Evaluating the ARF Diagnosis Calculator: A qualitative content analysis

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Introduction

Acute Rheumatic Fever (ARF) is an autoimmune inflammatory response to an infection with group A β-haemolytic streptococcus bacterium (GAS), in genetically susceptible individuals (1). The infection primarily affects the joints, skin, heart and brain in the acute period, manifesting as one or more of polyarthritis, erythema marginatum, subcutaneous nodules, carditis or chorea. Although ARF in the acute phase is rarely life-threatening, the progression to Rheumatic Heart Disease (RHD) is the primary sequelae, leading to significant morbidity and mortality (2).

Repeated episodes of undiagnosed and untreated ARF are the primary risk factors for RHD development (1). An accurate diagnosis then presents an opportunity to reduce recurrent episodes of ARF and therefore progression to RHD. Diagnosis however remains clinically challenging due to the lack of a specified gold standard test(3). Instead, diagnosis is a clinical decision supported by a complex algorithm, integrating the Jones criteria for diagnosis by the American Heart Association (AHA) and local guidelines (1). High regional variation within Australia also complicates diagnosis with many clinicians being inexperienced in ARF diagnosis and management.

The *ARF Diagnosis Calculator* was developed in 2014 by RHD Australia to reduce the diagnostic complexities of ARF into a simple and easy to use tool for clinicians. The calculator is embedded into the *RHDApp*, which provides further educational resources regarding ARF and RHD. Mobile health (mHealth) is an exciting new area of medicine presenting opportunities to support clinical decision making however is a largely unregulated field.

The aim of this study was to evaluate the *ARF Diagnosis Calculator* across three cohorts to assess its usability, accessibility and accuracy. The first, a survey of clinicians working at the Top End Health Service in the Northern Territory (NT), the second semi-structured interviews with specialist clinicians. The third involved comparison of ARF diagnoses made by a clinical team of experts against that of the calculator using already collected data through the START study (HREC-18-3126).

Results

Cohort One: Survey

A total of 35 survey responses were collected, 2 did not complete the survey and 9 were excluded given that they did not have the RHDApp downloaded on their phone, leaving a final 23 survey participants for analysis. Numerical values were assigned to a 6-point Likert scale (1: strongly disagree, 2: disagree, 3: slightly disagree, 4: slightly agree, 5: agree 6: strongly agree). The ARF Diagnosis Calculator was highly recommended (Mean 5.57, SD 0.59), considered easy to use (Mean 5, SD 1.13) and easier to use than hardcopy guidelines (Mean 5.43, SD 0.79). Participants were confident in the results of the calculator (Mean 5, SD 0.74) and believed it was helpful in identifying possible, probable, and/or definite cases of ARF (Mean 5.09, SD 1.04).

Cohort Two: Semi-structured Interviews

Semi-structured interviews were analysed through qualitative content analysis to identify five overarching themes.

1. The diagnosis of ARF remains a challenging clinical diagnosis
2. In remote settings the calculator will be inaccurate secondary to a lack of investigations, i.e. echocardiogram, ESR, ASOT/AntiDNase B.
3. The ARF Calculator can be oversensitive if not taken within the clinical context.
4. The ARF calculator is easily accessible and easy to use.
5. The ARF calculator is informative and provides educational opportunities for junior staff.

Cohort Three: Diagnosis Calculator vs Clinical Panel.

35 cases with clear diagnoses given by an expert clinical panel were placed through the ARF Diagnosis Calculator algorithm. Four diagnoses differed. In two cases, the calculator determined the case a “definite” diagnosis of ARF, however following further inspection of case notes the clinical panel determined these as “possible” and “not ARF” based upon clinical notes and plausible differential diagnoses that fit the clinical picture better. The third case was determined “possible” through the calculator however had a plausible differential diagnosis and was classified “not ARF” by the panel. The last case was considered “possible” by the calculator and “probable” by the panel with the difference relating to a higher degree of clinical suspicion by the expert panel.

