CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.4668569

Available online at: http://www.iajps.com *Research Article*

PREVALENCE, TREATMENT, AND COMPLICATIONS OF RHEUMATIC FEVER AMONG CHILDREN OF SAUDI ARABIA

Sameera Aljehani[1], Ghadi Ibrahim Munshi[2], Asmaa Ali Alzahrani[3], Kholood Bader Alotaibi[4], Ekram Abdulrahman Abukhashaba[5], Aziza Abdu Alzubaidi[6], Reham Hamed Alsaidlani[7], Hasnaa Jamaan Alzahrani[8]

[1]Consultant Pediatric Infectious Diseases , King abdalaziz hospital(KAAH), Jeddah , Saudi arabia.
[2]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[3]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[4]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[5]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[6]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[7]Pediatrics resident, King Abdulaziz Hospital, Saudi Arabia.
[8]Pediatric pulmonologist consaltant,King abdalaziz hospital, Jeddah , Saudi Arabia.

Article Received: November 2019 **Accepted:** December 2019 **Published:** January 2020

Abstract:

Background: *Rheumatic fever (RF) is a significant public health concern around the globe. Rheumatic heart disease (RHD) is the cardiac sequelae of untreated group A beta-hemolytic streptococcal infections. Although incidence rates are decreasing, the disease burden is significant in developing countries.*

Methods: *This was a cross-sectional study conducted among 723 of studied children in Jeddah, KSA, aiming to assess the prevalence, treatment, and outcomes. Pre-designed questionnaires were filled by parents attending King Abdulaziz Hospital, Jeddah, KSA, and data was entered and analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 23. Descriptive statistics were performed. Percentages were given for qualitative variables. The determinant factors were determined using the Chi-square test. P-value was considered significant if P < 0.05.*

Results: *The prevalence was found to be 0.7% among studied children. All rheumatic children were males aged 4 – 8 years. Improvement after treatment was reported among all rheumatic subjects and cardiac complications were reported by 60%.*

Conclusion: *We conclude that 0.7% of children were diagnosed with RF, 100% of rheumatic children improved after treatment with a relatively high level of cardiac complications. Further studies and health awareness programs are recommended.*

Keywords: *Rheumatic fever; Streptococcal infections; Saudi Arabia.*

Corresponding author:
Sameera Aljehani,
Consultant Pediatric Infectious Diseases **,**
King abdalaziz hospital(KAAH), Jeddah ,
Saudi arabia.
.

QR code

Please cite this article in press Sameera Aljehani et al., ***Prevalence, Treatment, And Complications Of Rheumatic Fever Among Children Of Saudi Arabia.,*** *Indo Am. J. P. Sci, 2020; 07(01).*

INTRODUCTION:

Congenital heart disease is the commonest cardiac illness in children [1]. However, acquired heart disease, particularly of rheumatic origin, remain to have significant issues in developing and underdeveloped countries. Acute rheumatic fever (ARF), with its varied and potentially devastating cardiac complication of rheumatic heart disease (RHD), has largely been eradicated from developing countries but continues to be a scourge mainly in poorly resourced areas of the world and also among the indigenous populations of some wealthy countries such as New Zealand and Australia [2]. Rheumatic heart disease (RHD) is a non-suppurative complication of group A Beta hemolytic streptococcal throat infection. It affects children and young adults in developing countries and most of these patients presents in heart failure and require surgical intervention [3]. Acute rheumatic fever (ARF) is the result of an autoimmune response to pharyngitis caused by infection with the sole member of the group A Streptococcus (GAS), Streptococcus pyogenes. ARF leads to an illness that is characterized by various combinations of joint pain and swelling, cardiac valvular regurgitation with the potential for secondary heart failure, chorea, skin and subcutaneous manifestations and fever [4]. The long-term damage to cardiac valves caused by ARF, which can result from a single severe episode or from multiple recurrent episodes of the illness, is known as rheumatic heart disease (RHD) and is a notable cause of morbidity and mortality in resource-poor settings around the world. Rheumatic fever, characterized primarily by carditis, chorea, and polyarthritis, occurs a minimum of 2–3 weeks after an episode of untreated or inadequately treated pharyngitis. Acute rheumatic fever does not cause lasting damage to the nervous tissue or joints. However, damage to heart valves can be irreversible and is worsened by repeat episodes of acute rheumatic fever [5, 6]. Permanent valvular damage, or rheumatic heart disease, increases the risk for infective endocarditis, stroke, heart failure, and premature death, and might necessitate valve replacement surgery [2].

