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Rheumatic heart disease an echo-based screening: A four-year audit of Suva school program from 2018 to April 2021

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Abstract

Introduction: Rheumatic Heart Disease (RHD) arises from recurrent infections by Group A Beta Hemolytic Streptococcus (GAS). Worldwide, approximately 35 million people are affected by RHD, with 10 million experiencing disabilities due to the disease. Notably, 84% of global RHD cases are found in regions across Asia, Africa, and Oceania, which includes countries like Fiji, Vanuatu, and the Solomon Islands. In Fiji, RHD prevalence stands at 19.2 per thousand, meaning 1 in 50 children or one child per classroom of 50 is affected. Fiji records around 60 RHD-related deaths annually, with an estimated direct and indirect cost of 5,500 FJD per patient to the government. To address this, a school screening program was initiated in 2018 by the Ministry of Health and Medical Services Fiji (MOHMS), Cure Kids NZ, and the New Zealand Medical Treatment Scheme, aiming to strengthen and expand existing RHD programs, reduce RHD morbidity, and ultimately decrease mortality.

Objective: This study assesses the effectiveness of the school screening program and identifies any inconsistencies within it. Identifying these inconsistencies is crucial to refining the program before a nationwide rollout.

Methods: This mixed-method study incorporated both quantitative and qualitative components. The study population consisted of all children screened by the Suva Health team. Eligible patients' data were entered into Microsoft Excel. Demographic factors (e.g., ethnicity, duration of prophylaxis, gender) were analyzed to determine their effect on adherence to Benzathine prophylaxis using statistical calculations, including odds ratios and cumulative incidence over a six-month period.

Results: Among the 7,132 children screened, 374 (5%) were referred to health facilities, of whom 184 presented for central registration. Among these, 154 (84%) were confirmed with RHD. The cumulative incidence of RHD was 21/1000 among screened children. Ethnically, the I-taukei population represented 79.5% of RHD-positive cases, with a mean age of 11.6 years (±1.4). The disease severity ranged from mild (79.8%) to moderate (26.6%) and severe (3.2%). The mitral valve was the most affected (60% of cases). Despite challenges due to the COVID-19 pandemic, adherence to follow-up at six months was 64%.

Conclusion: This study reveals a substantial number of undiagnosed RHD cases in primary schools. While screening has been effective in identifying RHD cases, the main challenge remains ensuring that identified cases present for registration. Improved methods for follow-up, particularly in light of COVID-19 disruptions and non-medical misconceptions about Benzathine prophylaxis, are necessary. Addressing these factors could enhance detection, follow-up, and adherence, thereby reducing RHD-related morbidity and mortality.

Keywords: Rheumatic Heart Disease, Echocardiology Screening, School screening.

Introduction

Acute rheumatic fever (ARF) is an autoimmune response to either throat or skin infection caused by Group A Streptococcus (GAS), also known as *Streptococcus pyogenes*. The association between ARF and carditis was first identified in 1812 by William Charles Wellscidence of GAS infection occurs between the ages of 5 and 15, a period when children are particularly susceptible to ARF. Repeated episodes of inflammation, particularly in the heart valves, can result in chronic scarring. This damage compromises valvular function, causing them to become leaky and resulting in a condition known as rheumatic heart disease (RHD).

The World Heart Federation (WHF) identifies rheumatic heart disease (RHD) as the most common acquired heart disease in individuals under 25 years of age. Comorbidities associated with RHD are largely preventable if detected early. However, in many endemic regions, most RHD cases are only identified when patients present to health facilities with advanced disease, often showing complications such as recurrent acute rheumatic fever (ARF), heart failure, atrial fibrillation, or stroke.

Current knowledge of RHD prevalence in children largely comes from studies conducted in schools, meaning that RHD rates among out-of-school children remain uncertain. Regional data on RHD prevalence in the Pacific, including New Zealand and Australia, from a World Health Organization (WHO) report, estimate a median prevalence of 7.6 per 1000 (95% CI 2.5–13.5) for children aged 5–14 years, highlighting the Pacific as one of the regions with the highest RHD incidence worldwide. In Fiji, the prevalence of RHD among children aged 5–14 years is estimated at 19.2 per 1000, suggesting that at least one child per classroom, or 1 in 50 children, may be diagnosed with RHD. Additionally, according to Cure Kids Fiji, around 60 deaths annually

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are attributed to RHD.

Rheumatic heart disease (RHD) represents a significant health challenge in Fiji, with approximately 60 deaths annually attributed to the condition. Compounding this issue, children in Fiji often present to clinical services at advanced stages of RHD, making them almost certain to be symptomatic by the time of diagnosis. The Suva subdivision, where this study is focused, extends from St. Joseph the Worker Primary School in Nakasi to Ro Delainamoko Primary in Lami. This area includes 81 primary schools across seven medical areas. Based on the 2017 national census by the Fiji Bureau of Statistics, the population stands at 884,887. Among these, children aged 11–14 years are identified as a high-risk group for RHD, with 13,883 children in this age range within the Suva subdivision alone, representing 8% of the country's population in this age group.

The school screening program for RHD began in 2014, following a collaboration between the Fiji Ministry of Health and Medical Services (MOHMS) and Cure Kids NZ. This partnership aimed to strengthen RHD programs across Fiji by focusing on five key objectives:

- Establishing a Register-Based Program
- Developing Best Practice Guidelines
- Creating a National Model for Early Detection of ARF/RHD Cases
- Promoting Health Education
- Implementing Primary Prevention Guidelines

The school screening program falls under the third objective, which involved introducing portable echocardiography in schools to screen children with parental consent. Screening was conducted for all Class 6 students in the Suva subdivision, a group chosen by the Ministry of Education and MOHMS because they were not preparing for major exams and belonged to an age group with elevated risk for recurrent ARF. In 2018, the program was piloted in Suva, where trained nursing practitioners identified potential cases in schools using a simplified protocol and portable Vscan (GE Healthcare) handheld machine echocardiography.

All children identified through the initial screening are referred to a cardiac sonographer for a follow-up scan using a portable GE Vivid Q echocardiography machine. The echocardiographic studies are saved and reviewed by a pediatric consultant. If the images meet the World Heart Federation (WHF) criteria for RHD, a diagnosis is confirmed. Nursing practitioners then counsel the parents, providing information about the diagnosis and arranging for the child to be reviewed at one of the main referral facilities, either Colonial War Memorial Hospital (CWMH) or Sai Prema. Parents receive a clinic appointment date to attend the facility. Upon presentation at CWMH or Sai Prema, a medical officer conducts further counseling and initiates the central registration process into the Rheumatic Fever Information System (RFIS). This includes beginning secondary prophylaxis, scheduling a dental review, and setting up appointments for follow-up at a consultant clinic.

Statement of the Problem

This study was conducted to investigate potential deficiencies in the current school screening program for rheumatic heart disease (RHD). There is a concern that not all cases diagnosed with definite RHD through echocardiographic screening are presenting for central registration at referral facilities, which may impact their access to necessary follow-up care and management.

Aim

To determine if all RHD-positive cases identified through school screening are presenting at hospitals, receiving proper follow-up, and adhering to secondary prophylaxis protocols.

Objectives

1. Evaluate whether identified RHD cases are being managed in accordance with the Fiji RHD Guidelines.
2. Determine the incidence of RHD in children screened within the Suva Subdivision.
3. Assess adherence rates to secondary prophylaxis among identified RHD cases.

Literature Review

The study by Carapetis, which compared screening tools (echocardiography versus auscultation) in Tongan children, highlights that RHD remains a significant issue in developing countries, with many cases only detected when patients present with heart failure015, the global burden of RHD was estimated to be 33.3 million cases in endemic countries and 221,600 cases in non-endemic countries . Traditiscultation has been the primary screening tool for RHD in developing regions. However, the growing use of portable echocardiography has demonstrated improved ability to detect early RHD changes, encouraging countries like Fiji to incorporate this method into RHD screening efforts .

Studies in the Pacific region utilizing echocardiography in schools to detect RHD have highlighted the effectiveness of this approach in identifying subclinical cases. In 2016, Philippe Corsenac found a point prevalence of 99-114 cases per 10,000 school-aged children, underscoring the benefit of early detection in this population. Pivotal studies conducted in Mozambique and Cambodia have compared RHD detection rates between portable echocardiography and auscultation, revealing that echocardiography detected 90% more cases than auscultation alone, which would have otherwise been missed. This improved detection is critical for identifying subclinical cases-those with definite RHD who are asymptomatic or lack a detectable murmur-and allowing for early intervention with secondary prophylaxis to halt disease progression.

Similar studies in the Pacific (Carapetis, 2007, and Corsenac, 2016) demonstrated that echocardiography had a higher sensitivity compared to auscultation. These studies found that echocardiography detected 54% of cases, whereas auscultation identified only 46%, indicating that a reliance on auscultation alone could miss approximately half of affected children, potentially delaying essential secondary prophylaxis. Fiji-specific studies on RHD prevalence using echocardiography offer further insights. In 2009, Andrew C. Steer conducted a study examining RHD prevalence in Fijian children aged 5-15 years, based on data collected in 2006. This study followed a three-stage process: initial auscultation, limited echocardiography for those with suspicious murmurs, and a detailed echocardiography review by a pediatric specialist. The findings indicated an RHD prevalence of 8.4 per 1000 children (95% CI: 5.6-12).

Another cross-sectional observational study in Fiji in 2009 also assessed school children aged 5-14 years using both echocardiography and auscultation. A study in Fiji's central division recruited 10 schools to assess RHD prevalence. The findings revealed that mitral regurgitation (MR) was the most common valvular lesion, with an RHD prevalence of 19.2 per 1,000, higher than the earlier 2006 study estimates. In 2011, Ben Reeves conducted another study in Lautoka on children aged 5-14 years, involving a four-minute echocardiography screening followed by a clinical examination. This study reported an even higher RHD prevalence of 55.2 per 1,000, concluding that Fiji has one of the highest RHD prevalence rates globally. According to the Cure

Kids Fiji website, the RHD prevalence confirmed by echocardiography among Fijian children in the 5-14 age range stands at 33.4 per 1,000. With this substantial disease burden, Fiji could greatly benefit from a comprehensive screening strategy to bolster primary and secondary prophylaxis for preventing both ARF and RHD. Secondary prophylaxis involves administering a four-weekly benzathine penicillin injection intramuscularly (IMI), which has been shown to reduce ARF risk significantly. Studies among American military recruits in the 1950s demonstrated an 80% risk reduction for ARF with regular benzathine injections. Systematic reviews further confirmed that penicillin prophylaxis results in a 55% reduction in ARF risk compared to no prophylaxis.

Comparative studies on auscultation versus echocardiography, such as those in Mozambique, Cambodia, and Tonga, indicate that echocardiography has a significantly higher sensitivity for detecting pathological valve disease. In line with this, the 2004 WHO report recommends echocardiography as the preferred diagnostic tool in RHD-endemic regions to detect "silent but significant rheumatic carditis" and advocates treating such cases as RHD until proven otherwise. Meta-analyses also show that echocardiography's sensitivity for RHD detection is 21%, compared to 15.6% for auscultation (p=0.0001), making echocardiography a sensible screening choice in high-prevalence areas like Fiji. Notably, even handheld echocardiography machines have demonstrated a 90% sensitivity rate when used by trained nurses or sonographers, with even higher accuracy by an experienced echocardiologist.

Pilot studies exploring nurse-led echocardiography screening for early RHD detection have shown promising results, supporting the potential effectiveness of Fiji's school-based screening program.

METHODOLOGY

Study Design

This research employs a mixed-method approach, incorporating both qualitative and quantitative components. The study's qualitative aspect is retrospective, while the quantitative component is descriptive.

Quantitative Component

This retrospective, descriptive study covers a period from May 2018 to June 2021. Data was collected from the Children's Outpatient Department at Colonial War Memorial Hospital (CWMH), Sai Prema Medical Center, CWMH Dental Department, and Namosi House - RHD School Team. The study population included all children referred by the school screening teams. The sample was obtained through convenience sampling, whereby all patients recorded in the various registries were included if they met the study's inclusion criteria.

Inclusion Criteria

1. All children referred by the Suva Sub-Division Health Team after an echocardiogram, meeting WHF criteria for RHD.
2. All children from the Suva Sub-Division Health Team who were confirmed with definite RHD following a re-echocardiogram at a main facility.

Exclusion Criteria

Children with normal echocardiogram results upon re-evaluation.
Children with congenital heart defects.
Children referred for echocardiograms outside the study period or outside the Suva subdivision.
Children with borderline RHD diagnoses.

Data Collection Process

Data collection involved reviewing the RHD registries from Sai Prema and CWMH. Registration forms with referrals from the school screening were identified. The RHD Benzathine injection logs from CWMH were also reviewed, and patient details were extracted. Medical folders were then retrieved through hospital records for further review, with a retrieval rate of 91% of all patient folders included for analysis. Names were de-identified, with patient data re-entered using a unique identification code accessible only to the researcher (see Appendix 4 and 5). The data was then entered into Microsoft Excel software for further analysis. A standardized data collection form (Annex 4) was utilized to extract the necessary data from patient records and registries.

Process for Data Management and Analysis

Data management was conducted through systematic data entry and storage in Microsoft Excel, following de-identification procedures to maintain patient confidentiality. Statistical analyses were then performed to calculate the incidence of RHD among the screened population, with incidence defined as the proportion of individuals developing the condition within the specified study period. The incidence rate was calculated using the following formula:

Incidence Rate=Number of new RHD cases within the study period-Total number of children screened during the same period×1000\text{Incidence Rate} = \frac{\text{Number of new RHD cases within the study period}}{\text{Total number of children screened during the same period}} \times 1000Incidence Rate=Total number of children screened during the same periodNumber of new RHD cases within the study period×1000

This measure provided a standardized incidence rate per 1,000 children screened, facilitating comparisons with existing studies on RHD prevalence in similar populations. Additional statistical methods were applied to assess adherence rates and determine associations with demographic factors. To assess the association of risk factors for RHD, an odds ratio (OR) can be calculated using a contingency (2x2) table. This analysis allows for evaluating the strength of association between specific demographic or clinical risk factors and the likelihood of RHD occurrence in the study population.

	Cases	Controls	Total
Exposed	A	B	a+b
Unexposed	C	D	c+d
Total	a+c	b+d	a+b+c+d

$$OR = (a/c)/(b/d)$$
$$= (a*d)/(b*c)$$

To calculate the adherence to benzathine prophylaxis (BPG) over a 6-month follow-up period, we can determine the percentage of prescribed injections that each patient received. The formula for adherence is:
Percentage Delivered=(Number of doses received/Number of doses recommended)×100

Example Calculation

Number of Doses Recommended: For this study, the number of doses recommended per patient over 6 months is 6.
Number of Doses Received: This will vary for each patient based on actual adherence.

For instance, if a patient received 4 out of the recommended 6 doses, the adherence percentage would be:

Percentage Delivered=(4/6)×100=66.67%

Interpretation

100% adherence would indicate full compliance, where the patient received all 6 recommended doses.

Less than 100% would reflect partial adherence, with specific percentages indicating the extent of adherence.

By applying this formula to each patient in the study, you can calculate and analyse adherence rates across the cohort, providing insight into how well patients are following the benzathine prophylaxis schedule.

Qualitative Component

To assess adherence to secondary prophylaxis, the researcher employed qualitative methods to gather data. This approach facilitated an exploration of the experiences and motivations behind the defaulters' behaviour. The data collection involved telephonic interviews conducted by the primary researcher with the parents of the patients. A structured interview was carried out using a questionnaire outlined in Appendices 6 and 7. The questionnaire included several parameters such as the patient's name, NHN (National Health Number) for biographical data, and five questions: their date of birth, the number of injections received, the health center where they received the injections, and the reasons for discontinuing secondary prophylaxis. Each telephone interview lasted approximately 15 to 20 minutes.

Sampling

This part of the study included all 154 children diagnosed with confirmed Rheumatic Heart Disease (RHD). The questionnaire comprised five structured questions, of which four were closed-ended and one was open-ended. The objective was to contact all 154 patients with confirmed RHD using the contact information provided on their registration forms. The adherence timeline for this study spanned from November 2020 to May 2021 (a six-month duration). Good adherence was defined as receiving more than 5 out of 6 or all 6 injections (equating to greater than 80% adherence). Defaulting on injections was defined as any patient who had ceased secondary prophylaxis. To verify adherence, patients were asked to send a picture of their RHD medical book via Viber or Messenger to the primary researcher, allowing for the tallying of all administered injections and corresponding months. A total of 101 patients were reached, and their data were analyzed in the results.

Process for Data Management and Analysis

Data was extracted onto data extraction forms as outlined in Annex 6 for questions 1 to 4. Thematic analysis was employed to analyze question 5, focusing on the reasons for defaulting injections, using an inductive approach. Codes were assigned, and themes were generated to identify patterns during the analysis.

Ethical Considerations

Ethics approval for this study was obtained from the College of Human Health Research Ethics Committee (CHREC) and the Fiji Institute of Pacific Health, under Fiji National University. Minor modifications to the study protocol were made, and subsequent approval was secured from the CHREC prior to data collection. All data collected during the study were kept confidential. Only the principal investigator had access to the identities of the patients, which were maintained under strict coding protocols and secured on software, as well as physically locked on the investigator's laptop. Additionally, permission to collect data from the Colonial War Memorial Hospital (CWMH) was granted by the Medical Superintendent as well as CEO of the Sai Sanjeevan Heart Hospital.

