International Journal of Multidisciplinary and Current Educational Research (IJMCER)
ISSN: 2581-7027 ||Volume|| 8 ||Issue|| 2 ||Pages 40-45 ||2026||

Epidemiology of Rheumatic Heart Disease in Students at Pasuruan Islamic Boarding School

[1,]Moh Zakky Kurniawan, [2,]Lucia Kris Dinarti, [3,]Hasanah Mumpuni, [4,]Real Kusumanjaya Marsam

[1,2,3,4,]*Department of Cardiology, Fakultas Kedokteran Universitas Gajah Mada, Indonesia, Dr. Sarjito Hospital Yogyakarta, Indonesia*

ABSTRACT : Rheumatic Heart Disease (RHD) is a chronic complication of rheumatic fever that generally occurs due to untreated group A Streptococcus β-hemolyticus infection. In Islamic boarding schools, crowded living conditions, suboptimal sanitation, and limited access to health services can increase the risk of transmission of upper respiratory tract infections, which are triggering factors for RHD. This study aims to describe the epidemiology of RHD among students at one Islamic boarding school in Pasuruan, including individual characteristics, environmental factors, health behaviors, and disease incidence patterns. Methodology: This study used a descriptive, cross-sectional observational design. The study population comprised all students at the Salafiyah Islamic Boarding School in Pasuruan City. Sample selection and data collection were carried out from July to August 2025 at the Salafiyah Islamic Boarding School in Pasuruan City. Results: 73 females (65.2%) and 39 males (34.8%). Respondents aged 16 years and older accounted for the largest share (30; 26.8%). The highest level of education among respondents was junior high school, reported by 63 respondents (56.3%). 65.7% of respondents reported coughing more than 2 times in the past 6 months, whereas 34.8% reported no more than 2 coughs. A history of cavities among respondents was reported by 72.3%. ECG results in students were normal in 98 respondents (87.5%); suspected RHD (aortic regurgitation) was present in 2 (1.8%), and other heart disorders were present in 12 (7.1%). There were no significant relationships between gender, age, nutritional status, education, recurrent cough with suspected RHD, or a history of cavities and suspected RHD ($p = 0.453$ for all). Conclusion: There was no significant difference in gender, age, nutritional status, education, history of cavities, or history of recurrent cough in the last 6 months with the incidence of suspected RHD.

KEYWORDS: Epidemiology, Rheumatic Heart Disease, Islamic Boarding School Students

I. INTRODUCTION

Rheumatic heart disease is a serious complication of rheumatic fever. It causes heart valve damage, such as regurgitation or stenosis, aortic dilation, and right ventricular dysfunction.[1] Acute rheumatic fever (ARF) is an inflammatory condition that can affect various organs and organ systems, such as the heart, joints, central nervous system, and subcutaneous tissue. Rheumatic fever is caused by infection with group A beta-hemolytic streptococcus. Initial symptoms include a sore throat. Fever, polyarthralgia, polyarthritis, chorea, and erythema marginatum appear about 2-4 weeks later.[2] Acute Rheumatic Heart Disease (RHD) occurs when a cross-reaction occurs between the bacterial carbohydrate cell wall and heart valve tissue, causing chronic damage to the heart valve, which then becomes Rheumatic Heart Disease (RHD).[3] The incidence of initial episodes of rheumatic heart disease peaks in children aged 5 to 15 years, and the highest incidence of recurrence occurs within 5 years of initial presentation. The prevalence of rheumatic heart disease increases in individuals aged 18 to 25 years and reaches 6.8 cases per 1,000 population.[4] This age group is the group most likely to benefit from secondary prophylaxis. The global incidence of RHD is estimated at over 15 million cases, with 282,000 new cases and approximately 233,000 deaths per year.[5] Based on Global, Regional, and National Burden of Rheumatic Heart Disease data from 1990-2015, Indonesia is classified as a country with endemic RHD.[6] Indonesia has the fourth highest prevalence of RHD globally, with 1.18 million cases annually and an estimated mortality rate of around 4.8 per 100,000 individuals at risk. Indonesia lacks official data on RHD prevalence, and studies on its prevalence remain limited. [3] The diagnosis of acute rheumatic fever is difficult to establish in tropical climates such as Indonesia, this is due to the differential diagnosis of fever accompanied by joint pain having a broad differential diagnosis, low self-awareness, and the limited number of screening operators who are competent in detecting RHD. The progression of RHD is influenced by repeated gastrointestinal infections and episodes of rheumatic fever, which trigger a continuous inflammatory response. [7] Secondary prophylaxis with regular intramuscular injections of benzathine penicillin can inhibit the development of stenosis and regurgitation in the

Heart valves.[8] Patients with RHD have a poor prognosis if they do not receive adequate secondary prophylaxis. If diagnosed late, these patients can have a poor prognosis, including congestive heart failure and even death. [9] RHD can cause severe disability, poor quality of life, and premature death, thus burdening the national economy. Most people with RHD are unaware they have it or experience the symptoms of rheumatic fever that precede it. Early RHD is usually asymptomatic, but it will manifest clinically in adulthood.[10] Most patients in endemic areas of RHD come to health facilities when they have already developed severe RHD or with RHD complications, namely heart failure, arrhythmia, pulmonary hypertension, stroke, systemic embolism, and infective endocarditis.[11] Severe RHD causes high morbidity and mortality rates, with a 2-year case fatality rate of 16.9%.[7] Disease progression, rheumatic heart valve morphology, and younger age are factors that influence poor outcomes. [12] Socioeconomic factors play a significant role in the pathophysiology of RHD. Low levels of education and income, with all their manifestations, such as ignorance, poor housing and environmental quality, overcrowding, poor nutrition, and lack of access to healthcare, contribute to the recurrent transmission of Streptococcus Pyogenes infections, which are responsible for RPR.[5] Early case detection can help prevent disease progression. Echocardiographic screening for RHD increases detection rates in endemic areas. The screening criteria guidelines, based on the New Features of the World Heart Federation 2023, are designed for use by non-specialists to detect suspected RHD cases. If the echocardiographic screening result is positive, a confirmatory echocardiographic examination will be performed by a specialist. 13 This method makes it easier to detect PJR early, especially in areas with limited numbers of competent operators.Islamic boarding schools are high-density areas, which pose a risk factor for the transmission of Streptococcus pyogenes. Based on these data, this study aims to screen for active case detection and examine the epidemiological profile and echocardiographic features of RHD cases among Islamic boarding school students.

II. METHODS

This study employs a descriptive, cross-sectional observational design to screen for active case detection and to examine the epidemiological profile and echocardiographic features of RHD among Islamic boarding school students. The study population comprised all students of the Salafiyah Islamic Boarding School in Pasuruan City. Sample selection and data collection were carried out from July to August 2025 at the Salafiyah Islamic Boarding School in Pasuruan City. The study employed non-probability consecutive sampling. The research sample was obtained from respondents of the Salafiyah Islamic Boarding School in Pasuruan City. The research sample comprised Islamic boarding school students who met the selection criteria until the required number of participants was reached.The sample in this study was selected based on meeting the inclusion and exclusion criteria. The inclusion criteria in this study were registered as students at the Salafiyah Islamic boarding school in Pasuruan City; aged 5-19 years; having a history of cough, cold, or sore throat > 2 times; having a history of fever > 2 times; having a history of toothache, and/or cavities; and agreeing to informed consent. The exclusion criteria in this study were: experiencing an infectious illness with acute symptoms such as fever, loss of appetite, nausea, vomiting, feeling weak, sore throat, pain when swallowing, abdominal pain, and polyarthritis; and not willing to be involved in the study.

