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PEDIATRIC INFECTIOUS DISEASES (I BROOK, SECTION EDITOR)

Impact of Socio-Economic Factors on Increased Risk and Progression of Rheumatic Heart Disease in Developing Nations

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Abstract

Purpose of Review Rheumatic heart disease (RHD) is a global health concern especially in low-income settings. Morbidity and mortality data from the World Health Organization (WHO) and global burden studies emphasizes on the prioritization of RHD on a global platform. Genetic, environmental, and socio-economic factors determine the sustainability and progression of RHD in various populations. In developing countries, low socioeconomic status (SES) is a vast and inevitable challenge in combating RHD. Concurrence between low SES and RHD has been well documented by several studies, but there is a paucity of data to understand comprehensive interdependency of low SES and RHD. In this review, we have made an attempt to present the overall correlation between SES and increased risk of RHD by examining and highlighting the role of key components of SES in different populations throughout the world as reported in literature.

Recent Findings In the recent past, developed countries have reported success stories regarding amelioration of RHD due to improved living conditions and better access to healthcare. Whereas, in low-income settings, various socio-economic parameters such as overcrowding, illiteracy, low monthly income, maternal employment, rural dwelling, and less access to good quality healthcare are the core challenges which significantly impose an increased risk of RHD.

Summary Overall, there is significant evidence which confirms the role of SES in increased risk and progression of RHD, but vigorous and systematic studies need to be done to evaluate the cumulative effect of SES. Also, it will be helpful in dissemination of efficient primary and secondary prevention of RHD. Additionally, another aspect of this review was to assess the plausible impact of low SES on the clinical spectrum of RHD which might characterize SES as an authoritative marker for disease progression and severity.

Keywords Rheumatic heart disease · Socioeconomic factors · Developing nations · Population screening

Introduction

Acute rheumatic fever (ARF) commences with group A streptococcus (GAS) infection and leads to pharyngitis [1, 2]. Long-term untreated ARF patients might further progress to rheumatic heart disease (RHD) which results in valvular heart damage. Carditis is one of the most severe manifestations of the ARF which causes valvular heart lesion and progresses towards chronic rheumatic heart disease in 30–45% of affected patients [3]. Statistical data shows presence of approximately 33,194,900 cases patients of RHD throughout the endemic countries and 221,600 cases in non-endemic countries [4]. RHD is one of the major acquired heart diseases in India with approximately 13.17 million RHD patients [4, 5] and imposes a great impact on overall disease burden. On contrary, the prevalence of ARF/RHD in India has been reported to be non-uniform and the data available solely depends upon the source of information e.g., Registrar General, population sources, and hospital admissions [5–7].

Socio-economic factors play an important role in pathophysiology of diseases. Socio-economic status (SES) of a person can be defined on the terms of education, employment status, housing type, and most importantly access to healthcare [8]. Worldwide 17.5 million deaths occur due to

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cardiovascular diseases, and out of which, 37% and 35% deaths occur in lower-middle income countries and in low-income countries (including India), respectively [8]. On the similar grounds, the pathophysiology of ARF and RHD is attributed to various risk aspects such as genetic predisposition and social and environmental factors. Although, a direct link between socio-economic factors and prevalence of RHD has not been established, a significant association between these two has been documented by a number of investigations [9–13, 14•, 15•]. Persistence of RHD in developing nations [16–18] and reemergence in some of the developed nations emphasizes on the role of socio-economic factors in sustainability of RHD. In this review, we have summarized the global perspective of low SES in entailing increased risk of RHD by discussing the various reports and research papers.

Socio-Economic Status and RHD

World

In early 1930s, Glover suggested significant role of SES in high prevalence of RHD in United Kingdom [19]. Globally, various studies have confirmed the significant association of SES and increased prevalence of RHD (Table 1). Many studies have reported high prevalence of RHD in these nations, but due to lack of high merit surveys, it is difficult to confirm the direct association of SES with high prevalence of disease.

In developing nations of Asia (India, Bangladesh, Pakistan, and Nepal), socio-economic factors play an important role in providing favorable conditions for the sustainability of RHD. In Nepal, a school-based cross-sectional study indicated that most of the affected children were attending government school as compared to non-RHD children which might explain the role of low SES in pathophysiology of RHD [27]. Additionally, in developing nations, people with low SES strive to maintain a healthy lifestyle which provides the basis for the link between low SES and ever-increasing clinical clutter of RHD in rural population. Recently, a hospital-based study performed in Nepal reported that majority of patients belonged to low (63.83%) and middle (34.47%) SES with 46.80% patients having mitral valve involvement and 33.62% patients with both mitral and aortic valve damage [28].

India

In India, first clinical evidence came from Punjab in 1935, and later on, Kutumbiah in 1940 reported rheumatism in children and adolescents [29, 30]. After these reports, a large number of hospital-based surveys were conducted and it was observed that RHD is highly prevalent in different populations of the country [5]. As per the recent data collected by Indian Council of Medical Research (ICMR) based on surveys done in various states of India, prevalence of RHD is 1.5–2/1000 in all age groups with 2.0 to 2.5 million patients of RHD within the country (ICMR Report 2000–2010). In Chandigarh, high prevalence of RHD has been associated with low socio-economic status of the people [31]. Similar study was conducted in Jammu and Kashmir, where prevalence of RHD was observed to be 5.09/1000. Same study reported predominance of RHD in poor housing conditions and overcrowding populations [32]. In Bikaner city of Western India, low prevalence of RHD was observed but increase in cardiac murmurs in children from low socio-economic status was predominant [33]. Overall, these studies conclude the role of low socioeconomic status in increased prevalence of RHD. Another study of school children from urban and rural areas of Shimla reported a decline in RHD during a span of 15 years due to improved socio-economic conditions and easy healthcare access [34]. Most recently, low SES has been reported to be associated with increased risk of RHD in Assam, India [35•].

Taken together, these studies demonstrate the association of SES with RHD in developing nations (Fig.1) and provide an insight for the prevention strategies and treatment intervention to control the menace created by increased prevalence of RHD in developing nations.

Table 1 Association of socio-economic parameters with RHD in different populations

Population	Parameters	Association with RHD	Ref
Yugoslavian	Overcrowding, illiteracy, and poor nutrition	Significant	[9]
Serbian	Mother's education and poor dwellings	Significant	[20]
Hawaiian	Low socio-economic status	Significant	[21]
Samoan	Rural background	Significant	[22]
Fijian	Maternal unemployment	Significant	[23]
Ugandan	Overcrowding, unemployment, and distance from public health centers	Significant	[24]
Pakistanis	Overcrowding, poor hygienic conditions, and illiteracy	Significant	[25]
Bangladeshis	Illiteracy, poor standard of living, and overcrowding	Significant	[26]
Nepalese	Lack of education and unemployment of parents	Significant	[27]

