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Original Article

Prevalence of rheumatic fever and rheumatic heart disease in Bangladeshi children



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ABSTRACT

Background: Recent prevalence data on rheumatic fever (RF) and rheumatic heart disease (RHD) are lacking in Bangladeshi population.

Aim: We have done this national level cross-sectional survey to determine the prevalence of RF and RHD in Bangladeshi children.

Methods: Samples were drawn from three out of seven divisions of Bangladesh from both urban and rural areas. Trained and experienced enumerators visited households to suspect cases of RF or RHD in 5–19 years children by asking structured questions on symptoms and signs of RF and RHD ($n = 56,827$). Then trained doctors again took history and examined them for RF/RHD. RF was defined according to the Modified Jones Criteria 1992. Doppler echocardiography was done to confirm the diagnosis in all suspected cases of RF/RHD.

Results: A total of 36 RF cases (new and old) and 16 Doppler echocardiography confirmed RHD cases were identified. Prevalence of RF and RHD was 0.9 per 1000 (95% confidence interval: 0.7–1.2) while prevalence of RF was 0.6 per 1000 (95% CI: 0.4–0.9) and RHD 0.3 per 1000 (95% CI: 0.2–0.5).

Conclusion: Observed prevalence of RF and RHD indicates that RF/RHD is disappearing from Bangladesh. However, studies using new technology of portable echocardiographic screening are needed.

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1. Introduction

Rheumatic heart disease (RHD) has become rare in developed countries but it is still considered to be a public health

problem among children and young adults in developing countries including Bangladesh.¹ Several studies in Bangladesh^{2–6} have reported prevalence of RHD but they differed in terms of sample and case definitions. Most of them were done in schools,^{3–5} one in rural community⁶ and one in

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mixed samples drawn from hospitals, community and work-sites.² Because of low enrollment and frequent absenteeism, the school-based studies are unlikely to accurately reflect the RHD burden in Bangladesh. The last community based study, having a potential of true prevalence for Bangladesh (1.3 per 1000 children), was done more than two decades ago.⁶

A study from the National Center for Control of Rheumatic Fever and Heart Diseases (NCCRFHD) has reported that rheumatic fever (RF) commonly happens in 5–22 years age group in Bangladesh contrary to the previous belief that RF occurs usually in 5–15 years age group.⁷ Therefore studies, which include children, adolescent and young adults, are required to understand the exact burden of RF & RHD in this population. To assess and further strengthen the RF & RHD control programme, the disease burden from community at large is required. We conducted a cross sectional population-based study in rural and urban areas of Bangladesh to determine the prevalence of RF and RHD.

2. Methods

2.1. Settings and sampling techniques

Bangladesh has seven administrative divisions (Dhaka, Chittagong, Rajshahi, Rangpur, Barisal, Sylhet and Khulna). One in ten Bangladeshi people live in Dhaka city. Therefore we selected purposively one urban area in Dhaka city and two rural areas, one each from Rajshahi and Chittagong divisions. A cross sectional survey was done simultaneously in all selected areas in July–December 2005 using a standardized common protocol. All children and adolescents aged 5–19 years (hereinafter referred to children) of the study areas were targeted. Children were recruited at their households, which were first listed by trained enumerators.

In the Dhaka division, the study was done in Mohamadpur area of Dhaka City. This is a densely populated residential area inhabited by people of all income groups. This area is divided into seven wards. Approximately five percent of households from all wards were selected consecutively beginning from house number one of each ward to recruit 9000 children. However 7863 children (response rate 87%) could be recruited. In Chittagong division, the survey was done in three unions of Matlab North upazila (sub-district) of Chandpur district. This is a classical rural area and people are mainly dependant on their agricultural incomes. A total of 14,764 children out of targeted 15,000 consecutive children (response: 98%) could be recruited. In Rajshahi division, the survey was done in five unions of Dinajpur Sadar upazila having some degree of urbanization. A total of 34,200 children out of targeted 36,000 (response: 95%) could be recruited. In total 56,827 children (95%) out of targeted 60,000 participated. Surveys were done by four partner organizations (NCCRFHD, Ekhlaspur Center of Health (ECOH), Zia Heart Foundation (ZHF) and National Heart Foundation (NHF)).

2.2. Training of field team

All enumerators were health assistants working for NCCRFHD, ECOH and ZHF. They had experience in conducting health

surveys in the past also. They were trained in Dhaka on the administration of the survey questionnaire. There were lecture sessions on signs/symptoms of RF/RHD. They were taken to the outpatient departments and cardiac wards to see for themselves cases of RF and RHD. A meticulous training was given in detecting normal and abnormal heart sounds in real situation. In addition, audio-visual aids were used to acquaint them with abnormal sounds. Emphasis was given to detect more false positives and avoid false negatives. All these trainings were attended by the research physicians also. One research physician was assigned for each divisional team of enumerators. A group of laboratory technicians were also trained centrally to aid diagnosis of RF and RHD. All investigators also remained present during all these training courses.

2.3. Screening of subjects

After obtaining consent from the household head, enumerators gathered demographic information from each household. If any households had anyone aged 5–19 year living at the time of visit, then they were interviewed and examined for common sign symptoms of RF or RHD. The subjects were identified as suspected RF or RHD if s/he had any of the following features in last six weeks: 1. sore throat, 2. arthralgia, 3. breathlessness, 4. leg swelling, 5. skin rash suggestive of erythema marginatum, 6. subcutaneous nodule, 7. abnormal physical movement (chorea), 8. abnormal heart sound on auscultation during the survey. (Although sore throat is not a symptom of RF, it was included for primary prevention of RF in the area.) Suspected cases were listed for examination by the survey doctor next day in the field at a convenient place. A random check of non-suspected subjects was also given by the survey physician to ensure that enumerators' suspicions are more than 100% sensitive. Enumerators also referred old cases of RF/RHD receiving prophylaxis from any physician for further evaluation by the survey physician. The physician then invited possible cases to the respective clinics (NCCRFHD in Dhaka, ECOH in Chittagong and ZHF in Rajshahi) for laboratory (anti-streptolysin O (ASO), erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) and echocardiographic evaluation. Updated Jones Criteria 1992⁸ were used to guide the diagnoses done by the survey physicians. These diagnoses were validated by one of us responsible for assigned area. In next phase Doppler echocardiography was carried out in all clinically diagnosed cases of RF/RHD in the echo lab of NCCRFHD (for Dhaka), NHF (for Chittagong) and ZHF (for Rajshahi). However, between-centre variations were not tested.

2.4. Data analyses

We entered the data in to a spreadsheet after thorough checking of the completeness of data. Residence (urban–rural) and sex specific prevalence of RF and/or RHD with their 95% confidence intervals were calculated.

3. Results

We report here prevalence of RF and RHD in 56,827 children aged 5–19 years having a fair representation of Bangladesh. A

little more than half of them (28,999) were males. This proportion of sexes was persistent across three study areas. About half of the parents of the participating children had above primary education. On an average subjects were 11 years old with a standard deviation of 5 years.

Doppler echocardiography was done in all suspected RF/RHD cases. Finally 36 RF and 16 RHD cases were confirmed. Arthritis and fever were the commonest manifestations of RF cases. All RHD cases had mitral valve lesions and only two had additional aortic and tricuspid valve lesions. Distribution was as follows: thickening of mitral valve leaflets, 6; mitral valve prolapse with regurgitation, 6; mitral regurgitation with stenosis, 1; mitral regurgitation with tricuspid regurgitation, 2; and combined mitral, aortic and tricuspid valve cusp thickening, 1.

At the beginning we checked area-specific prevalence to exclude heterogeneity. Prevalence of RF/RHD combined ranged from 0.6 in Dhaka though 0.9 in Rajshahi up to 1.0 in Chittagong per 1000 subjects. Prevalence of RF and RHD in Bangladeshi children (data combined) was 0.9 per 1000 children (Table 1) with a confidence interval ranging from 0.7 to 1.2. Prevalence in boys and girls in this sample (0.9 per 1000) was same. It was higher in rural area (1.0 per 1000) compared to urban area (0.6 per 1000). However this difference was not significant as indicated by their overlapping confidence intervals (Table 1).