The primary data for this study were obtained from echocardiography, cardiac auscultation with a stethoscope, weight measurement with a scale, and height measurement with a microtoise. Heart sounds were auscultated using a stethoscope, and murmurs were recorded in the following locations:

1. Ictus cordis to hear heart sounds coming from the mitral valve
2. The left second intercostal space is used to listen for heart sounds originating from the pulmonary valve.
3. The third intercostal space on the right is the best place to listen for heart sounds originating from the aorta.
4. The fourth and fifth intercostal spaces at the right and left edges of the sternum or the sternal tip to listen for heart sounds originating from the tricuspid valve.
5. Echocardiography screening is performed on a population sample using a handheld or portable

Machine. Echocardiography screening results are then categorized as positive and negative. Positive screening results must meet the following criteria:

1. Minimum MR jet length (1.5 cm in patients weighing <30 kg and 2.0 cm in patients weighing ≥30 kg) is present on at least one image in at least two consecutive leads, or
2. AR jet is present on at least one image in at least two successive leads, or
3. Restriction of mitral valve leaflet movement and opening
4. Positive screening results are then referred for echocardiography to confirm RHD by an expert.

III. RESULTS

The study included 112 respondents who met the inclusion and exclusion criteria. Primary data was collected through questionnaires, height and weight measurements, cardiac auscultation, and echocardiography.

Table 1. Characteristics of Research Respondents

Research variables	Frequency (n)	Percentage (%)
Gender		
Female	79	65.2 %
Male	39	34.8 %
Age		
12 years old	2	1.8 %
13 years old	3	2.7 %
14 years old	11	9,8 %
15 years old	20	17,9 %
16 years old	30	26,8 %
17 years old	24	21,4 %
18 years old	15	13,4 %
19 t years old	7	6,3 %
Education		
Elementary School	47	42 %
Junior High School	63	25,3 %
Senior High School	2	1,8 %

Based on the data presented in Table 1 above, the respondents in this study comprised 73 females (65.2%) and 39 males (34.8%). Respondents aged 16 years and over had the highest percentage, at 30 (26.8%). The highest level of education for respondents was junior high school, at 63 (56.3%).

Table 2. Respondent Characteristics Based on Risk Factors for RHD

Research variables	Frequency (n)	Percentage (%)
Cough frequency > 2x in the last 6 months		
Yes	94	65.%
No	18	34.8%
History of cavities		
Yes	81	72.3 %
No	31	27.7 %

Based on Table 2 above, 65.7% of respondents reported coughing more than twice in the last 6 months, and 34.8% did not. A history of cavities among respondents was 72.3%.

Table 3. Frequency distribution based on echocardiography results

Research variables	Frequency (n)	Percentage (%)
Normal	98	87.5
RHD Suspect (aorta regurgitasi)	2	1.8
Other heart disorders	12	7.1

Based on Table 3 above, the majority of ECG results among students were standard (98 respondents, 87.5%); suspected RHD (aortic regurgitation) was 2 (1.8%); and other heart disorders were 12 (7.1%).

Table 4. Bivariate analysis of characteristics of respondents with suspected RHD

Characteristic	RHD Suspect			P value
	Yes	No	Total	
Gender				0.51
Female	0	73	73	

Male	2	37	39	
Age				0.560
>15 years old	2	94	96	
12-15 years old	0	16	16	
Nutritional status				0.790
Obesity	0	9	9	
Overweight	0	18	18	
Normal	2	72	74	
Underweight	0	11	11	
Education				0.453
Elementary School	0	47	47	
Junior High School	2	61	63	
Senior High School	0	2	2	
History of cavities				0.454
Yes	1	81	82	
No	1	29		
History of recurrent cough in the last 6 months				0.532
Yes	2	92	94	
No	0	18	18	

Based on Table 4 above, no significant relationship was found between gender and suspected RHD (p-value = 0.51). No significant relationship was found between age and suspected RHD (p-value = 0.560). No significant relationship was found between nutritional status and suspected RHD (p=0.790). No significant relationship was found between a history of recurrent cough in the last 6 months and suspected RHD (p-value = 0.532). There was no significant relationship between education and suspected RHD (p=0.453) or between a history of cavities and suspected RHD (p=0.453).

