

## Handheld echocardiography: a new tool for rheumatic heart disease screening in the developing world?

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We read with great interest the recent editorials written by Drs. Saxena (1) and Rémond (2) discussing the role of handheld echocardiography in rheumatic heart disease (RHD) screening in the developing world. The authors astutely point out that there are many yet unanswered questions before recommending the widespread use of handheld echocardiography for RHD screening.

RHD continues to pose a significant threat to public health in the developing world. In this setting, the majority of patients are diagnosed late, when they are symptomatic from heart failure or complications such as arrhythmia, endocarditis, and stroke (3). Additionally, up to 80% of these patients cannot recall an episode consistent with acute rheumatic fever, when initiation of secondary prophylaxis with scheduled penicillin injections would have been most effective. Late presentation leaves few options for intervention, particularly in the context of the developing world, where surgical and catheter-based interventions are severely limited by cost and lack of access.

Screening to detect early, asymptomatic RHD, then becomes quite important. Early detection of RHD affords patients the opportunity to be placed on secondary prophylaxis that may prevent recurrent streptococcal infections, and break the cycle that leads to chronic, advanced RHD. Auscultatory screening has been shown to be clinically ineffective, with both poor sensitivity and specificity (4). Echocardiographic screening has proven highly sensitive (5), but is limited by both the lack of financial and human resources in areas which likely have the highest prevalence of RHD.

Handheld echocardiography has the potential to lower the financial burden of an echocardiographic screening program; as it is significantly less expensive compared to

standard echocardiography equipment. Additionally, our recent study demonstrated that handheld echocardiography offers significant improvement over auscultation alone and is highly sensitive for detecting definite RHD (4,6). Handheld echocardiography was also significantly better than auscultation for the detection of borderline disease; however, the sensitivity was less than that for definite RHD and it is likely that some borderline cases would be missed with this approach. Given the lack of access to standard echocardiography, we believe that screening with handheld echocardiography is better than screening with auscultation or no screening at all. Adaptation of the World Heart Federation (WHF) criteria (7) for use with handheld echocardiography may improve sensitivity and specificity for the detection of RHD (8). Additionally, future improvements in handheld echocardiographic technology including the ability to perform continuous wave Doppler may further expand the role of handheld echocardiography in RHD screening.

Our study did not address the issue of limited human resources. We agree wholeheartedly with Dr. