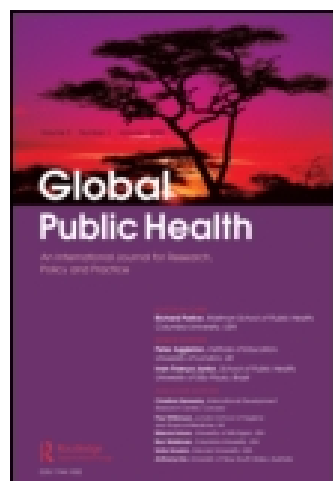




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Sources and prevalence of self-reported asthma diagnoses in adults in urban and rural settings of Bangladesh

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This study provides data on the sources of asthma diagnoses in the adult Bangladeshi population in urban and rural settings. The paper also reports the prevalence of self-reported asthma diagnoses and associated socio-demographic factors. A cross-sectional study was conducted in three communities: two rural settings and one urban setting, with a total sample size of 32,665 subjects. Pre-existing surveillance data provided individual socio-demographic factors. Provider categories were based on previous research describing provider plurality in Bangladesh. Descriptive statistics, univariate regression and multivariate regression analyses were performed. Bachelor of Medicine, Bachelor of Surgery (MBBS) generalists provided the largest proportion of diagnoses in both urban (54.6%) and rural (42.4%) sites. The largest proportion of non-MBBS-trained healthcare workers providing diagnoses of asthma was spiritual healers (13.3%) in the urban settings and village doctors (42.4%) in rural settings. The overall prevalence of self-reported asthma diagnoses was 5.0% in the urban population and 3.5% in the rural population. The results highlight the importance of non-MBBS doctors in serving the healthcare needs of the Bangladeshi population. This study reveals a higher prevalence of self-reported asthma diagnoses in the urban setting than in rural ones, which is consistent with international literature on the topic.

Keywords: asthma; sources of diagnosis; non-allopathic; healthcare-seeking behaviour; prevalence

Introduction

In adults aged above 30 years, chronic diseases account for 72% of the global disease burden and were accountable for 60% of deaths worldwide in 2005 (Yach *et al.* 2004). An estimated 300 million children and adults currently have asthma (Braman 2006), resulting in a worldwide loss of an estimated 15 million Disability Adjusted Life-Years per year, which is approximately equivalent to those attributable to other chronic diseases such as diabetes (Masoli *et al.* 2004).

The International Study of Asthma and Allergies in Childhood has revealed a trend of increasing asthma prevalence in developing countries as such countries adopt more Western lifestyles and become more urbanised (Beasley *et al.* 2000), a trend also supported by the results of individual country-specific studies. For

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example, a study in Ghana found an approximate doubling over a 10-year period of the prevalence of exercise-induced bronchospasm in schoolchildren (Addo-Yobo *et al.* 2007). A recent study in Peru has also shown increased prevalence of asthma in urban and peri-urban areas as compared to populations in rural villages (Robinson *et al.* 2011).

Overall, the World Health Survey found that low-income countries with high-income inequality reported the highest prevalence of current wheezing symptoms (Sembajwe *et al.* 2010). The increasing prevalence of asthma in low-income countries is significant because the burden of disease tends to be greater in areas that lack the infrastructure and supportive care to properly manage asthma attacks (Cesaroni *et al.* 2003). There are many factors thought to be linked to variations of asthma prevalence within a population, including medication use, air pollution, environmental allergens and socio-demographic characteristics such as income inequality and educational level (Masoli *et al.* 2004, Lai *et al.* 2009, Wijesinghe *et al.* 2009, Sembajwe *et al.* 2010).

In Bangladesh, asthma, or Hapani, is perceived as one of the most serious diseases in adults and elderly (Sharmin *et al.* 2009). However, only two major asthma prevalence studies have been published in Bangladesh. The earliest study, conducted in 1997, found a prevalence of asthma of 11.8% in Bangladeshi children in the coastal region (Kabir 1999). The more recent National Asthma Prevalence Study (Hassan *et al.* 2002), which collected data in 1999, reported an overall asthma prevalence of 6.9% and found no statistically significant differences between metropolitan, urban and rural areas after adjusting for age.

Despite the significance of asthma to global health and to ordinary Bangladeshis, there is little data on asthma in Bangladesh collected over the last 10 years. Our study describes self-reported healthcare provider-diagnosed asthma prevalence, type of diagnosing provider and associated risk factors within the asthmatic population.

Methods

Study sites

The study population was obtained from sites included in the Health Demographic Surveillance System (HDSS) run by the International Center for Diarrheal Disease Research, Bangladesh (ICDDR, B). Two rural sites, Abhoynagar (south-western Bangladesh) and Mirsarai (south-eastern Bangladesh), had study populations of 34,791 and 39,107, respectively. One urban site in Kamalapur (south-eastern Dhaka) had a study population of 32,441. Ethical clearance for surveillance site activities was obtained from the ICDDR, B review board.

Study and population characteristics

This cross-sectional survey collected respondent data for a sampling time period of 2 months at each site; the first study site began in January 2009 and the last site finished in December 2009. The study population was limited to men and women aged above 25 years residing in a HDSS surveillance area. Information was collected during daytime household visits; only those present for the interview were included. Rural sites have been part of the well-established HDSS for many years and data

were collected during regular surveillance rounds. The urban site was established in 2009 and data were collected after an initial HDSS census. The sampling method did not differ between the rural and urban sites. The maximum number of surveillance households that the HDSS surveillance teams could survey in a two-month period determined the study population size (32,665).

Pre-existing surveillance data provided individual socio-demographic factors. The household-based poverty quintile was used as a proxy for socio-economic status of the respondents. Poverty quintiles were based on household assets (mobile phone, furniture, vehicle, appliances, etc.) and housing characteristics (construction materials, energy used for cooking, ownership of household assets, income, etc.). Variable reduction techniques combined assets and household characteristics into a single asset variable. Further details have been published elsewhere (Razzaque *et al.* 2007). After ranking this variable from low to high, households were divided into five equally sized poverty quintiles. The poorest group of people was defined as being in the lowest asset quintile. This procedure was repeated for each site; household stratification did not account for possible poverty/wealth differences between sites.

Pack year history for smokers was calculated as number of packs per day per year. Smokeless tobacco was quantified by frequency of use. Physical activity was measured as insufficient or sufficient. We used the Brief Physical Activity Assessment Tool, validated by Marshall *et al.* (2005), which constructs one indicator using questions regarding moderate and vigorous physical activity. The only change to the instrument was to provide examples that would fit the cultural context. For example, instead of mentioning sports activities like tennis or football as benchmarks to classify the physical activity, we used daily household- and work-related activities that require similar energy use or activity level as the examples included in the original instrument.

Trained research assistants conducted the interviews in Bengali using a two-part questionnaire on chronic disease lifestyle risk factors and management. Asthma status was self-reported. Respondents were asked whether they had ever been diagnosed with asthma. They were then asked who had diagnosed them most recently. Providers were categorised into two main groups: qualified allopathic practitioners and alternative private practitioners. Qualified allopathic practitioners include Bachelor of Medicine, Bachelor of Surgery (MBBS) generalists, MBBS specialists, nurses, health workers and paramedics. The sub-categories of alternative private practitioners include:

- Village doctors: informal healthcare providers who practice allopathic medicine.
- Drug sellers: supply allopathic or alternative medicines but have not been formally trained to diagnose disease or prescribe medicines.
- Kabiraj/spiritual healers: Kabiraj practice an ayurvedic system of medicine that commonly involves diet, exercise and herbs. Spiritual healers most often make use of chants or sacred readings to treat illnesses.
- Homeopaths: follow a homeopathic system of medicine, involving treatment through small quantities of the presumed cause of disease.

These categories of providers were selected and defined based on previous research describing provider plurality in Bangladesh (World Bank 2003). Data were not

collected on self-reported asthma symptoms or asthma treatments prescribed by healthcare practitioners.

