseases (CVDs) and cancers are on a rise (Ahmed et al. 2015). Yet, country's prevalent main

Fig. 1 Extent of the study area. Source: reproduced from MSDP data (UDD 2014).

health challenges are insufficient health care facility, childhood malnutrition, communicable diseases (e.g. tuberculosis, pneumonia and water-borne diseases), and NCDs like chronic diseases, cancer, diabetes, CVDs, chronic respiratory diseases, etc. (Eminence; Johns Hopkins Bloomberg School of Public Health CCP; MeasureDHS; USAID 2013). Death toll from NCDs is increasing due to rapid urbanization that may exacerbate in future as the urban population is predicted to be 200–225 million over the next four decades.

Around 84% of urban and 75% of rural population in Bangladesh depend on private, small, and informal health-care service providers who are mostly semi-skilled with no professional training (Ahmed et al. 2015). Notably, among all treatment-seekers, 13% take government services, 27% use private services, and rest 60% rely on unqualified service-providers. Here, unequal access to health services between urban and rural areas is profound. Formal health services (sector) as well as higher-level care and diagnostic facilities are concentrated

in urban areas in contrast to informal health services sector dominating in rural areas. Inequitable distribution of health services facilities and richness of qualified providers has created urban-rural disparity, which is precluding majority to access better health facilities and quality care (Ahmed et al. 2015).

Currently, local government institutions as well as many non-governmental (development) organizations are implementing public health improvement programs in rural areas to minimize that urban-rural disparity. However, more efforts are needed from the policymakers and stakeholders to minimize urban-rural gap (Khan et al. 2013). Hence, this study aims to contribute in decision-making by evaluating healthiness of different communities in a region. Through this empirical case study, a way forward to assess community's healthiness will be portrayed and the outcome obtained through this initiative can potentially help in tailoring strategic decisions for specific community's explicit issues impending its overall healthiness. Specific objec-

tives of this study are to identify the nature and extent of health disparities; and compare healthiness among urban, peri-urban and rural communities in the study region. This study has brought peri-urban area, apart from commonly discussed urban and rural, into healthiness assessment consideration. Within this study, we define peri-urban as the area that lies in-between urban and rural area, representing a zone in transition to be urbanized and consisting of a mix of both urban and rural characteristics (Ravetz et al. 2013).

2 Study area

Being located at around 120 kilometers north of Dhaka city (capital of Bangladesh), Mymensingh district demonstrates great economic importance for its agricultural production and trade (BBS 2013). The district has rich political and cultural history as well a unique landscape comprised single wood forests, rivers, and river valleys touching the Garo Hills. There lived above 5.1 million people in 2011 in just over 1.1 million holdings in the district, of which nearly 60% were engaged in agriculture and farming related activities (BBS 2013). Urban center of Mymensingh district is also known as ‘city of education’ (Zaman 2016; BBS 2013) because of its reputed educational and training institutions including universities, medical colleges, vocational training schools, etc. The city stands on the bank of old Brahmaputra river that changed its main course in 1897 due to the great Assam Bengal earthquake (BBS 2013).

The study was undertaken in Mymensingh Strategic Development Planning (MSDP), 2011–2031 master plan project boundary (Fig. 1) since that region is ascribed as one of the best places for living and schooling in Bangladesh (UDD 2014). The MSDP area incorporated one municipality, two fringe areas with strong urbanizing character and eight predominantly rural localities (UDD 2011) under Mymensingh District (see Table 1), having in total the area of around 296 square kilometer; 0.68 million population and 0.15 million households (BBS 2012; UDD 2014). Municipalities are designated urban lands (BBS 2012) considered as urban and it’s urbanizing fringe areas were classified here as peri-urban. Majority of people in the study area were involved in business activities. Income and expenditure were higher in urban than rural, but land ownership status among households was higher in rural than urban area. Overall, rickshaw and battery-powered three-wheelers were dominant means of local transportation.