Results

Table 1: Total Number of Children Screened and Referred to Hospital.

	Class 6 school Roll n (%)	Number of Screened in school n (%)	Number Referred to Hospital n(%)	Total Presented to Hospital n(%)	Confirmed by Cardiologist n(%)
2018	2646 (31)	2308 (32)	90 (24)	4 (2)	3(2)
2019	2641 (32)	2249 (31)	160 (42)	75(40)	74(48)
2020	2452(34	2167(30)	108 (28)	80 (43)	57 (37)
2021	468 (10)	408 (6)	16 (4)	25 (13)	20 (13)
Total	10,853	7132 (54)	374 (5)	184 (49.1)	154 (84)

Study recruitment showed that of the 10, 853 patients that were enrolled in the school roll, 7132 (65%) got screened of that 373 (5%) were referred for confirmation to a health facility. 50.8% were lost to follow-up and 184 (49.1%) presented to a health facility of which 30 patients were noted do not have fulfilled the RHD criteria and 154 (83%) were registered as new RHD cases.

Table 2: Demographic Characteristics of Study Population.

Characteristics	Total N=154 (%)
Age in Years (mean +)	**11.6 + 1.4**
10 years	11 (7)
11 years	55 (35.7)
12years	60 (38.9)
13 years	28 (18)
Gender n(%)	
Male	71 (46.1)
Female	83 (53.5)
Ethnicity n (%)	
I-Taukei	123 (79.8)
Fijian of Indian descent	20(12.9)
Others	11(7.1)
Disease Severity n (%)	
Mild RHD	108 (79.8)
Mod erate RHD	41 (26.6
Sever RHD	5 (3.2)
Valves Affected n (%)	
Mitral Valve	93 (60.3)
Aortic Valve	23 (14.9)
Both	38 (24.6)

Study demographics showed that of the 154 patients that were screened. More of the children were within the age of 12 years 60 (38.9%). Gender distribution showed more females 83(53%) than males 71 (46.1%). More I-taukei 123 (79.8%) had RHD than the other ethnicity. RHD severity showed that Milder RHD were being picked up 108 (79.8%) with mitral valve lesion being the commonest 93 (60.3%).

Table 3: Showing the turn Around time from Echo to Central Registration.

Not Documented	<2 Weeks	2-4 Weeks	>4 Weeks	> 3Months
3	42	10	89	10

Table 3: showing that majority of children in the study were turning up to a health facility >4 weeks after initial screening that is 89 (59.5%) patients, and 10 (6.4%) of patients took > than 3 months to present for central registration. Together making 65% or more than half of the children presenting >4 weeks after their initial echo.

Table 4: The cumulative incidence calculated for the study was 21 per 1000.

Total Number of kids Screened	7132
Total Number confirmed by Pediatrician	154
Minimum Cumulative Incidence	21/1000

Table 6: Number of Follow-up Clinics and Defaulters.

Year	Defaulted	Good Follow-up
2018	-	100%
2019	37.5%	62.5%
2020	96%	3.7%
2021	91.6	16.6%

Table 6 shows that 2018 had 100% return of all follow -up patients in 2019 defaulter cases were noted to be 37.5% however good follow-up was 62.5% .In both 2020 and 2021 the graph shows that there was a tendency for more defaulters 96% and 91.6% than follow-ups 3.7% and 16.6% respectively.

Graph 1: Adherence for 6 Months Follow-up.
Despite the Covid pandemic, 6-month adherence was good 64%.

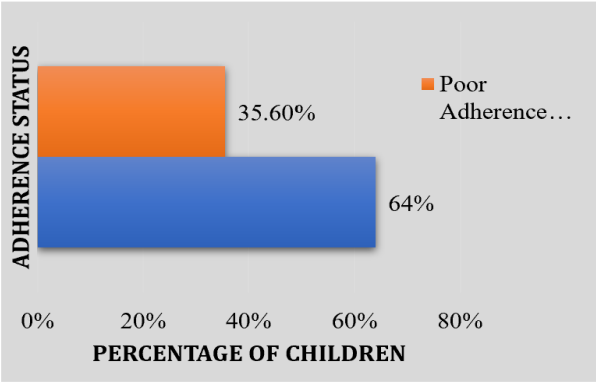


Table 7: Adherence in Relation to Demographic Factors and Statistical Calculations.