IV. DISCUSSION

Of the respondents who underwent echocardiography screening, two were suspected of having RHD and 12 were suspected of having other heart disorders. In the 112 study subjects, the prevalence of RHD was 17/1000. This figure is higher than the prevalence rate reported in previous research on children in Bangladesh, which indicated a prevalence of RHD around 0.8/1000 (16). This figure is also higher than the prevalence rate of 2.2/1000 reported in previous research across 16 developing countries in 5 WHO regions.[14]Many studies have shown that women have a higher prevalence of RHD than men. Several global studies (e.g., the WHO and cohort studies in Africa and Asia) have shown that women experience more severe progression of valve disease, particularly mitral stenosis.[15] Women are known to have a stronger immune response, making them more susceptible to diseases with autoimmune mechanisms, including rheumatic fever, which causes PJR.[16]A small proportion of students attend elementary madrasahs (primary schools), suggesting a potential for disease onset in childhood. While students' educational attainment is not directly related to the pathogenesis of rheumatic fever (RHD), it may influence health knowledge and behaviors, including recognizing the symptoms of streptococcal pharyngitis, seeking medical attention, and adherence to benzathine penicillin prophylaxis. Previous research has shown that greater health literacy is associated with higher adherence to treatment in patients with rheumatic fever and rheumatic heart disease.[17]

Nutritional status in patients with rheumatic heart disease (RHD) remains a significant clinical aspect in long-term disease monitoring and management. Several modern studies have shown the prevalence of malnutrition in patients with rheumatic heart disease (RHD). For example, a survey by Desta et al. (2023) reported that approximately 50.7% of RHD patients demonstrated malnutrition (underweight and/or stunted) based on anthropometric measurements. This malnutrition can exacerbate cardiac burden because low nutrient intake weakens the immune system and hinders tissue recovery, especially during the phase of heart failure or cardiac decompensation.[18] Research in Indonesia also highlights the relationship between nutritional status and heart valve disease severity. A cross-sectional study of children with RHD found that nutritional status was significantly associated with the severity of mitral valve regurgitation: children with obesity tended to have more severe mitral valve regurgitation. This finding suggests that both severe malnutrition and overnutrition (obesity) may play a role in the progression of valve lesions.[19]In Islamic boarding schools, students typically live in dormitories and are heavily influenced by the knowledge and discipline of their teachers, caregivers, and health workers. Crowded living conditions,

Communal living patterns, and limited access to healthcare can increase the risk of transmission of Streptococcus pyogenes (WHO, 2018).[20] Therefore, structured and ongoing health education is essential, especially for students at lower levels of education who may still have a limited understanding of preventing throat infections and the importance of long-term PJR prophylaxis. Acute Rheumatic Fever (ARF), which is the initial phase before developing into RHD, most often occurs in children aged 5–15 years. At this age, children usually experience pharyngitis caused by group A β-hemolytic Streptococcus; immunity to streptococci is not yet fully developed; and exposure in school is high. It is from ARF that chronic heart valve damage (RHD) develops.[21] Children who experience recurrent ARF without prophylaxis typically begin to exhibit heart murmurs, mild regurgitation, and cardiac enlargement during adolescence (10–20 years). The progression of valve disease usually begins to appear at this age. Heart valve damage due to ARF is progressive, so clinical symptoms appear gradually. [22]

Not much modern literature (especially in the last 10 years) directly mentions "recurrent cough" as a risk factor for RHD. Instead, research focuses more on pharyngeal Streptococcus infection (tonsillopharyngitis) as a trigger for rheumatic fever. According to StatPearls, acute rheumatic fever is caused by an immune response to Group A Streptococcus (GAS) infection in the throat (pharynx) → this is the basis of RHD. In a review of ARF risk, Baker et al. (2019) identified several modifiable factors, including household conditions (crowding), sanitation, and access to healthcare, that may increase the risk of recurrent GAS infection → Although they do not explicitly state "cough >2x" but these environmental factors can be correlated with recurrent upper respiratory infections.[23] A study by Amade et al. (2023) evaluated combined screening for RHD and dental caries (DC) in schoolchildren in sub-Saharan Africa. They noted that dental caries among children with RHD could be an important risk factor and that dual screening was highly relevant.[24] This study reviewed evidence from the literature (2014–2024) and found that RHD patients with poor oral hygiene had a higher risk of developing infective endocarditis through oral bacteremia. It concluded that preventive oral care should be part of the management of high-risk RHD.[25] Systematic reviews show that oral hygiene practices (e.g., tooth brushing) have a positive impact on the risk of cardiometabolic disease, which, although not RHD-specific, support the concept that oral health influences heart health. [26]

Other studies have shown that the risk of developing suspected rheumatic fever (RHD) does not differ significantly between men and women. Some studies suggest that although women are more likely to develop clinical rheumatic fever in adulthood, screening results typically do not show significant differences by sex at the suspected or early stages. In the early stages, heart valve changes due to rheumatic fever are often subclinical, so the influence of sex-related biological factors is not yet apparent.[27] Although the age group 5–15 years is the group most at risk for rheumatic fever, screening results often do not show significant age differences in the RHD suspect category.This is because most screening is conducted in relatively homogeneous school-age groups, so age variations are not significant enough to influence the suspect status [28] Another study also found no significant association between recurrent cough in the past 6 months and suspected RHD ($p = 0.532$). A recurrent cough does not explicitly indicate GAS (Group A Streptococcus) infection. The majority of recurrent coughs are caused by viral infections, allergies, or environmental irritants and are not indicators of streptococcal pharyngitis, so it is not surprising that it is not associated with suspected RHD.[29]

V. CONCLUSION

In a study of RHD screening prevalence among students at the Pasuruan Islamic boarding school, the prevalence was 18 per 1,000 people, or 1.8%. All students suspected of having RHD had a history of coughing more than twice in the last 6 months. There were no significant differences in gender, age, nutritional status, education, history of cavities, or history of recurrent cough in the last 6 months with the incidence of suspected RHD.

REFERENCES

1. WHO. Rheumatic fever and rheumatic heart disease. *World Health Organ Tech Rep Ser*. 2004;923(November 2001):1–122.
2. Gewitz M, Baltimore R, Tani LY, Sable CA, Shulman ST, Carapetis J, 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. *Circulations*. 2015;134:1806–18.
3. Hasanah, Zafira Uswatun and Elvi Suryati. Penyakit Jantung Rematik pada Anak. *Medula* |Volume 10 |Nomor 3 | Oktober 2020 | 484-490
4. Seckeler MD, Hoke TR. The worldwide epidemiology of acute rheumatic fever and rheumatic heart disease. *Clin Epidemiol*.2011;3: 67-84. DOI: 10.2147/CLEP.S12977.