3 Determinants of health

“Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO 2014). However, at individual level, healthiness is commonly understood from the conventional medical perspective and it refers to the state of a body or a mind free from diseases (Boruchovitch & Mednick 2002). Until now, none of those definitions has come into absolute consensus to be accepted universally and many other concepts are evolving (Amzat & Razum 2014).

Table 1 Basic information of the study area

Locality name*	Community type ⁺	Land area ⁺ (sq.km)	Household ⁺ (#)	Population ⁺ (#)
Mymensingh Municipality	Urban	21.5	54 869	258 040
Akua union ¹	Peri-urban	14.3	10 738	51 686
Baera (Kewatkhali) union	Peri-urban	12.8	5 469	25 851
Bhabkhali union	Rural	31.4	10 748	48 937
Bhangnamari union	Rural	27.6	5 546	25 465
Char Ishwardia union	Rural	29.8	10 676	50 044
Char Nilakshmia union	Rural	31.2	9 140	41 956
Dapunia union	Rural	29.4	10 073	45 559
Ghagra union	Rural	33.4	11 462	50 890
Khagdahar union	Rural	34.3	9 790	44 593
Sirta union	Rural	29.8	7 954	36 962
Total		295.5	146 465	679 983

Source: *Survey report (UDD 2014), ⁺Inception report (UDD 2011); ¹Union is a local government’s administrative unit under Upazila, which is also a sub-division of District

Not only health care but also many other factors including biological, behavioral, social and economic conditions have effects on health of individuals and populations (Durch et al. 1999). Furthermore, health is determined by the circumstances and environment (WHO 2017), which are often interactive and beyond an individual's control (Department of Health 2009). The most cited factors (WHO 2017; Sundmacher et al. 2011; Bambra et al. 2010; Department of Health 2009) that affect human health are the followings:

- Income and social status: Higher income and social status are linked to better health. On the contrary, lower income and social status negatively affects health by reducing resilience and increasing vulnerability to illness.
- Education: Education is one of the most significant determinants of health which regulates many other determinants e.g. income, social status, food habit and nutrition intake, awareness on environmental and living condition, etc. simultaneously.
- Employment: People in employment with good working conditions are healthier than others who are living with job insecurity, underemployment and precarious employment, informal employment, child labor, and forced labor situations (Benach et al. 2010).
- Physical environment: Access to safe water and clean air, healthy workplaces, safe houses, improved sanitation, roads and transportation all contribute to maintain good health. Individual/ community exposed to contaminated air, water, etc. are vulnerable to many chronic and communicable diseases. In a wider view, climate change and the associated weather extremes also have effects on health.
- Health facilities: Access to healthcare (both geographic and economic) and use behavior to those facilities/ services to prevent and treat diseases influence community health. However, such access and use of healthcare facilities often have less impact on maintaining a good health (WHO 2017).
- Personal behavior: Health is influenced largely by personal behaviors among which regular physical activity and healthy diet are highly beneficial. Conversely, unbalanced diet, insufficient exercise, alcohol or tobacco consumption, etc. increase risk of diseases.
- Social support networks: A strong and friendly social support network, which can be family,

friend(s), or community, is linked with better health. It helps making healthier behavior choices as well as to discuss and address social and economic issues.

- Culture: Customs, traditions, beliefs, behaviors, language, diet, emotions, attitudes, etc. are influenced by culture of the family and community that affects health.
- Genetics: This inborn factor plays a part in determining lifespan, healthiness and the likelihood of developing certain illnesses by inheritance.
- Gender: Sometimes women, at different ages, are exposed to and suffer from different diseases. Disparities in the forms of income, decision making right, food intake, work environment, access to health facilities, etc. are found responsible to worsen health conditions for women.

While ranking potential impact of those factors, income should be positioned first as it can enable individuals and families to get access to better amenities and living standards followed by education and employment of individuals in a community. The remaining factors except genetics can be understood of having similar impact on human health and thus healthiness. Genetics is an inborn situation and is hardly predictable and comparable to any other.