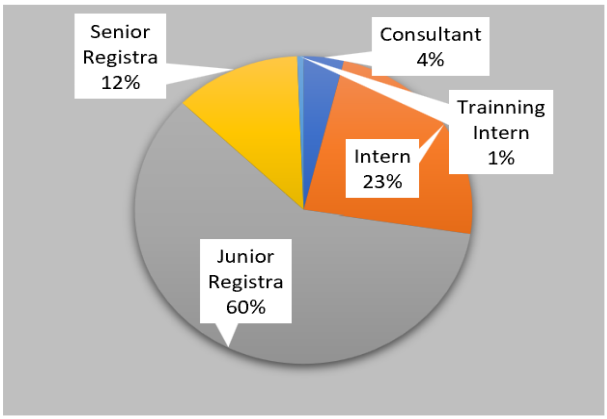
	Odd Ratio	95% CI	P-Value
Good Adherence Itaukei vs Non Itaukei	0.64	0.2 to 1.7	0.3 *NS*
Good Adherence 4 versus 3 weekly	0.3	0.04-3.3	0.3 *NS*
Good Adherence in Females versus Males	1.09	0.4-2.4	0.3 *NS*

When adherence was compared to demographic factors such as ethnicity, frequency of secondary prophylaxis and gender they did not reach any statistical significance.

Table 8: Reasons for Non-Adherence to Secondary Prophylaxis.
Table above which showed the reasons to why patients had stopped their secondary prophylaxis, with most of the parents indicating Covid-19 as the main contributing factor to stopping their secondary prophylaxis. This was followed by the reasoning of child looking too well 9 (3.5%)to be sick , and misplacing of card, herbal medication 2,2, (1.2%) and transport issues 1 (0.6%).

Reasons for Defaulting	Number of Defaulters
Child too well not thinking they need Benzapen	9
Covid -19 lockdown	13
Transportation Issues	1
Herbal Medication Use	2
Misplaced their RHD card	2

Pie Graph 3: Medical personal responsible for central registration



Central registration pie chart shows that the majority of the patients were registered by the junior registrar on initial presentation 60%. Interns 23% followed with senior registrars 12% . Consultants made up 4% and Training interns also making up 1% of central registration

Discussion

This study is the first of its kind in Fiji to specifically audit the school screening program for Rheumatic Heart Disease (RHD). Within the study's limitations, we found a significant attrition rate of 50.8% among those screened and referred to the hospital. One notable factor contributing to this attrition, as highlighted in both this study and previous research, is the distance from the main registration facility (CWMH/Sai Prema) to the patients' residences.

The geographical spread of residences relative to registration facilities often requires a two-bus journey of approximately 20 kilometers. St. Neha et al. (2019) examined defaulter rates and noted that patients living within 5 kilometers of a health center were more likely to adhere to primary prevention measures. In contrast, those living 10 kilometers or more from a facility exhibited higher rates of default, a trend reflected in our findings.

Moreover, a commentary by Remond et al. critically addresses the challenges faced in regions with underdeveloped infrastructure and low socioeconomic status, particularly regarding the utility of echocardiography. The authors pointed out the limitations of echocardiography, specifically its lack of specificity, which can result in a higher number of false positives. This not only leads to increased costs and inconvenience for families needing to confirm diagnoses but also causes significant emotional stress when children must return for additional echocardiograms only to be informed that their scans were normal.

Interestingly, our results indicate that children are presenting for central registration more than four weeks after screening, despite findings of moderate to severe RHD. Timely initiation of secondary prophylaxis is crucial, as early intervention plays a vital role in halting disease progression. Remond et al. emphasize that early initiation

of secondary prophylaxis during the natural history of the disease is essential for effective management. This is supported by recent clinical trials conducted by Andrea et al., which demonstrated a 0.8% reduction in the risk of disease progression in the prophylaxis group compared to an 8.2% risk in the control group. Additionally, ongoing studies, such as the GOAL study in Uganda, have shown that secondary antibiotic prophylaxis can significantly reduce the risk of disease progression over two years in patients with subclinical or latent RHD. These findings provide reassurance to parents, emphasizing that proactive measures can prevent disease advancement.