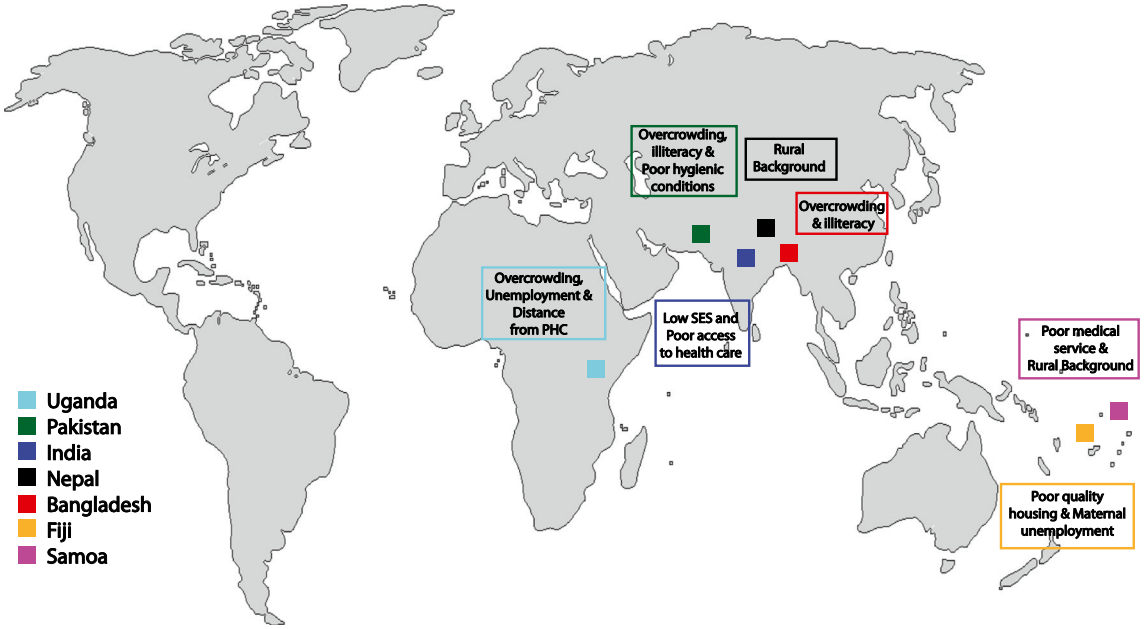

Fig. 1 Representative map showing various socio-economic factors associated with RHD in developing countries. (Map not to scale)

Significance of Various Socio-Economic Parameters Associated with RHD

In the previous sections, we have discussed the comprehensive documentation of the potential role of SES in RHD in different populations across the globe [26, 36–38]. These studies suggested predominance of some critical components of SES associated with considerably increased prevalence of RHD in developing nations. In this section, we have tried to illustrate the relative impact of each separate dimension of SES on increased risk and severity of RHD.

Education

Primary prevention of RHD can be efficiently incorporated by educating patients and their families about consequences of pharyngitis, significance of primary prophylaxis for RF, and strategies to control RHD. These parameters can easily be incorporated in educated population, whereas they are slightly compromised in illiterate or less educated population [39]. In case of children, lack of education of parents might lead to compromised healthcare quality and awareness about the treatment of the disease. Previously, we have observed a significant association between patient's education and increased risk of RHD but did not find any correlation with parent's education [35]. On the other hand, another aspect of education is lack of awareness regarding consequences of untreated rheumatic fever (RF) which might further lead to permanent valve damage among population. Few studies showed that increased awareness, clinical follow-up, and interactive sessions with school staff, parents, and other members of family can significantly decline the burden of RHD in low-middle income settings.

Monthly Income

Monthly income has been reported as a risk factor for RF/RHD [23] as it implies poor living conditions and limited access to healthcare facilities. On contrary, low income did not show any impact on increased risk of RF/RHD in RHD patients of Uganda [24] and the explanation was based on lack of information regarding actual income of patients and controls. In northeastern population of India, it has been reported that male RHD patients were engaged in low-income occupations and most of the female patients were housewives. Moreover, we found that families of RHD patients were having six or more members with only one or two earning members [35•]. On contrary, there is a study that reported large family size as a protective factor against RF/RHD [26] which might be due to there being multiple members to care for the sick, and may also be due to large families living in uncrowded conditions rather than overcrowded conditions. Collectively, both low monthly incomes of family and large family might impose a great impact in increased risk of RHD.

Poverty and Overcrowding

Many studies have reported no association of poverty with RHD [20], and overcrowding has been considered as a key socio-economic component associated with increased risk of RHD in many populations [40]. A negative association between overcrowding and RHD was observed in our study [35•]. In most of the families, two people were sharing a room, and, in some families, more than two people were sharing a single room, but ample size of the room might explain no impact of overcrowding on the disease.