4 Methods

For community's comprehensive health assessment, there is no commonly accepted health metrics due to diverse needs, perspectives, and ever-changing complex relationships among different health determinants (Boothe et al. 2013). Nevertheless, a healthy community is comprised of strong community and organizations, healthy people and families, and a supportive physical environment (Lerman 2011). Therefore, this study has perceived healthiness as a product of good health, which is maintained by good physical, social, economic, environmental, and behavioral state/status. Moreover, to satisfy conventional perspective of healthiness, presence of common (non-genetic) illness types e.g. air and water borne diseases has been considered here. Thus, information on socioeconomic, physical environment, sickness, and personal behavior records of the targeted communities were aggregated. Notably, this study's unit of analysis is 'household' and individual information

of the member(s) was not collected and analyzed. As a result, healthiness assessment in terms of age, sex, and genetics are beyond scope of this study.

Originally, information on community were gathered through structured (socioeconomic) questionnaire survey that was performed on sampled households (HHs) by MSDP project during the last quarter of 2013 (UDD 2014). The MSDP adopted a spatially explicit (stratified) random sampling technique by which representative HH samples from each of existing urban, newly formed urban, peri-urban, and rural geographies were collected. This study gathered MSDP's 1397 HH-survey records in total (removed 2 nos. after checking) (UDD 2014) and re-classified those into HHs residing in urban (n=938), peri-urban (n=83), and rural (n=376) communities. Additionally, the study took data from household census survey conducted by Bangladesh Bureau of Statistics (BBS 2012). For general HH information, such as family size, gender, religion, literacy, employment, housing, etc., the study relied on census data as it comprehended every HHs' information from each locality. Information on natural environment and pollution in Mymensingh region were collected from reports and webpages accessed through Google search.

In line with conventional perspective, overall illness and disease manifestation scenarios were analyzed to ascertain healthiness of those communities. Moreover, their socioeconomic and environmental indicators were studied so that healthiness comparison could be made among urban, peri-urban and rural communities. Indicators were developed corresponding to each of the health determinants that would measure proportion of households in any community having access or contribution to those. Statistical analyses were performed in order to obtain findings for each indicator and then those were compared to get overall healthiness scenario of different communities. To build a combined healthiness index, an incremental score of 1, 2, or 3, which signifies quality of being poor, average, and good, respectively, was assigned to those determinants upon reviewing communities' relative dominance or performance. Finally, those assigned scores were averaged to get generalized healthiness quality of a community. Notably, here all those determinants were regarded to be of similar importance in regulating community's overall healthiness, despite their relative significance mentioned in section 3, as no such rank was apparent in scholarly literature. Later, determinants which scored 1 or 2 were identified as factors affecting corresponding community in achieving healthiness if compared with other communities in the same region. Scores ap-

plied in the index and the results drawn from it only signify a community's relative advancement vis-à-vis straggle in terms of healthiness, but not the degree to which one is ahead or behind of another. This study used Stata (v. 13) software for statistical analysis, ESRI ArcMap (v. 10.2) for mapping, and Microsoft Excel (v. 2013) for tabulation purposes.

5 Results

5.1 Status of health determinants

Socioeconomic status

In the study area, average family size was 4.5 persons (see details in Table 2). Around 86% of the total populations were Muslim in urban, and above 97% in other two areas. Ratio of male among total family members was dominant and highest in peri-urban followed by urban and rural area. Members above 7-years of age were largely (74%) literate in urban, but only 56% in peri-urban and 39% in rural area. Almost every HH in a rural area was found headed by male member. Overall, 24% of total populations were above 7-years of age and not-attending school, of which 40% were employed. That rate of employment was found almost similar in all three communities. Among occupations of the household-heads, majority were involved in business in that region. Fewer rural HH-heads were found engaged in service sector (employment type) in comparison to other two communities. Agriculture was identified as the second largest sector of employment in both rural and peri-urban area. A detailed overview on employment status by sector and community are shown in Fig. 2. Income difference between urban and non-urban was very high in the study area. Mean monthly income (Table 2) of urban HHs was above 21 000 Bangladeshi Taka (BDT, 1 BDT = USD \$0.013 as on 31-Dec-2013). HHs living in peri-urban and rural averagely earned around 9 800 BDT and 10 400 BDT per month respectively. Later, proportion of HHs was recorded under five different income groups by monthly income range shown in Table 3. The result revealed that around 65% in both peri-urban and rural HHs earned within 5–10 thousand BDT per month. In contrast, around 80% HHs in urban had month income over 10 000 BDT.

Physical environment

Households in urban area availed far better-quality roads and accessibility than both in peri-urban and rural areas. Average distance of urban HHs

Fig. 2 Occupation of HH-heads living in different geographic settings (NGO stands for non-government)

from main road was found 335 meters, which was above 630 meters for other two areas. Average width of access roads in urban was seven meters whereas they were only three meters wide in both peri-urban and rural areas. Top surface of those access roads was largely bituminous in urban (67%) and peri-urban (63%) but was rarely found (only 12%) in rural area. Another significant portion (26%) of those roads in urban were brick covered. Majority (81%) of roads in rural and 35% of that in peri-urban were earthen type. In terms of road quality, 94% of urban HHs were connected with good conditioned roads whereas this was only available to 60% HHs in peri-urban and 41% HHs in rural areas.

Piped water supply was available in urban area mainly and 50% of its HHs had access to that ser-

vice. Besides this, 40% of urban HHs were depending on tube-well water and 10% were collecting water from nearby river/ other sources for drinking purposes. Meanwhile, 10% of HHs in peri-urban areas had access to piped water supply whereas 88% depended on their own/ shared tube-wells. Rural HHs were completely (100%) dependent on tube-well water for drinking purpose. In terms of water sufficiency regardless of its collection sources, both urban and rural HHs were mostly (95%) satisfied but a significant portion (22%) of HHs in peri-urban expressed dissatisfaction. Quality of water was overall very good as only 4% urban, 2% peri-urban, and 1% rural HHs reported undrinkability of collected water. No further lab test was performed to ensure acclaimed water quality.

Table 2 Summary of socioeconomic indicators of the study area

Socioeconomic factor	Average in a community			Overall mean
	Urban	Peri-urban	Rural	
¹ Family size (person)	4.4	4.6	4.6	4.5
¹ Sex ratio [(male/female)*100]	105	106	99	103
¹ Religion: Islam	86%	98%	97%	94%
¹ Literacy (age>7)	74%	56%	39%	56%
¹ Not attending school (age>7)	14%	24%	33%	24%
¹ Employment (age>7 & not studying)	39%	41.40%	40.70%	40.40%
² Mean monthly income (BDT)	21,019	9,815	10,400	17,498
² Local resident by birth (HHs)	63%	90%	99%	84%

Source: ¹National database (BBS 2012); ²Survey report (UDD 2014)

Table 3 Income status of the respondents living in different settings

Income range/ month	Income group	Percentage of HH by community			Overall mean
		Urban	Peri-urban	Rural	
Below 5000	Poor	1%	4%	2%	1%
5000-10000	Moderate	19%	66%	63%	34%
10001-20000	Middle income	50%	29%	31%	44%
20001-30000	Upper-middle income	19%	1%	2%	13%
Above 30000	Rich	11%	0%	2%	8%
Total		100%	100%	100%	100%

Residential units or houses in urban were mostly built of concrete materials as opposed to that in peri-urban and rural areas. By separating roofing materials of houses into three dominant categories, it was found that 39% houses in urban were made of concrete/reinforced concrete cement (RCC); 41% of those used metal/iron sheet; and rest 20% were made of thatched materials. Thatched roofing type was dominant in both peri-urban and rural settings (Fig. 3a). Most of the buildings were single-storied in the study region, where only 12%, 5%, and 1% multi-storied houses were detected in urban, peri-urban, and rural area respectively (Fig. 3b).

Environmental pollution

Both air and water pollution, mainly originating from improper management of municipal solid and clinical wastes, was existent in that region. Open dumping near Shambhuganj Bridge across the Old Brahmaputra river (toward north of the municipality) was affecting urban area severely (LGED

2017; M. Islam 2017). Besides, odor from dustbins was identified during socioeconomic survey and 10% HHs living in urban reported about it. Dust in air was another pollution that was affecting urban and peri-urban population. Among those three communities, relatively cleaner air was found in rural parts.