What does this mean for us?
Our study underscores the concerning delay of up to three months in initiating secondary prophylaxis from the time of the first echocardiogram. This delay is particularly alarming given that, by the time of initial registration, many patients already exhibit significant valvular damage. Such a prolonged wait adversely impacts the efficiency of case detection and treatment, presenting a considerable public health and clinical dilemma.

Additionally, we noted a striking lack of dental reviews during the initial registration process, with only 1% of cases receiving such assessments prior to central registration. Dental health is crucial for patients with RHD, as highlighted in local RHD guidelines, which state that access to dental care and hygiene is vital in minimizing complications associated with RHD. Maharaj and Parrish also emphasize that preventing infective endocarditis and recurrences of rheumatic fever should be integral to the care of RHD patients to reduce unnecessary morbidity and mortality in developing countries.

Further emphasized by the study conducted by Sharma and Toor, there is a documented increased risk of Rheumatic Heart Disease (RHD) associated with poor oral hygiene, which propagates streptococcal infections that lead to rheumatic fever (RF) and subsequently progress to RHD. In a hospital surveillance study by Baro et al., it was reported that 47% of RHD patients had dental caries, 30% had missing teeth, and 63% were unaware of the importance of oral hygiene in relation to RHD.

The cumulative incidence calculated in this study was 21 per 1,000, representing a minimum estimate, as not all referred cases presented to the hospital. Therefore, the actual incidence of RHD is likely higher if all children had attended central registration. This study's incidence aligns with a national cumulative incidence reported over a five-year surveillance period, which also showed an RHD incidence of 21 per 1,000. This finding is consistent with recent meta-analyses that placed clinically silent RHD incidence at 21.1 per 1,000.

Our study suggests that poor adherence to secondary prophylaxis was particularly associated with the I-Taukei population. Although further analysis did not reach statistical significance, this finding is consistent with local studies, such as Engelman et al., which highlighted ethnicity as a significant factor influencing adherence rates. Their study indicated that non-I-Taukei individuals demonstrated better adherence compared to the I-Taukei population, attributing this discrepancy to complex sociocultural and environmental factors.
When comparing adherence rates by gender, our findings indicated better adherence among females, a result corroborated by other studies, including Ehmke et al., which also reported higher adherence in females compared to males.

In addition to highlighting the impact of COVID-19 on adherence, our study identified factors similar to those reported in global studies. These studies indicate that distances greater than 10 kilometers negatively affect adherence to benzathine prophylaxis, with children appearing well being cited as a reason for missed injections. Participants in our study who had ceased benzathine injections cited transportation difficulties and distance as key factors contributing to their default.

Although factors such as pain at the injection site and forgetfulness regarding injection times were not prevalent reasons for ceasing injections in our study, they were noted in other research, such as that by Musoke et al. Engelman et al. suggested that patient education plays a crucial role in promoting adherence. They distinguished between education provided to screened patients diagnosed with RHD and those diagnosed clinically during hospital admission, noting that the latter typically had better follow-up due to the memorable nature of the health event and healthcare interaction, which may enhance future adherence.

Despite our study indicating good benzathine adherence, a notable 34% of participants had ceased injections. This underscores the importance of comprehensive counseling during initial registration, which our study revealed was often conducted by junior team members, including interns and junior registrars (23% and 60%, respectively). Engelman et al. found that families received some education at diagnosis; however, deficiencies in follow-up may have hindered the reinforcement of health promotion messages appropriate for different stages of childhood, leading to families deciding to discontinue treatment. This indicates the critical need for effective counseling, particularly during initial interactions. Consequently, there is a call for more aggressive counseling during initial registration and consideration of whether senior medical personnel should lead the counseling and registration of these patients at the onset.

Conclusion

In summary, our study has demonstrated that the school screening process is effective in identifying cases of Rheumatic Heart Disease (RHD). However, the pathway for ensuring that these positive cases complete their registration raises significant concerns, with 50.8% of identified cases failing to present for central registration. Screening 7,000 children is a substantial undertaking, particularly given current resource limitations.

It is crucial to ensure that the 374 positive cases identified return for their central registration, as this is a vital initial step in reducing the burden of illness in our communities. As previously mentioned, secondary prophylaxis can lead to disease regression in mild or latent cases. Thus, strengthening this public health strategy for early detection is essential to ensure that the considerable efforts spent on screening do not go to waste due to patient default before initiating secondary prophylaxis.