Dwelling Location

Another important socio-economic parameter is dwelling location which plays a substantial role in health status of a population. We found that majority of the patients lived in rural areas as compared to control subjects and the difference reached statistical significance. In rural areas, lack of proper sanitation and living condition might contribute to increased risk of RF/RHD. Several studies have shown a high prevalence rate of RHD in rural areas of Pakistan [41], Bangladesh [32], Nepal [42], and in various states of India [40, 43–45]. We did not find significant association of RHD with housing type and type of fuel used for cooking [35•]. However, most of the female patients used wood for cooking but proper ventilation of the houses might have excluded the probability of contribution of smoke or congestion in increased risk of RF/RHD.

Healthcare Facilities

Access to healthcare facilities is one of the key factors in determining RHD risk and progression of disease. Distance between patient's house and public healthcare (PHC) facilities critically determines the actual picture of primary prophylaxis and quality of treatment received by patients. Also, private healthcare centers and physicians' nearby patient's house are generally not cost-effective. Such disparities in developing countries encourage compromised treatment which ultimately leads to progression of disease. Previously, studies have shown that distance of 5 km or less to healthcare center represents good category of healthcare access and facilitates better primary prevention of disease [46, 47]. Other studies have reported that the distance between dwelling location and health centers is a risk factor in RF/RHD [24]. In our experience, distance (in km) between residence of patients and nearest PHC center did not act as a risk factor as most of the patients reside in the vicinity of PHC [35•]. Although patients were having a better access to healthcare, many patients often missed injections which might be due to some other reasons such as lack of awareness of treatment, and interestingly, all the patients who had missed the treatment were from low SES.

Additionally, few studies indicated that RHD tends to be more common in females and reduced access to primary and secondary prevention has been raised as a key factor in developing nations [48]. On the other hand, a study of seven different regions of northeast India reported that, on an average, 0.3% of both males and females were diagnosed with RHD [49]. Similarly, in our study, we had found no significant difference in the prevalence rate of RHD in males and females [35•].

Association Between SES and Clinical Profile of RHD Patients

SES is a decisive determinant of health, and it has been reported that socio-economic and enivronmental factos play an important role in prediction of majority of cardiovascular disorders. Previously, it has been found that RHD is more prevalent in regions with low SES but no study has directly correlated clinical profile of RHD patients with SES of a population. In a study of Indian population, it was found that 80.7% and 90.9% cases of mitral and aortic valve thickening belonged to rural background [35•].

Another important clinical parameter associated with increased risk of RHD is oral hygiene as poor oral hygiene propagates streptococcal infection which leads to RF [50, 51] and which further progresses towards RHD. Also, significant association between lack of oral hygiene and low SES is well documented. [52, 53]. Previously, we have observed a high frequency of dental caries in RHD patients of Assam, northeast India, and interestingly, majority of patients having dental caries, missing tooth, and no knowlegdge of oral hygiene were from rural background. Additionally, it has been recommended by Amercian Heart Association (AHA) that lifetime risk of infective endocarditis can be diminished by maintaining good oral hygiene in all patients with chronic RHD [54]. Taken together, low SES can signicantly influence the clinical outcome of RHD.

Conclusion

Even though few studies have been conducted for the investigation of socio-economic factors having role in increased risk of RHD, significant correlations have been reported. Studies discussed in this review seem to clarify the impact of socio-economic risk factors in RHD patients of developing nations. In many studies, some parameters (e.g., cooking fuel, parent's education) did not reach statistical significance but an increasing trend towards RHD has been observed. Conclusively, this review suggests that the existing disease burden of RHD and its debilitating clinical scenario is more prevalent in low SES populations. Further detailed case-control-based investigations are required to determine the overall scenario of the disease in low SES population. Such studies will establish the substantial role of socio-economic factors in RHD patients across the globe which might be helpful in prevention and early interventional strategies to control RHD in low SES populations.

Compliance with Ethical Standards

Conflict of Interest Neha Sharma and Devinder Toor declare no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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