Access to health facilities

Among available health facilities in the study area, government hospital, health complex, private clinic, and pharmacy were prominent. Average distance of those facilities from HHs of different communities was found to vary significantly. Since most of those facilities were urban-centered, rural HHs had to travel 7.5 kilometers (KM) on average to get to their nearest health facility. That average distance from peri-urban and urban HHs was 3.4 KM and 1.8 KM respectively. Pharmacies, sometimes accompanied by a doctor, were available within walking distance (0.6 to 1.6 KM) in the study area (see Fig. 4 for details). Village doctors were found

Fig. 3 Proportion of residential building/structure by (a) roof material types (BBS 2012) and (b) floor height/stories (calculated from MSDP data)

to make a minimal contribution to the health services available to rural people as those people rarely visited them. Ideally, medical centers like hospitals, clinics, doctor's chambers should be available within a travel distance of 20 minutes from community (Sundmacher et al. 2011) that this study undertook as benchmark to measure access to health facilities of different communities. Considering common local transportation available, that ideal distance should not exceed five kilometers for any community within the study area. Here, except rural, peri-urban and urban HHs were found living within the desirable distance (Fig. 4) from existing facilities. The study area was largely being facilitated by the only government hospital available there. Out of total HHs, 75% went to that hospital whereas only 10% and other 7% went to private clinics and MBBS doctors/practitioners respectively. The rate of admittance into government hospital was almost similar in all three communities except a little higher in urban setting. Few shares of urban, peri-urban, and rural HHs were found visiting private clinics, practitioner's chambers, and village doctors respectively for receiving medical assistances.

Cost of receiving medication through government hospital was comparatively lower than private medical facilities. Mean monthly HH's expenditure for health purposes was nearly 1 100 BDT in the study area (Table 4). Such expense was found highest amongst urban HHs and lowest in peri-urban area. Moreover, that expenditure was found directly proportionate with income of HHs in any community.

Table 4 Mean monthly household health expenditure among different income groups

Income group	Mean monthly expense (in BDT)			Overall mean BDT
	Urban	Peri-urban	Rural	
Poor	620	150	275	359
Moderate	658	410	510	555
Middle income	1 002	713	795	950
Upper-middle income	1 537	1 500	1 529	1 536
Rich	3 984	N/A	2 500	3 910
Overall mean (BDT)	1,346	501	641	1 104

Personal behavior

As a personal behavior leading to healthiness, the study looked into physical activity, in particular walking tendency, of HH members during their regular (e.g. work and education related) trips. Based on their modal choice behavior, it was found that nearly 37% of total trips in urban was made on foot, which was 26% and 41% among peri-urban and rural dwellers respectively. Parks and recreational spaces were inadequately and poorly available throughout the study area. Therefore, only 15% leisure seeking people reported visiting those regularly.

Social support network

Social support network varies by residential density, size of immigrants, family size, socioeconomic status, etc. of a community (Campos 1996). However, strength of that network is directly proportionate with family size only (and others are inversely proportionate). Here, gross population density per sq.km was found highest in urban (12 026 persons) followed by peri-urban (2 815 persons) and rural (1 390 persons) areas (calculated from Table 1). Ur-

Fig. 4 Mean distance of health facilities from HHs in the study area

ban areas had the smallest proportion of permanent HHs (residing since birth), smallest family size, and best socioeconomic status (see Table 2 and Table 3). These altogether point to a presence of a relatively weaker social support network in urban areas compared to the other two. Similarly, peri-urban areas were identified with weaker network because of higher residential density and size of immigrants than rural despite having same family size and similar socioeconomic status. Finally, it was concluded that rural community had maintained better social support network than peri-urban followed by urban community.