Descriptive statistics, univariate regression and multivariate regression analyses were performed on the study population. Crude and adjusted odds ratios (ORs) were portrayed based on presentation of previous asthma research. ORs compared asthmatics with non-asthmatics across a wide spectrum of risk factors. ORs were adjusted for the other entries in the model. Weighting the study population to match the relative age–sex distribution of the population surveillance sites adjusted for selection bias. Version 8 of the Statistical Analysis Software (SAS) from the SAS Institute (Cary, NC, USA) was used to perform the analysis.

Results

We interviewed a total of 32,665 subjects: 11,593 from Abhoynagar and 11,994 from Mirsarai in the rural areas and 9078 from Kamalapur in urban Dhaka. Overall, a higher prevalence of asthma was reported in the urban population than in the rural population (5.0% vs. 3.5%). The mean age of the urban population under study was 39.8 compared to a mean of 44.5 years in the rural sample. The urban population also had a higher percentage of men than the population in rural areas. In both settings, the mean age of asthmatics was higher than that of the general population. Overall, prevalence of asthma diagnoses was 4.0% among men and 3.9% among women. People in urban settings achieved a higher level of education overall than people in rural settings. The majority of the population reported being non-smokers and never chewing tobacco or betelnut. In both urban and rural areas, a greater percentage of people diagnosed with asthma reported previously being smokers than the general population. A higher percentage of people diagnosed with asthma reported insufficient physical activity than the general population. Insufficient physical activity levels were more common for both asthmatics and non-asthmatics in urban settings as compared to rural ones (Table 1).

In rural areas, MBBS generalists and village doctors each provided 42.4% of diagnoses. MBBS specialists were the next most prominent group, providing 4.9% of diagnoses. In urban areas, MBBS generalists provided the majority of diagnoses (54.6%), whereas MBBS specialists provided the second most (16.5%). However, this percentage was almost equalled by the number of diagnoses provided by spiritual healers (13.3%; Table 2).

People in the urban areas are 62% more likely to suffer from/report asthma compared to people living in rural settings (Table 3).

Increasing age was significantly associated with reported asthma diagnoses in both settings. This effect was more pronounced in rural settings: people aged 65 years and above had 4.43 (95% CI: 3.34–5.86) times higher odds of having asthma than 25 to 35-year-old people, whereas in the urban population, the OR was 2.28 (95% CI: 1.47–3.53). Neither the urban nor the rural population showed any significant association between gender, education or asset quintile and the prevalence of asthma diagnoses (Table 4).

The reported smoking habits in urban and rural populations were similar. Previous smoking was significantly associated with asthma diagnoses in both populations with an OR of 1.70 in urban areas (95% CI: 1.19–2.42) and of 1.94 in rural areas (95% CI: 1.51–2.49). No significant associations were found between

Table 1. Sample and asthmatic socio-demographic characteristics.

Variables	Urban		Rural	
	Total, <i>n</i> (%)	Asthmatics, <i>n</i> (%)	Total, <i>n</i> (%)	Asthmatics, <i>n</i> (%)
Sample size (weighted)	9078	453 (5.0)	23,587	831 (3.5)
Age groups, mean (SD)	39.8 (11.9)	43.7 (13.8)	44.5 (14.4)	54.7 (15.3)
25–34	3742 (41.2)	142 (31.3)	7101 (30.1)	107 (12.9)
35–44	2577 (28.4)	124 (27.3)	6065 (25.7)	127 (15.2)
45–54	1675 (18.5)	90 (19.8)	4823 (20.5)	179 (21.5)
55–64	753 (8.3)	62 (13.7)	2950 (12.5)	172 (20.7)
65+	330 (3.6)	36 (7.9)	2644 (11.2)	247 (29.7)
Gender (male)	4817 (53.1)	242 (53.4)	11,395 (48.3)	406 (48.9)
Education				
No education	2760 (30.4)	142 (31.4)	9898 (42.0)	396 (47.7)
Primary (1–5)	1701 (18.7)	82 (18.0)	6228 (26.4)	229 (27.6)
Secondary (6–10)	2660 (29.3)	140 (31.0)	6144 (26.1)	173 (20.8)
Higher (11+)	1957 (21.6)	89 (19.7)	1317 (5.6)	33 (3.9)
Asset quintiles				
Poorest	1405 (15.5)	63 (13.8)	3793 (16.3)	119 (14.4)
Poorer	1571 (17.3)	77 (16.9)	4168 (17.9)	142 (17.3)
Middle	1658 (18.3)	83 (18.3)	4717 (20.2)	159 (19.3)
Less poor	1946 (21.4)	94 (20.7)	5107 (21.9)	179 (21.8)
Least poor	2498 (27.5)	137 (30.3)	5538 (23.8)	224 (27.2)
Smoking history				
No smoking	6394 (70.6)	338 (74.7)	17,515 (74.8)	666 (80.6)
Less than 1 pack year	101 (1.1)	1 (0.3)	223 (1.0)	6 (0.7)
1–14 pack year	1337 (14.8)	54 (12.0)	2523 (10.8)	46 (5.6)
15+ pack year	1227 (13.5)	59 (13.0)	3170 (13.5)	108 (13.1)
Previously smoked	709 (7.8)	67 (14.8)	1646 (7.0)	156 (18.8)
Tobacco and betelnut chewing history				
Never chewed	6956 (76.6)	309 (68.3)	18,076 (76.6)	561 (67.5)
Currently chewing	1806 (19.9)	115 (25.3)	5000 (21.2)	230 (27.7)
Previously chewing	315 (3.5)	29 (6.4)	510 (2.2)	40 (4.8)
Chewing load (SD)	1.2 (8.0)	2.0 (10.9)	1.0 (6.9)	0.8 (6.4)
Physical activity				
Insufficient physical activity	4032 (44.4)	231 (51.0)	4971 (21.1)	325 (39.2)