While most cases of RHD are managed according to Fiji's RHD guidelines, the referral for dental reviews is notably inadequate. Strong evidence supports the need to improve this referral pathway, as it is critical for the ongoing management of RHD. The cumulative incidence identified in our study was 21 per 1,000, representing a minimum estimate, as not all referred cases presented to the hospital. Consequently, the actual incidence of RHD is expected to be higher if all children had attended central registration. Our six-month follow-up indicated that 64% of children had good adherence (>80%). However, further analysis of factors influencing non-adherence did not reveal statistical significance regarding gender, ethnicity, or duration of prophylaxis.

Recommendations

Before rolling out this screening process nationwide, the following recommendations should be instituted:

Counseling and Registration On-Site

Train more healthcare personnel in echocardiology to confirm RHD diagnoses and provide counseling to patients and their families. This approach would enable immediate registration and initiation of secondary prophylaxis, reducing waiting times and financial constraints associated with travel to health facilities.

Increasing Clinic Booking Capacity

- Anticipating that screening will reveal a large number of children with RHD, it is imperative to either increase clinic capacity or extend the number of days patients can be seen.
- Establish an RHD HUB dedicated to screening patients diagnosed in schools, staffed by healthcare personnel specialized in this area. This initiative could reduce default rates related to long wait times, misplaced clinic cards, and parental indecision.

Strengthening Capacity of Primary Health Facilities

- Empower Medical Officers (MOs) in peripheral health centers to conduct registrations and referrals. This can be achieved through training during their internship year or regular workshops focused on effective counseling.
- Enhance access to the Rheumatic Fever Information System (RFIS) or consider transferring RHD information to the Patient Administration and Tracking Information System (PATIS). The accessibility and accuracy of patient information should be improved to ensure efficient management.
- Strengthen follow-up capabilities by notifying main facilities about patient status. This allows RHD nurses or zone nurses to keep track of patients' health and prophylaxis status, thereby reducing default rates and addressing parental hesitancy regarding secondary prophylaxis.

Maintaining Alternative Backup Plans During Natural Disasters

- Develop contingency plans for disruptions to screening and secondary prophylaxis during pandemics, cyclones, and flooding.
- Consider allocating dedicated resources, such as a mobile van, to reach marginalized or vulnerable populations during challenging times, ensuring they receive necessary injections.
- Ensure that RHD is prioritized during pandemics, preventing nursing resources from being diverted to other health sectors. Given the endemic nature of RHD in Fiji, it should remain a priority to prevent lapses in care.

Additional Recommendations

Dental Referral

Increase awareness within the dental department and the pediatric team by establishing standard operating procedures (SOPs) to ensure that all medical officers follow a consistent process. This will help ensure that dental personnel are aligned with registration protocols and that no steps are overlooked in the referral process.

Digitalized Forms & Patient Access to PATIS/RFIS

During the outreach for adherence feedback, it was noted that many patients had changed phone numbers and addresses, leading to difficulties in contact. Implementing a digitalized patient portal or profile would allow patients to update their contact information and addresses. Additionally, benzathine prophylaxis records could be stored in this portal. This ensures that even if patients lose their RHD book, they can still access their information through the PATIS/RFIS system.

In-Depth Study

Conduct further research into the ethnic distribution of RHD among affected children. This data can inform policy reforms and tailored interventions that address the unique needs of different population groups.

Study Limitations

This study has several limitations:

Retrospective Nature: The first part of the study relied on available records, which may not comprehensively represent the entire population of interest.

Lack of Data on Sensitivity and Specificity: The study could have provided more meaningful statistical analysis regarding the sensitivity of portable handheld devices if data on false negatives had been available. Additionally, demographic characteristics necessary for calculating statistical relevance (e.g., p-values) were not accessible for the entire screened population of 7,132 children.

Insufficient Computerized Data: A significant portion of data has not yet been digitized, and the RFIS requires updates. Communication breakdowns between the screening team and the data compilation team may hinder the study's outcomes and contribute to inconsistencies in RFIS updates.

Contact Challenges: The inability to reach 34% of patients for adherence feedback may have impacted the study's results, potentially skewing the findings.

Sample Size Limitations: The study did not achieve the desired sample size, resulting in many analyses lacking statistical significance.

Lack of Data on Reasons for Poor Adherence: The study did not collect data on the reasons behind poor adherence, which would have provided valuable insights for comparison with earlier local studies to identify any changes over the years in Fiji.

Research Approval

The study received approval from the College of Human Health Research Ethics Committee, Fiji Institute of Pacific Health Institute, under approval number 238.20.

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