It is estimated that 12 million people worldwide are affected by rheumatic fever and rheumatic heart disease and two-thirds of these are children between the ages of five and fifteen, with 79% of cases from developing countries particularly those in the African continent [7]. Estimates from 2005 showed that most of the 15 - 19 million people affected by RHD worldwide were living in developing countries, and an estimated 233 000 people were dying annually from RHD [2].

According to a World Health Organization (WHO) estimate over a decade ago, RHD affects children of school-going age with a prevalence of 5.7 cases per 1000 school children. The prevalence varies from one region to another but it is known that the rates are still high in sub-Saharan Africa compared with the Western countries [8]. Primary episodes of ARF occur mainly in children aged 5 - 15 years and are rare in children under 5 years of age [9]. contrary to the previous belief that RF occurs usually in 5–15 years' age group, 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 [10]. Acute rheumatic fever is no longer a nationally notifiable disease in the United States, and its annual incidence in the continental United States declined in the late 20th century to approximately 0.04–0.06 cases per 1,000 children [11]. In Bangladesh, another study found that the overall prevalence of RF and RHD Bangladesh was 0.9 per 1000 Bangladeshi children aged 5–19 years [12]. Indian studies (having children of a similar background as Bangladeshi children) reported prevalence from 1.4 to 2.9 per 1,000 [13, 14]. In compare to Indian studies there was a decline in RF/RHD prevalence in Bangladesh population. Over the last three-decade, substantial social and economic development in Bangladesh has occurred and

indicators for human development have shown positive trends [15]. The overall improving sanitary condition might have caused lower throat infection in the community. Also, there is an improvement in the awareness about RF and early treatment of sore throat by the physician which might have contributed to the lowering of cases of RF & RHD. However, Rizui et al screened 9430 people in rural Pakistan reported a high rate of RHD; he found 54 cases of RHD (5.7/1000) [16]. A systematic review conducted in South Africa revealed a high prevalence of RHD, with up to 20.2 per 1,000 children with asymptomatic RHD in some regions in that country [17]. In Nigeria, the prevalence rates vary from region to region with some centers reporting rates of 12.4 per 1,000 children seen in the hospital [18]. According to a WHO report, Africa is one of the regions with the highest prevalence of RHD and the rate doesn't appear to be decreasing compared to regions like the European countries where it is almost extinct [8].

As regards risk factors of Rheumatic fever; in relation with age the incidence of initial cases of ARF is highest in children aged 5–14 years, although first episodes do occur in younger children, with reported cases of ARF in those as young as 2–3 years old [19]. Although cases in people >30 years of age are rare, Initial episodes can also occur in older adolescents and adults. In most populations, ARF is equally common in males and females. However, RHD occurs more commonly in females, with a relative risk of 1.6 to 2.0 compared with males. In addition, these sex differences might be stronger in adolescents and adults than in children [20]. The reasons for this association are not clear, but intrinsic factors such as greater autoimmune susceptibility, as observed in systemic lupus erythematosus and extrinsic factors such as greater exposure to GAS infection in women than in men as a result of closer involvement in child-rearing might explain this difference [21].

The diagnosis of RF is made using clinical criteria (the Jones Criteria) and by excluding other differential diagnoses. The diagnosis of ARF is made when the patient presents with two major manifestations or one major manifestation and at least two minor manifestations [22]. The most common presenting features of ARF are arthritis (75% of patients) and fever (>90% of patients). The arthritis of ARF is the most difficult diagnostic challenge because of the large number of differential diagnoses, especially in patients who present with an initial mono-arthritis. The arthritis of ARF is highly responsive to anti-inflammatory drugs (aspirin and NSAIDs) and if the patient does not respond within 48–72 hours alternate diagnoses should be considered. Carditis occurs in >50% of patients with ARF and cardiomegaly occurs when there is moderate or severe valvular regurgitation. Since publication of the previous Jones Criteria in 1992, new data have been published on the use of Doppler echocardiography in diagnosing cardiac involvement in ARF [23]. On the basis of these results, echocardiographic evaluation for all patients who are suspected of having ARF is a new recommendation that has been included in the 2015 Jones Criteria.

The priorities in management of ARF relate to eradication of GAS from the throat, symptomatic treatment of arthritis and/or arthralgia and management of carditis and/or heart failure. The eradication of ARF/RHD is a complex process that needs to be addressed at various levels. These include education of vulnerable communities about the disease, provision of easy access to medical care, and increasing the availability of free penicillin to treat group A streptococcal pharyngitis and for secondary prophylaxis against further attacks of ARF in patients with established RHD. Antibiotics can prevent acute rheumatic fever if administered no more than 9 days after symptom onset. Long-term benzathine penicillin G (BPG) injections are effective in preventing recurrent acute rheumatic fever attacks and are recommended to be administered every 3–4 weeks for 10 years or until age 21 years to children who receive a diagnosis of acute rheumatic fever [6]. Just as important is to address poverty and overcrowding, which are associated with high levels of ARF and RHD, as improvement in socioeconomic conditions has also been shown to promote the control of ARF [24]. There is no doubt that rheumatic heart disease still remains a cause of morbidity and mortality in low and middle income countries, despite its eradication in developed societies.

Objectives:

This study will be conducted to estimate the prevalence, treatment and complications of rheumatic fever among children of different regions of Saudi Arabia.

Research questions:

1.What is the prevalence of post-streptococcal rheumatic fever among children in Saudi Arabia?
2. How well are the patients complied to treatment?
3. What are common complications of rheumatic fever in Saudi Arabia?

SUBJECTS & METHODOLOGY:

Study design and setting:

A cross-sectional study was carried out in Jeddah, Saudi Arabia. The study was done during the period from July to September 2019.

Sampling and Data collection:
The targeted population was Saudi citizens attending King Abdulaziz Hospital, Jeddah who match the inclusion criteria. Pre-designed disseminated questionnaire was distributed for data collection throughout the two-months period (July – August 2019).

Inclusion criteria: participants enrolled in the study were adults, married, had children, currently aged 12 years or less, and completed correct filling of the form.
Exclusion criteria: participants who were not willing to participate, whose children had chronic diseases or congenital anomalies.

Data collection tools:
A pre-designed questionnaire has been distributed among the targeted population and was filled by participants after a brief introduction and explanation of the aims and objectives of the research to the participants. Sampled participants filled out the self-reported predesigned questionnaire to collect socioeconomic and data related to rheumatic fever including:

- Socio-demographic characteristics of the participants including age, educational status, monthly income, and employment.
- Data regarding rheumatic fever, history, treatment and complications.

Sample size:
We expected a high response rate, however, we eliminated all invalid, incomplete responses or any responses that did not match the inclusion criteria with a total of 723 participants.

Data management and Statistical analysis:
The collected data was entered and analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 23. Descriptive statistics were performed. Percentages were given for qualitative variables. The determinant factors were determined using the Chi-square test. P-value was considered significant if $P < 0.05$.

Ethical considerations:
The participants will be informed that participating is completely voluntary. All the participants will understand that their data will be dealt with confidentiality. No names will be written in the forms and the data will be kept safely.

RESULTS:

Table 1: Shows Socio-demographic characteristics of the studied children; the study included 723 subjects, 390 (53.9%) of were males. The majority of children (40.9%) were aged 4 – 8 years, followed by below 4 years (37.9%), and 8 – 12 years (20.7%). Most of the mothers (73.2%) and fathers (62.5%) had a university degree. Most of the fathers were occupied (92.9%), while only 51.9% of the mothers were occupied. One third of the families (34.0%) had a monthly income of 5000 – 1000 SAR, and about two-fifths (43.0%) of the families lived in a first floor apartment. Only 5 (0.7%) of children were diagnosed with Rheumatic Fever.

Table 2: Shows socio-demographic characteristics of the rheumatic children (n=5). All the children were males, currently aged from 4 to 8 years whose fathers and mothers are occupied and had a monthly family income of 5000 – 10000 SAR. Three of them were living in a ground floor apartment, while 2 were living in a second floor apartment.

Table 3: Shows the symptoms experienced by the subjects, family history and age of onset. Two out of five reported a positive family history. Age of onset was reported 2, 3 and 4 years by 2, 2, and 1 subjects, respectively. Fever, joint pain, tonsillar enlargement, and malaise were reported among all 5 subjects. Other lymph nodal enlargement, upper respiratory tract infection, recurrent headache, nausea, and vomiting were symptoms reported by 2 out of 5 rheumatic children. While 3 subjects reported skin rash, and abdominal pain.

Table 4: Shows treatment and outcomes among rheumatic children (n=5). Long acting penicillin was used by all 5 subjects, while only 2 used anti-inflammatory medications. All 5 were improved after treatment. Cardiac hypertrophy was reported as a complication by 3 children.

Table (1): Socio-demographic characteristics of the participants (N=723).

Variables	Frequency (N=723)	Percent
Sex		
• Male	390	53.9
• Female	333	46.1
Age groups of the children		
• - 4 years	274	37.9
• - 8 years	296	40.9
• - 12 years	150	20.7
• More than 12 years	3	.4
Mother's education		
• Primary or illiterate	33	4.6
• Preparatory	158	21.9
• Secondary	3	.4
• University degree	529	73.2
Father's education		
• Primary or illiterate	35	4.8
• Preparatory	175	24.2
• Secondary	61	8.4
• University degree	452	62.5
Mother's occupational status		
• Occupied	375	51.9
• Non-occupied	348	48.1
Father's occupational status		
• Occupied	672	92.9
• Non-occupied	51	7.1
Family monthly Income (SAR)		
• 5000 or less	164	22.7
• 5000 – 10000	246	34.0
• 10000 – 20000	142	19.6
• 20000 or more	171	23.7
Residency level		
• Ground floor	160	22.1
• First floor	311	43.0
• Second floor	148	20.5
• Third floor and higher	104	14.4
Diagnosis of rheumatic fever		
• Yes	5	.7
• No	718	99.3

Table (2): Socio-demographic characteristics of the patients (N=5).

Variables	Frequency (N=5)	Percent
Sex		
• Male	5	100.0
• Female	0	0.0
Age groups of the children		
• - 4 years	0	0.0
• - 8 years	5	100.0
• - 12 years	0	0.0
• More than 12 years	0	0.0
Mother's education		
• Primary or illiterate	0	0.0
• Preparatory	3	60.0
• Secondary	0	0.0
• University degree	2	40.0
Father's education		
• Primary or illiterate	0	0.0
• Preparatory	0	0.0
• Secondary	0	0.0
• University degree	5	100.0
Mother's occupational status		
• Occupied	5	100.0
• Non-occupied	0	0.0
Father's occupational status		
• Occupied	5	100.0
• Non-occupied	0	0.0
Family monthly Income (SAR)		
• 5000 or less	0	0.0
• 5000 – 10000	5	100.0
• 10000 – 20000	0	0.0
• 20000 or more	0	0.0
Residency level		
• Ground floor	3	60.0
• First floor	0	0.0
• Second floor	2	40.0
• Third floor and higher	0	0.0

Table (3): History and symptoms of RF among patients (n=**5**)

Variables	Frequency (N=5)	Percent
History		
Age of onset		
• 2 years	2	40.0
• 3 years	2	40.0
• 4 years	1	20.0
Family history of Rheumatic fever		
• Yes	2	40.0
• No	3	60.0
Symptoms		
Fever		
• Yes	5	100.0
• No	0	0.0
Joint pain		
• Yes	5	100.0
• No	0	0.0
Tachycardia		
• Yes	0	0.0
• No	5	100.0
Chest pain		
• Yes	0	0.0
• No	5	100.0
Skin rash		
• Yes	3	60.0
• No	2	40.0
Lymph node enlargement		
• Yes	2	40.0
• No	3	60.0
Dysphagia		
• Yes	2	40.0
• No	3	60.0
Upper respiratory tract infections		
• Yes	2	40.0
• No	3	60.0
Tonsillar enlargement		
• Yes	5	100.0
• No	0	0.0
Abdominal pain		
• Yes	3	60.0
• No	2	40.0
Nausea and vomiting		
• Yes	2	40.0
• No	3	60.0
Recurrent headache		
• Yes	2	40.0
• No	3	60.0
Malaise		
• Yes	5	100.0
• No	0	0.0

Table (4): Treatment and outcomes of RF among patients (n=**5**)

Treatment		
Anti-inflammatory drugs		
• Yes	2	40.0
• No	3	60.0
Anti-epileptic drugs		
• Yes	0	0.0
• No	5	100.0
Long acting penicillin (monthly)		
• Yes	5	100.0
• No	0	0.0
Improvement after treatment		
• Yes	5	100.0
• No	0	0.0
Complications		
• Cardiac hypertrophy	3	60.0
• No complications	2	40.0

DISCUSSION:

Rheumatic fever (RF) and rheumatic heart disease (RHD) are major causes of death and disability in developing countries. Acute rheumatic fever (ARF) is an inflammatory disease of the heart, joints, CNS, and subcutaneous tissue that develops after a pharyngeal infection by one of the group A beta-hemolytic streptococci (Streptococcus pyogenes) [25]. RF is an autoimmune disease follows infection with the bacterium Streptococcus pyogenes, predominantly affects children aged between 5 and 15 years, with the peak incidence of first episodes occurring at age 12 years [26]. It is considered one of the most common causes of acquired heart disease in children and young adults all over the world [27]. ARF leads to an illness that is characterized by various combinations of joint pain and swelling, cardiac valvular regurgitation with the potential for secondary heart failure, chorea, skin and subcutaneous manifestations and fever [4]. It is estimated that 12 million people worldwide are affected by rheumatic fever and rheumatic heart disease and two-thirds of these are children between ages of five and fifteen, with 79% of cases from developing countries particularly those in the African continent [5]. This cross sectional study was conducted among 723 of studied children, KSA. The study aimed to estimate the prevalence of RF among children and its management and outcomes.

According to a World Health Organization (WHO) estimate over a decade ago, RHD affects children of school going age with a prevalence of 5.7 cases per 1000 school children [8]. As regards to prevalence, our study found that 0.7% of cases had diagnosed with rheumatic fever. The last large study of the disease in Saudi Arabia was published in 1991; this showed a high prevalence of rheumatic fever of 0.3 per 1000 and the prevalence of chronic rheumatic heart disease of 2.8 per 1000, giving an overall rate of 3.1 per 1000 school children 6–15 years old [28]. In the city of Aden, Yemen, a cross-sectional case-finding survey of RF was conducted in 6000 school-children aged 5–16 years reported that the prevalence of RF was 36·5/1000 school-children, which is one of the highest reported among school echocardiography surveys in the world [29]. Also, a systematic review conducted in South Africa revealed a high prevalence of RHD, with up to 20.2 per 1,000 children with asymptomatic RHD in some regions in that country [17]. In Nigeria, another study found that the prevalence rates vary from region to region with some centres reporting rates of 12.4 per 1,000 children seen in the hospital [18]. In Zimbabwe, a cross-sectional survey was carried out in which consecutive children aged 1 - 12 years found that the overall case rate of ARF/RHD among children aged 1 - 12 years was high at 11.9/1 000 [30]. Another study was conducted in Bangladesh, found that overall prevalence of RF and RHD Bangladesh was 0.9 per 1000 Bangladeshi children aged 5–19 years [12]. In Australia, New Caledonia, another study reported that the prevalence of RF was 8.9 cases per 1000 [31]. Today, the disease has almost disappeared in industrialized countries. Prevalence rates in different countries are difficult to compare because of differences in the ages of the populations studied and in the methodologies of the surveys.

The diagnosis of ARF is made when the patient presents with two major manifestations or one major manifestation and at least two minor manifestations

[22]. The most common presenting features of ARF are arthritis (75% of patients) and fever (>90% of patients).

According to symptoms of rheumatic fever, we found that all of cases 100% reported fever, tonsillar enlargement, malaise and joint pain followed by skin rash, abdominal pain reported by 60% for each of them. Lymph node enlargement, dysphagia, upper respiratory tract infections, nausea and vomiting and recurrent headache reported by 40% for each of them. No one reported tachycardia or chest pain. In contrast to our results, another study found that ESR was the most common manifestation in (94%) of cases followed by fever 83%, arthritis 77% and carditis 53% [32].

The priorities in management of ARF relate to eradication of GAS from the throat, symptomatic treatment of arthritis and/or arthralgia and management of carditis and/or heart failure. Antibiotics can prevent acute rheumatic fever if administered no more than 9 days after symptom onset. Long-term benzathine penicillin G (BPG) injections are effective in preventing recurrent acute rheumatic fever attacks and are recommended to be administered every 3–4 weeks for 10 years or until age 21 years to children who receive a diagnosis of acute rheumatic fever [6]. Our study reported that all cases had taken long acting penicillin (monthly) followed by 40% take anti-inflammatory drugs. All cases had improved after treatment and 60 % of them had cardiac hypertrophy. Similar to our findings, another study reported that all the children were placed on intramuscular (IM) benzathine penicillin, 1.2 million units every 21 days, 82% of cases had received aspirin [32]. However, another study reported that Penicillin was administered intramuscularly in (78.8%) of cases, oral macrolides (erythromycin, clarithromycin, azithromycin) were administered (17.6%) and the majority (91.8 %) used Nonsteroidal anti-inflammatory drugs [33].

CONCLUSION:

We conclude that 0.7% of children were diagnosed with RF, 100% of rheumatic children improved after treatment with a relatively high level of cardiac complications. Further studies and health awareness programs are recommended.

REFERENCES:

1. Chielo D, Nguefack F, Menanga AP, et al. Spectrum of heart diseases in children: an echocardiographic study of 1,666 subjects in a pediatric hospital, Yaounde, Cameroon. Cardiovasc Diagn Ther. 2016;6(1):10–9.
2. Carpets JR, Steer AC, Mulholland EK, Weber M. e global burden of group A streptococcal disease. Lancet Infect Dis 2005;5(11):685-694. [http://dx.doi.org/10.1016/S1473-3099(05)70267-X].
3. WHO . Report of a WHO Expert Consultation. Geneva: Rheumatic fever and rheumatic heart disease. 29 October-1 November 2001. Accessed April 24 2017.
4. Carapetis JR, Beaton A, Cunningham MW, et al. Acute rheumatic fever and rheumatic heart disease. Nat Rev Dis Primers. 2016;2:15084. Published 2016 Jan 14. doi:10.1038/nrdp.2015.84
5. World Health Organization. Rheumatic fever and rheumatic heart disease. World Health Organ Tech Rep Ser. 2004;923:1–122.
6. Carapetis JR, Brown A, Wilson NJ, Edwards KN Rheumatic Fever Guidelines Writing Group. An Australian guideline for rheumatic fever and rheumatic heart disease: an abridged outline. Med J Aust. 2007;186:581–6.
7. Prevention WHO and C for DC and P . Rheumatic Fever and Rheumatic Heart Disease. In: Mackay J, Mensah G, editors. The Atlas of Heart Disease and Stroke. Geneva: WHO; 2004. pp. 20–1. [Google Scholar]
8. Press D. The worldwide epidemiology of acute rheumatic fever and rheumatic heart disease. 434 2011.
9. Tani LY, Veasy LG, Minich LL, Shaddy RE. Rheumatic fever in children younger than 5 years: Is the presentation different? Pediatrics 2003;112(5):1065-1068. [http://dx.doi.org/10.1542/peds.112.5.1065]
10. M.M. Zaman, M.A. Rouf, S. Haque, et al.Does rheumatic fever occur usually between the ages of 5 and 15 years?Int J Cardiol, 66 (1998), pp. 17-21
11. Stockmann C, Ampofo K, Hersh AL, et al. Evolving epidemiologic characteristics of invasive group A streptococcal disease in Utah, 2002–2010. Clin Infect Dis 2012;55:479–87.
12. Zaman, M. Mostafa, et al. "Prevalence of rheumatic fever and rheumatic heart disease in Bangladeshi children." indian heart journal 67.1 (2015): 45-49.
13. A.C. Steer, J.R. Carapetis, T.M. Nolan, F. ShannSystematic review of rheumatic heart disease prevalence in children in developing countries: the role of environmental factors J Paediatr Child Health, 38 (2002), pp. 229-234
14. S. Padmavati Rheumatic heart disease: prevalence and preventive measures in the Indian subcontinent Heart, 86 (2001), p. 127