Discussion

This study provides evidence for the acceptability and usability of the ARF Diagnosis Calculator in the diagnosis of ARF in the Northern Territory. Across the first two cohorts the calculator was considered easy to use, accessible and preferrable to hardcopy guidelines. It was strongly recommended across both cohorts. The ARF Diagnosis Calculator was also considered educational and informative.

Providing easy access to guidelines is essential to improving the diagnosis of ARF, especially given the transient nature of the NT health workforce. By providing local guidelines via mHealth, these clinicians now have access to informative, user-friendly and easily accessible resources at point of care opportunities.

This study identified concerns regarding the oversimplification of an ARF diagnosis and the oversensitivity of criteria that may disregard other more relevant conditions. Particularly in the case of possible and probable cases in which clinical suspicion of ARF can mean the difference between 12 months and 5 years of treatment. This was also identified within cohort three where two cases resulted in definite diagnoses by the calculator that were considered “possible” and “not ARF” by the expert panel, when taking into account the clinical context. Again in the other two differing cases, the assessment of clinical suspicion by the user dictated differing diagnosis between the calculator and panel.

Oversensitivity is often the aim in high risk populations to ensure atypical presentations are not missed, with evidence there are ongoing missed presentations of ARF in the NT. The ARF Diagnosis Calculator was considered an acceptable tool to assist with decision making however does not replace clinical experience and acumen. In remote areas the calculator also did not perform as well due to the lack of complete investigations available. In these areas simply a risk identification and transfer to a tertiary centre was deemed more appropriate.

Limitations: This study is limited by small sample size and generalisability. Triangulation of data across three cohorts identifies similar themes and confirmation of findings, strengthening internal validity.

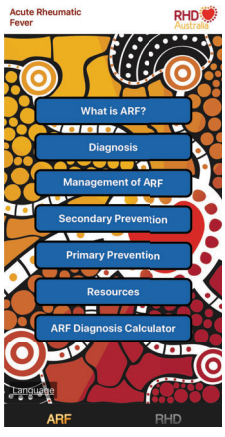

Figure 1: RHDApp home page

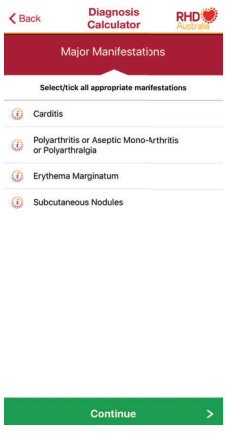

Figure 2: Question regarding the presence of major manifestations of ARF

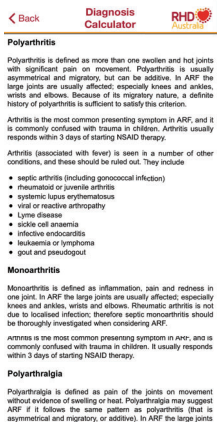

Figure 3: Further detailed information regarding arthritis embedded within the calculator.

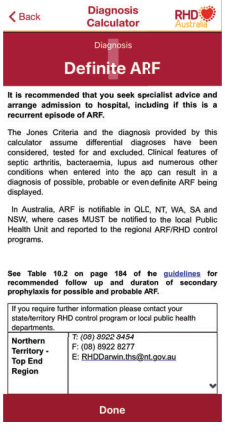

Figure 4: Final result from the calculator including details of notification requirements

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Ethics Approval was gained through the HREC of the NT Department of Health and Menzies School of Health Research (HREC: 2019-3505).

References:
1. RHDAustralia (ARF/RHD writing group). The 2020 Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (3rd edition). Darwin: Menzies School of Health Research; 2020.
2. Remenyi B, Elguindy A, Smith SC, Yacoub M, Holmes DR. Valvular aspects of rheumatic heart disease. *The Lancet*. 2016;387(10025):1335-1346.
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