4. Discussion

In this study we found that overall prevalence of RF and RHD Bangladesh was 0.9 per 1000 Bangladeshi children aged 5–19

Table 1 – Prevalence of RF and RHD per 1000 male and female subjects aged 5–19 years in Bangladesh.

	No. of cases	Prevalence per 1000	95% confidence interval	
<i>Gender</i>				
Female (n = 27,828)				
RF	18	0.6	0.4	1.0
RHD	7	0.3	0.1	0.5
RF & RHD	25	0.9	0.6	1.3
Male (n = 28,999)				
RF	18	0.6	0.4	1.0
RHD	9	0.3	0.1	0.6
RF & RHD	27	0.9	0.6	1.4
<i>Residence</i>				
Rural (n = 48,964)				
RF	34	0.7	0.5	1.1
RHD	13	0.3	0.1	0.8
RF & RHD	47	1.0	0.7	1.2
Urban (n = 7863)				
RF	2	0.2	0.03	0.9
RHD	3	0.4	0.07	1.1
RF & RHD	5	0.6	0.2	1.5
All (n = 56,827)				
RF	36	0.6	0.4	0.9
RHD	16	0.3	0.2	0.5
RF & RHD	52	0.9	0.7	1.2

RF indicates rheumatic fever; RHD, rheumatic heart disease.

years. We observed a lower prevalence of RF and RHD in the rural and urban communities of Bangladesh compared to those reported by studies done in '90s or before (Table 2). Although a direct comparison of the studies can not be done due to different methodology and survey setting, a comparison of the prevalence shows a decline in the prevalence of RF and RHD over three decades in Bangladeshi population. A hospital based study has shown that there has been consistent decline of newly diagnosed RF and RHD cases in NCCRFHD from 1991 to 1997.⁹ Analysis after this period indicates a further decline of RF/RHD to corroborate what has already been reported.

Our findings also conform to recent trends of RF and RHD in other South Asian countries. A review of studies on prevalence of RF and RHD in developing countries has shown a high prevalence of RF and RHD in the Pacific island countries with a lower prevalence in the Indian subcontinent.¹⁰ Indian studies (having children of similar background as Bangladeshi children) reported prevalence from 1.4 to 2.9 per 1,000.^{10,11} Therefore the low prevalence of RF and RHD observed in our study and the declining trend over several decades may reflect a true underlying trend of RF and RHD in this population.

There are several reasons for a decline in RF/RHD prevalence in our population. Poverty, sanitary condition and malnutrition are risk factors for RF. Over the last three decade substantial social and economic development in Bangladesh has occurred and indicators for human development have shown positive trends.¹² The overall improving sanitary condition might have caused lower throat infection in community. Also there is improvement in the awareness about RF and early treatment of sore throat by physician which might have contributed to the lowering of cases of RF & RHD. At the same time awareness about RF and its sequels i.e. heart disease is high in the population due to intensive campaign done by NCCRFHD. There is also easy access to physician and antibiotics for rural population and people seek early treatment for throat problem of children. Moreover recent observation suggested that the virulence of Group A beta hemolytic streptococci may have declined.⁹

4.1. Potential for under-reporting of burden

Although we have used experienced and trained enumerators for initial suspicion of cases, there is reason to believe that they may not be able to correctly suspect relevant signs or symptoms in a few instances. The NCCRFHD was established in 1980s and it has been working on increasing public awareness and providing health personnel training for the treatment of prevention of RF and RHD over three decades. In one of the rural areas (Matlab North) a clinic specialized for RF treatment has been operating for last four years. The activity of these centers might have also lowered the RF RHD disease burden in this community. All Bangladeshi studies used auscultation method to do the primary screening that makes them comparable among themselves. All of these studies were done before the introduction of portable echocardiography for mass screening.

RHD diagnosis has historically relied on cardiac auscultation. Auscultation can effectively be used by experienced

Table 2 – Prevalence of RF and RHD per 1000 reported by community/school studies in Bangladesh.

First author (Reference number)	Study year	No. of subjects	Setting	Age group, years	Prevalence/1000		
					RF	RHD	RF& RHD
Malik A. ^{2,a}	1976	7062	Hospital, community and factory	All		7.5	
Banoo H. ³	1987	4349	School, urban	4–17	43.9	5.1	48.9
Mahmud RS. ⁴	1989	5011	School, urban	5–18	0.9	2.8	3.6
Begum UHN ^{5,b}	1990	10,538	School, urban	5–15	2.4	0.2	2.6
Ahmed J. ⁶	1991	5923	Community, rural	5–15	1.2	1.3	2.5
Zaman MM (current study)	2005	56,827	Community, rural & urban	5–19	0.6	0.3	0.9

RF indicates rheumatic fever; RHD, rheumatic heart disease.
^a No mention about echocardiography.
^b Echocardiography not used.

clinicians. However in large scale studies it has been a difficult choice to employ experienced clinicians at field level. Ours is not an exception. Employing nurses was not a feasible option because number of nurses in Bangladesh was smaller than doctors in the survey year. The World Heart Federation has recently developed guidelines for echocardiographic diagnosis of RHD to address a full spectrum of RHD process.¹³ This has introduced an opportunity to include a large pool of subclinical patients without having clinical murmur. The evolution of portable echocardiographic equipment has changed the face of RHD screening over the past five years, with greatly increased sensitivity. However concerns have been raised about the specificity of echocardiography.¹⁴ Cost-effectiveness of such approach to RHD screening also poses a serious question, which is quite relevant to a country like Bangladesh. Early studies on short term follow-up suggest that two-third of asymptomatic individuals without a history of acute rheumatic fever and without clinical murmur are non-progressive and one-third of them revert to normal echocardiographic findings.^{15,16}

4.2. Limitation

The study was done nine years back. Although it may not reflect burden of RF/RHD for current years, so far there has not been any population-based studies after 90s. This study at least be very useful for trend analysis in future.

In conclusion, we would like to convey a message that prevalence of RF/RHD has declined compared to previous studies in Bangladesh. Studies using new technology of portable echocardiographic screening are needed. The comprehensive ongoing prevention programme should continue further to make RHD a history.

Observed prevalence of RF and RHD indicates that RF/RHD is decreasing in Bangladesh. However, studies using new technology of portable echocardiographic screening are needed.

Conflicts of interest

All authors have none to declare.

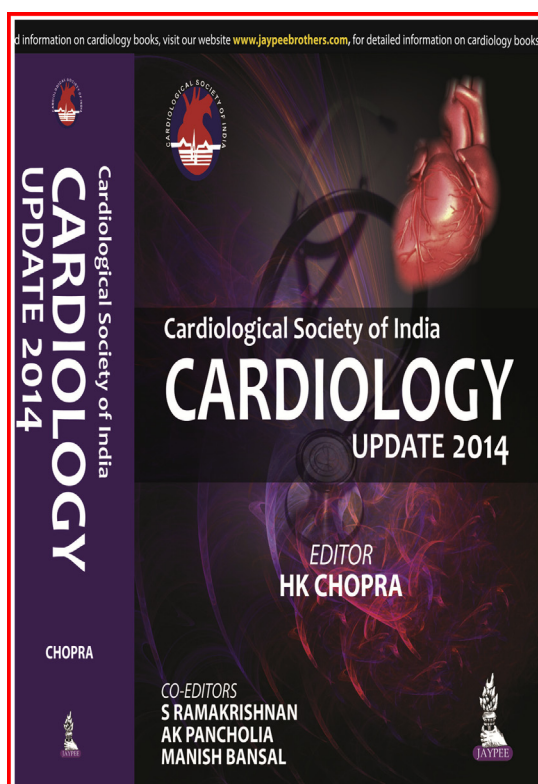
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REFERENCES

1. Rheumatic fever and Rheumatic Heart Disease. Report of a WHO Expert Consultation. Geneva: WHO; 2001. Technical Report Series 923.
2. Malik A. Congenital and acquired heart disease. *Bangladesh Med Res Counc Bull.* 1976;11:17–22.
3. Banoo H, Rahman S, Awal ARM, Azad AK, Syeed A. Prevalence of rheumatic fever and rheumatic heart disease in school children in Dhaka city. *Bangladesh Med Res Counc Bull.* 1987;13:92–100.
4. Mahmud RS, Hossain M, Mosud, et al. Prevalence of rheumatic fever and rheumatic heart disease in 5-18 years school children of Dhaka city—A study of 5011 children. *Chest Heart Bull.* 1992;16:15–21.
5. Begum UHN, Haque KMHSS, Hossain M, Amanullah M, Zafar A. Prevalence of rheumatic fever and rheumatic heart disease in the Dhaka city, Bangladesh. *Bangladesh Heart J.* 1994;9:4–8.
6. Ahmed J, Zaman MM, Hasan MMM. Prevalence of rheumatic fever and rheumatic heart disease in a rural population of Bangladesh. *Trop Doct.* 2005;35:160–161.
7. Zaman MM, Rouf MA, Haque S, et al. Does rheumatic fever occur usually between the ages of 5 and 15 years? *Int J Cardiol.* 1998;66:17–21.
8. American Heart Association. Guidelines for the diagnosis of rheumatic fever: Jones' criteria updated 1992. *Circulation.* 1993;87:303–307.
9. Zaman MM, Rouf MA, Haque S, et al. Declining trend of rheumatic fever observed in Bangladesh. *Trop Doct.* 2001;31:169–170.
10. Steer AC, Carapetis JR, Nolan TM, Shann F. Systematic review of rheumatic heart disease prevalence in children in

- developing countries: the role of environmental factors. *J Paediatr Child Health*. 2002;38:229–234.
11. Padmavati S. Rheumatic heart disease: prevalence and preventive measures in the Indian subcontinent. *Heart*. 2001;86:127.
 12. Human Development Report: United Nations Development Programme. http://hdr.undp.org/reports/global/2003/indicator/cty_f_BGD.html Accessed 29.04.06
 13. Reményi B, Wilson N, Steer A, et al. World Heart Federation criteria for echocardiographic diagnosis of rheumatic heart disease—an evidence-based guideline. *Nat Rev Cardiol*. 2012;9:297–309. <http://dx.doi.org/10.1038/nrcardio.2012.7>.
 14. Roberts K, Colquhoun S, Steer A, Reményi B, Carapetis J. Screening for rheumatic heart disease: current approaches and controversies. *Nat Rev Cardiol*. 2013;10:49–58. <http://dx.doi.org/10.1038/nrcardio.2012.157>.
 15. Zühlke L, Mayosi BM. Echocardiographic screening for subclinical rheumatic heart disease remains a research tool pending studies of impact on prognosis. *Curr Cardiol Rep*. 2013;15:343. <http://dx.doi.org/10.1007/s11886-012-0343-1>.
 16. Saxena A, Ramakrishnan S, Roy A, et al. Prevalence and outcome of subclinical rheumatic heart disease in India: the RHEUMATIC (Rheumatic Heart Echo Utilisation and Monitoring Actuarial Trends in Indian Children) study. *Heart*. 2011;97:2018–2022. <http://dx.doi.org/10.1136/heartjnl-2011-300792>.



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Book Review

Dr. Chopra:

I have read and perused *Cardiology Update 2014* from the Cardiological Society of India. It is a comprehensive and highly impressive work consisting of 184 chapters (160 contributors) covering virtually every aspect of cardiovascular care and those diseases relevant to cardiology practice in India. It is literally the “Braunwald” of India. My only suggestion for the next edition is for a comprehensive chapter on the diagnosis and management of hypertrophic cardiomyopathy, an increasingly important disease to Indian patients and physicians.

Dr. Barry J. Maron, MD