15. Human Development Report: United Nations Development Programme. http://hdr.undp.org/reports/global/2003/indicator/cty_f_BGD.html Accessed 29.04.06
16. Rizvi SF, Khan MA, Kundi A, Marsh DR, Samad A, and Pasha O. Status of rheumatic heart disease in rural Pakistan. Heart. 2004;90:394–399.
17. Zuhlke L, Engel M, Watkins D, Mayosi B. Incidence, prevalence and outcome of rheumatic heart disease in South Africa: a systematic review of contemporary studies. Int J Cardiol. 2015;199:375–83.
18. Sani UM, Ahmed H, Jiya NM. Pattern of acquired heart diseases among children seen in Sokoto, NorthWestern Nigeria. Niger J Clin Pract. 2015;18(6):718–25.
19. Lawrence JG, Carapetis JR, Griffiths K, Edwards K, Condon JR. Acute rheumatic fever and rheumatic heart disease: incidence and progression in the Northern Territory of Australia, 1997 to 2010. Circulation. 2013;128:492–501.
20. Rothenbuhler M, et al. Active surveillance for rheumatic heart disease in endemic regions: a systematic review and meta-analysis of prevalence among children and adolescents. Lancet Glob Health. 2014;2:e717–e726.
21. Yacoub Wasef SZ. Gender differences in systemic lupus erythematosus. Gend Med. 2004;1:12–17.
22. Gewitz MH, et al. Revision of the Jones Criteria for the diagnosis of acute rheumatic fever in the era of Doppler echocardiography: a scientific statement from the American Heart Association. Circulation. 2015;131:1806–1818. The 2015 revision of the Jones Criteria provides, for the first time, differing criteria for low and high disease incidence settings.
23. Vijayalakshmi I, Vishnuprabhu RO, Chitra N. The efficacy of echocardiographic criterions for the diagnosis of carditis in acute rheumatic fever. Cardiol Young. 2008;18:586–592.
24. DiSciascio G, Taranta A. Rheumatic fever in children. Am Heart J 1980;99(5);635-658. [http://dx.doi.org/10.1016/0002-8703(80)90739-5]
25. easy L.G., Hill H.R. Immunologic and clinical correlations in rheumatic fever and rheumatic heart disease. Pediatr. Infect Dis. J. 1997;16(4):400–407.
26. World Health Organization. The Current Evidence for the Burden of Group A Streptococcal Diseases. Geneva, Switzerland: World Health Organization, 2005. WHO/FCH/CAH/05.07; WHO/IVB/05.12.
27. Elia M, Ayoub MD. Acute rheumatic fever. Heart disease in infants, children and adolescents, 1995;11: 1401-40.
28. Al-Sekait M.A., Al-Sweliem A.A., Tahir M. Rheumatic fever and chronic rheumatic heart disease in schoolchildren in Saudi Arabia. Saudi Med. J. 1991;12(5):407–410.
29. Ba-Saddik, I. A., et al. "Prevalence of rheumatic heart disease among school-children in Aden, Yemen." Annals of tropical paediatrics 31.1 (2011): 37-46.
30. GAPU, P et al. Rheumatic fever and rheumatic heart disease among children presenting to two referral hospitals in Harare, Zimbabwe. SAMJ, S. Afr. med. j. [online]. 2015, vol.105, n.5 [cited 2019-12-29], pp.384-388.
31. Baroux, Noémie, et al. "High prevalence of rheumatic heart disease in schoolchildren detected by echocardiography screening in New Caledonia." Journal of paediatrics and child health 49.2 (2013): 109-114.
32. Qurashi MA. The pattern of acute rheumatic fever in children: Experience at the children's hospital, Riyadh, Saudi Arabia. J Saudi Heart Assoc. 2009;21(4):215–220. doi:10.1016/j.jsha.2009.10.004.
33. Boyarchuk O, Boytsanyuk S, Hariyan T. Acute rheumatic fever: clinical profile in children in western Ukraine. J Med Life. 2017;10(2):122–126.