tobacco or betelnut chewing and asthma prevalence. Insufficient physical activity was significantly associated with asthma diagnoses in rural areas (OR 1.45, 95% CI: 1.23–1.72) and the trend was also seen in urban areas (OR 1.22, 95% CI: 0.99–1.50; Table 4).

Discussion

MBBS doctors provided a majority of diagnoses in urban and rural settings. Non-allopathic practitioners (NAPs) played a relatively major role in the urban

Table 2. Providers of diagnoses in urban and rural settings.

Providers of diagnoses	Urban asthmatics, <i>n</i> (%)	Rural asthmatics, <i>n</i> (%)
MBBS generalist	247 (54.6)	352 (42.4)
MBBS specialist	75 (16.5)	41 (4.9)
Nurses	0 (0.0)	1 (0.1)
Health workers	2 (0.4)	1 (0.1)
Paramedics	4 (0.9)	18 (2.2)
Village doctors	13 (2.8)	352 (42.4)
Drug sellers	29 (6.5)	20 (2.4)
Kabiraj/spiritual healers	60 (13.3)	19 (2.3)
Homeopaths	23 (5.0)	27 (3.2)

setting only, whereas village doctors played a significant role in rural settings only. The reliance on NAPs in cities and village doctors in rural settings may reflect the local availability of care providers. People may seek out the services of NAPs after treatment by MBBS doctors is deemed ineffective or unaffordable.

It is interesting to note that amongst chronic diseases under study by the ICDDR, B, asthma is the only condition for which NAPs provided a substantial proportion of the diagnoses (Parr *et al.* 2011). A previous study in Bangladesh reported beliefs that attribute asthma to a supernatural aetiology (Stewart *et al.* 1994), which may contribute to patients' propensity to seek care from NAPs for this condition but not other chronic diseases. A further study of parental beliefs on asthma in an outpatient clinic in India revealed that 14% of parents attributed asthma to supernatural influences and 16% of parents thought 'God men' could treat asthma (Lal *et al.* 1995). As the study by Lal *et al.* was conducted in a hospital setting, these numbers likely underestimate the prevalence of these beliefs in the population as a whole. Although asthma prevalence and care-seeking behaviour are not uniform across all populations and cultures, our results indicate the general importance of including healthcare practitioners other than MBBS doctors in evaluations of burden of disease and understanding care-seeking behaviour in designing healthcare interventions.

The interaction between providers and patients among the major groups under study may also have an important role in explaining these results. In urban settings, patients are likely to seek further care to manage asthma if they are unsatisfied with the quality of disease management or of their interaction with an MBBS doctor, which is consistent with the large percentage of urban asthma patients seeking care from NAPs (Bangladesh Health Watch 2008, Mahmood *et al.* 2009, Sharmin *et al.* 2009).

We found that the adult population of Bangladesh has an average self-reported asthma diagnosis prevalence rate of 3.9% overall; 5.0% in urban settings and 3.5% in

Table 3. Multivariate analysis comparing urban and rural asthma prevalence.

Locality	Total <i>N</i>	Asthmatic (%)	Multivariate OR (CI)
Rural (reference)	23,587	3.5	
Urban	9078	5.0	1.62 (1.43–1.85)

Table 4. Multivariate analysis of selected risk factors and asthma among adult Bangladeshis.

Variables	Total <i>N</i>	Asthmatic (%)	Multivariate OR (CI)	
			Urban	Rural
Age groups, years				
25–34	10,843	2.3		
35–44	8642	2.1	1.24 (0.96–1.61)	1.37 (1.05–1.79)
45–54	6498	4.1	1.33 (0.99–1.78)	2.26 (1.74–2.93)
55–64	3703	6.3	1.89 (1.34–2.68)	3.27 (2.49–4.29)
65+	2974	9.5	2.28 (1.47–3.53)	4.43 (3.34–5.86)
Gender				
Female	16,453	3.9		
Male	16,212	4.0	0.89 (0.67–1.18)	0.94 (0.76–1.17)
Education				
No education				
Primary	12,658	4.2		
Secondary	7929	3.9	1.08 (0.81–1.45)	1.13 (0.95–1.36)
Higher (11+)	8804	3.6	1.22 (0.91–1.63)	0.98 (0.79–1.21)
	3274	3.8	0.89 (0.69–1.42)	0.94 (0.63–1.41)
Asset quintile				
Most poor	5198	3.5		
More poor	5739	3.8	1.06 (0.75–1.51)	1.11 (0.86–1.43)
Poor	6375	3.8	1.05 (0.74–1.49)	1.04 (0.80–1.33)
Less poor	7054	3.9	0.99 (0.68–1.44)	1.03 (0.80–1.33)
Least poor	8036	4.5	1.07 (0.73–1.57)	1.14 (0.88–1.47)
Smoking history				
No smoking	23,909	4.2		
Less than 1 pack year	324	2.3	0.34 (0.06–1.84)	1.34 (0.58–3.06)
1–14 pack year	3861	2.6	0.94 (0.65–1.34)	0.72 (0.51–1.02)
15+ pack year	4397	3.8	0.88 (0.60–1.30)	0.97 (0.73–1.30)
Previously smoked	2355	9.5	1.70 (1.19–2.42)	1.94 (1.51–2.49)
Smokeless tobacco				
Never chewed	25,032	3.5		
Currently chewing	6806	5.1	1.14 (0.88–1.48)	1.06 (0.89–1.26)
Previously chewed	825	8.3	1.48 (0.97–2.26)	1.18 (0.83–1.69)
Physical activity				
Insufficient	9003	6.1	1.22 (0.99–1.50)	1.45 (1.23–1.72)

rural settings. In comparison, previous research on asthma prevalence in Bangladesh reported a higher prevalence of doctor-diagnosed asthma in a low-pollution setting in coastal Bangladesh than in the capital city, Dhaka (Hassan *et al.* 2005). Our finding that there is a higher prevalence of reported asthma diagnoses in urban settings is consistent with the international literature on urban–rural differences in asthma prevalence in other countries as well (Niekerk *et al.* 1979, Keeley *et al.* 1991, Yemaneberhan *et al.* 1997, Litonja *et al.* 1999, Hijazi *et al.* 2000). The discrepancy in results may be due to the inclusion of NAPs as sources of asthma diagnoses in our study as the previous study included only allopathic practitioners (both qualified and

unqualified) as sources of diagnosis. Also, the study by Hassan *et al.* 2005 did not include adults aged above 44 years and included children aged above 5 years, whereas the current study reported doctor-diagnosed asthma for all adults aged above 25 years. Alternatively, increased urbanisation in Bangladesh and environmental changes in pollutants or allergens may have shifted the distribution of asthma prevalence within the population. Indoor and outdoor environmental pollutants such as vehicle exhaust (Trasande and Thurston 2005) and combustion of materials for cooking (Ostro *et al.* 1994) are factors that can exacerbate asthma symptoms and may be linked with increasing number of diagnosed cases of asthma. Furthermore, Zaman found that early childhood respiratory infections are correlated with prevalence of asthma (Zaman *et al.* 2007) and it is possible that the prevalence of such infections in urban versus rural environments has shifted since the previous studies were completed.

We found a significant association between increased asthma prevalence and previous smoking as well as increasing age in rural and urban areas. Studies suggest that smoking can exacerbate asthma symptoms in susceptible individuals, leading them to cease smoking even prior to a formal diagnosis of asthma (Troisi *et al.* 1995, Piipari *et al.* 2004). However, it is also likely that the association between asthma and age as well as previous smoking may be attributable to the misdiagnosis of chronic obstructive pulmonary disease (COPD) as asthma (Godtfredsen *et al.* 2001, Tinkelman *et al.* 2006). Finally, the association we found between asthma and insufficient physical activity may in turn be attributable to the aggravation of asthma symptoms by exercise that predisposes asthmatics to inactivity (Glazebrook *et al.* 2006).

Neither the urban nor the rural population showed a significant association between education, asset quintile or household size and asthma prevalence. Previous studies have also suggested that differences in asthma prevalence are not due to socio-economic indicators such as income or education per se, but rather physical environmental factors – such as residence in urban areas – are responsible for increased risk of asthma in a population (Strachan *et al.* 1994, Aligne *et al.* 2000). This is consistent with our results demonstrating a significant difference in asthma prevalence based on location of residence but not on income or education level. However, our study did not collect information on severity of asthma or number of attacks, which may be correlated with socio-economic status indicators such as income and education (Mielck *et al.* 1996, Cesaroni *et al.* 2003) due to living conditions and medical treatment options available to groups of different socio-economic status. The most disadvantaged groups are likely to have the least access to quality medical care to manage existing cases of asthma and thus to suffer a disproportionately high burden of morbidity for this condition.

Our study methodology relied on the use of self-reported diagnoses as a means to identify asthma cases, which is likely to produce a smaller number of false-positive diagnoses. Self-reported diagnoses were used as an assessment tool rather than recall wheezing symptoms by survey participants to reduce the likelihood that conditions with similar symptoms to asthma – such as acute respiratory infections, emphysema or COPD – would be misidentified as asthma during the survey process (Tinkelman *et al.* 2006). However, there are some limitations associated with our study that should be acknowledged. The use of self-reported asthma diagnosis may be less sensitive than a questionnaire report of symptoms. Also, data for our analysis were obtained from a questionnaire designed for a larger study of non-communicable chronic diseases and the questionnaire design was not specifically made for asthma.

In particular, our study design does not have a mechanism to check for misdiagnosis of conditions with similar symptoms as asthma. The potential for misdiagnosis of COPD as asthma is of particular concern for older adults, and this may have contributed to the observed association between previous smoking and ‘asthma’ (Peña *et al.* 2000, Gibson *et al.* 2010). Specifically, untrained medical practitioners such as village doctors may be more likely to misidentify other conditions as asthma. Bias in surveying our study population could have been introduced due to the fact that data were collected during the day when men are typically at work, which may have excluded them from sampling. This bias was adjusted for, but alternative data collection strategies are needed within HDSS sites in order to gather data on health issues affecting working adults, particularly men.

Conclusion

Understanding the prevalence of asthma and current provider proportions is crucial to informing policy decisions for managing asthmatics in Bangladesh. These results indicate the need for future interventions to consider the role played by NAPs and village doctors in respiratory disease care. In addition, the study highlights the higher prevalence of self-reported asthma diagnoses in urban areas and identifies groups at risk for chronic pulmonary conditions, including the elderly, previous smokers and those with insufficient physical activity. Additional data on the severity of asthma and the management practices of people with this condition in Bangladesh would aid in the design of effective community-based solutions. To accomplish this, further research is needed to understand the impact of asthma morbidity and misdiagnosis across socio-demographic groups in Bangladesh.

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