Cultural practices

Culture, religion, ethnicity, and race have profound relationship with both physical and mental health (Basu-Zharku 2011; Bhui 2010; Egede 2006). Majority of HHs in the study area were Muslims (religion of Islam) (see Table 2) and maintained common beliefs. Ethnic diversity was also insignificant in that region as below 1% non-Bengali (ethnicity) HHs were living in each of urban, peri-urban and rural areas (BBS 2012). Therefore, health disparity due to cultural practices was assumed insignificant in those communities.

5.2 Healthiness status and comparison

Conventional perspective

To comprehend community's healthiness from a conventional perspective, this study investigated on proportion of HHs none of whose members were fallen sick during past one year of the survey period. Evidently, a lower proportion of urban dwellers were reportedly sick at that time than other two communities (Fig. 5) and thus urban can be re-

garded as the healthiest community from conventional viewpoint.

Table 5 Portion of HHs reported prevalence (case summary) by disease type and category

Category of diseases	Disease type	Affected HHs by community		
		Urban	Peri-urban	Rural
Waterborne	Dysentery	8%	23%	34%
	Diarrhea	15%	29%	24%
	Skin-related	12%	17%	15%
	Jaundice	7%	8%	10%
	Others	8%	4%	5%
Airborne	Cold and Cough	77%	94%	88%
	Others	5%	5%	7%
Vector-borne	Mosquito-borne	9%	2%	16%
Other NCDs	Heart diseases	5%	5%	5%
	Diabetes	12%	7%	3%
	Others	14%	12%	13%

More specifically, around 13% urban HHs reported that they did not get sick absolutely during past one year of the survey (Fig. 6a). Sickness by income group revealed that all (100%) poor HHs got sick at least once during that period. Prevalence of sickness among HH members in all three communities had a gradual decline with an increase in income group (Fig. 6b). However, around 89% HHs in the study area, regardless of their income group, went through sickness during past one year of the survey period.

Both peri-urban and rural HHs largely (above 80%) suffered from waterborne diseases during past one year of the survey period (Table 5). Similarly, airborne diseases were dominant in those areas compared to urban. Cold and cough related sicknesses

Fig. 5 Overall percentage of HHs reported sickness by disease category

Fig. 6 Percentage of HHs by (a) community and (b) income group reported sickness of any family member during past one year from the day of survey

were identified as main airborne diseases prevailing in the study area.

Combined health index

Apart from initial findings, a healthiness assessment and comparison index has been developed using a set of common health determinants (see Table 6). In it, an incremental score of 1 to 3 was assigned to those determinants for each community based on findings described in Section 4.1.

Table 6 Generalized healthiness index of different communities

Health determinants	Obtained score			Highlights from most dominant community
	Urban	Peri-urban	Rural	
Income status	3	1	2	21,000/month in urban
Education	3	2	1	74% literate in urban
Employment	1	3	2	41.4% in peri-urban
Safe water	1	2	3	99% covered in rural
Clean air	1	2	3	Less pollution in rural
Safe houses	3	2	1	80% in urban
Roads	3	2	1	94% good in urban
Health services	3	2	1	Within 2 KM in urban
Walking behavior/trip	2	1	3	41% trips in rural
Social support networks	1	2	3	Best in rural
Cultural practice	3	3	3	Almost indifferent
Average score	2.2	2	2.1	Highest in urban setting

Finally, overall healthiness status was determined by mean obtained score of a community. This combined index-based healthiness assessment also resulted in a similar scenario to that obtained using a conventional perspective. In both assessments, peri-urban communities got the lowest position whereas urban topped keeping rural in between.

Vector-borne disease was less intensive throughout the Mymensingh region. Among all NCDs, diabetes was found in urban communities at a higher rate than in peri-urban and rural areas.

6 Discussion

Urban community was recognized as the healthiest one among all using both conventional and health-index based healthiness assessment approaches. Urban areas were found healthier despite its lower employment rate, lesser access to safe drinking water, poorer quality of natural environment, and weaker social support network than rural community. On the contrary, rural community was found healthier than peri-urban although peri-urban had higher literacy and employment rate, better housing and road conditions, and closer proximity to health services. Despite having higher employment rate, peri-urban people had lesser mean monthly income than that of other two communities. Here, exceptionally, rural HHs had better mean monthly income than those in peri-urban, largely resulting from business and agriculture related activities.

In this region, rural people, mostly being resident since birth, had better access to agricultural lands in comparison to peri-urban dwellers, a significant portion of whom migrated to there from other regions.

Peri-urban people were found to suffer from sicknesses more frequently whereas they actually could afford less to recover due to income constraint. Thus, income status can be regarded as one of the most influential factors affected peri-urban community to fall behind. Relatedly, there is a profound direct relationship between income and human health (CSDH 2008; Benzeval et al. 2001) that supports this argument of the study. Other reasons behind peri-urban's unhealthiness are also clear from the health index. It suggests that peri-urban people need to improve their personal (fitness) behavior to become healthier. Improved education, water supply, air quality, and road network system are also necessary for improving that community's healthiness.

Rural community's healthiness was found to be better than peri-urban but poorer than that of the urban community. Like peri-urban, rural area also lack improved education, housing, road network, and health infrastructures for which extensive development initiatives are necessary. Around 33% of total population of above 7 years of age were found not attending in school in rural community (see Table 2). In this case, higher literacy may help rural HHs improving their socioeconomic status leading to uplift overall healthiness of the community as education and health are in a strong interrelationship (Zimmerman et al. 2015). Specific interventions are essential to reduce that huge portion of non-school-attending rural children.

Apparently, similar scenario may exist in other regions of Bangladesh and this study's findings can be carried into framing future development priorities by policy makers and authorities to improve country's overarching development goal. However, it is to acknowledge that this empirical study's findings are not applicable to large capital and divisional cities as their growth patterns are significantly different from that of the studied region. Despite this, a broader message that this study conveys is to emphasize on minimizing income gap among different communities regardless of their spatial geographies. Furthermore, interventions specifically designed to educate out-of-school children can bring great success to ensure better health for the country's citizens.

As of limitations, firstly, this study was unsuccessful in collecting the MSDP's original sampling strategy and resultantly sample weights were not uti-

lized in the analyses. Therefore, the scenarios portrayed here could have overrepresented the actual one. Besides, this study relied on household level data that restrained doing member-specific analyses that might have exaggerated overall sickness status of the region. Again, this study did not consider age, sex, and genetics in the healthiness assessment. It also did not analyze relationships among different health indicators assessed here. Moreover, only walking was considered as health promoting personal behavior whereas it incorporates physical exercise, balanced food intake, smoking habit, and many other individual activities. Despite all those limitations, this study sets a pathway to assess healthiness of communities where those limitations can be overcome to achieve comprehensive outcome. Importantly, using the health index developed here, specific interventions required to improve community's healthiness and minimize gap among them can easily be identified.

7 Conclusion

To achieve inclusive and long-lasting health improvement, combined effort by many entities including primary care and public health providers are necessary. Community's healthiness assessment using a common set of health determinants can facilitate improvement efforts by creating a shared understanding of the factors affecting health (Boothe et al. 2013). On that ground, the methodology adopted in and findings disclosed by this study can be very useful. Here, healthiness was assessed through conventional medical approach as well as using the combined health index guided by a set of common health determinants. Looking into indifferent results of those assessments, the study confers that healthiness of a region and/or community can be perceived by analyzing its sickness status. However, it is necessary to study all above described health determinants to ascertain factors regulating community's healthiness. In this study's context, both rural and peri-urban communities need prioritized interventions by the government to improve school attendance and literacy rates. Expansion of health infrastructure is also necessary for rural parts of that region. Peri-urban area needs creating or supplying more employment offering better income. As potential future urban area, peri-urban entails planning for integrated development offering improved road access, better housing, safer water, and cleaner environment before haphazard growth takes place in that area. Municipal authority (for

urban area) should emphasize improving coverage and quality of piped-water supply and solid waste management system. A pedestrian friendly urban community having adequate parks and playgrounds can further improve its overall healthiness as has been identified by this study. Relevantly, future progress should come along developing explicit weights for the health determinants corresponding to their significance that will help in ascertaining the degree to which one community is ahead or behind of another in a region.

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