5. Watkins DA, Johnson CO, Colquhoun SM, Karthikeyan G, Beaton Andrea, Bukhman Gene, *et al*. Global, regional, and national burden of rheumatic heart disease, 1990-2015. *N Engl J Med*. 2017;377:713-22. DOI: 10.1056/ NEJMoa1603693.
6. Woodruff RC, Eliapo-Unutoa I, Chiou H, Gayapa M, Noonan S, Podila PSB, et al. Period prevalence of rheumatic heart disease and the need for a centralized patient registry in american samoa, 2016 to 2018. *J Am Heart Assoc 2021*;10:e020424.
7. Zühlke L, Karthikeyan G, Engel ME, Rangarajan S, Mackie P, Cupido-Katya Mauff B, Islam S, Daniels R, Francis V, Ogendo S, et al. Clinical outcomes in 3343 children and adults with rheumatic heart disease from 14 low- and middle-income countries: two-year follow-up of the Global Rheumatic Heart Disease Registry (the REMEDY Study).*Circulation*. 2016; 134:1456–1466.
8. Rémonda M, Atkinson D, White A, Brown A, Carapetis J, Remenyi B, et al. Are minor echocardiographic changes associated with an increased risk of acute rheumatic fever or progression to rheumatic heart disease? *Int J Cardiol.* (2015)
9. Francis JR, Fairhurst H, Yan J, Fernandes Monteiro A, Lee AM, Maurays J, et al. Abbreviated Echocardiographic Screening for Rheumatic Heart Disease by Nonexperts with and without Offsite Expert Review: A Diagnostic Accuracy Study. *J Am Soc* Echocardiogr [Internet]. 2023 Jul 1 [cited 2023 Dec 3];36(7):733–45.
10. Lilyasari O, Prakoso R, Kurniawati Y, Roebiono PS, Rahajoe AU, Sakidjan I, et al. Clinical Profile and Management of Rheumatic Heart Disease in Children and Young Adults at a Tertiary Cardiac Center in Indonesia. *Front Surg* [Internet]. 2020 Aug 12 [cited 2023 Dec 3];7
11. Okello E, Wanzhu Z, Musoke C, Twalib A, Kakande B, Lwabi P, Wilson NB, Mondo CK, Odoi-Adome R, Freers J. Cardiovascular complications in newly diagnosed rheumatic heart disease patients at Mulago Hospital, *Uganda.Cardiovasc J Afr*. 2013; 24:80–85.
12. Beaton A, Aliku T, Dewyer A, Jacobs M, Jiang J, Longenecker CT, et al.. Latent rheumatic heart disease; identifying the children at highest risk of unfavorable outcome. *Circulation.* (2017) 136:2233–44.
13. Rwebembera J, Marangou J, Mwita JC, Mocumbi AO, Mota C, Okello E, et al. 2023 World Heart Federation guidelines for the echocardiographic diagnosis of rheumatic heart disease. Nature Reviews Cardiology 2023 [Internet]. 2023 Nov 2 [cited 2023 Dec 3];1–14
14. WHO cardiovascular disease unit and principle investigator, WHO programme for the prevention of Rheumatic fever / Rheumatic heart disease in 16 developing countries: Report from phase 1 (1986-90). Bull WHO. 1992;70(2): 213-18.
15. Carapetis, J.R. et al. (2016). *Acute Rheumatic Fever and Rheumatic Heart Disease*. Nature Reviews Disease Primers.
16. Cutolo, M. et al. (2014). *Sex Differences in Autoimmune Diseases: The Role of Estrogens*. Autoimmunity Reviews.
17. Zühlke, L. J., & Engel, M. E. (2013). The importance of awareness and education in preventing acute rheumatic fever and rheumatic heart disease. *Global Heart*, 8(3), 235–239.
18. Desta, T. T., et al. (2023). *Descriptive Analysis of Rheumatic Heart Disease Related* Pediatric Health Med Ther, 2023 Feb 11;14:45–57.
19. Akmatul, Arya; Dyahris Koentartiwi; Hajeng Wulandari (2023). Hubungan Status Gizi dengan Derajat Keparahan Regurgitasi Katup Mitral pada PJR Anak**.** Universitas Brawijaya Repository
20. World Health Organization (WHO). (2018). *Rheumatic fever and rheumatic heart disease: Report of the WHO expert consultation*. Geneva: WHO Press.
21. Gewitz et al. (2015). *AHA Guidelines for Diagnosis of Acute Rheumatic Fever*.
22. Marijon E. et al. (2012). *RHD Progression from Childhood to Late Teen Years*. Lancet.
23. Karthikeyan G, Guilherme L. Acute rheumatic fever. Lancet. 2018 Jul 14;392(10142):161-174.
24. Amade, E. S., et al. (2023). *Integrated Screening for Rheumatic Heart Disease and Dental Caries*. *BMJ Global Health*
25. Amiria, F., & Gumilas, N. S. A. (2025). *The association between poor oral hygiene and infective endocarditis risk in rheumatic heart disease patients: a systematic review*. *Padjadjaran Journal of Dentistry*, **37**(2), 258–267
26. Church, L., Franks, K., Medara, N., Curkovic, K., Singh, B., Mehta, J., Bhatti, R., & King, S. (2024). *Impact of Oral Hygiene Practices in Reducing Cardiometabolic Risk, Incidence, and Mortality: A Systematic Review*. *International Journal of Environmental Research and Public Health*, **21**(10), 1319.
27. Beaton et al. (2019). *Echocardiographic Screening in RHD*. NEJM.
28. Engelman et al. (2020). *Age Distribution and RHD Subclinical Findings*.
29. Gerber et al. (2015). *Diagnosis and Management of Streptococcal Pharyngitis*. AHA.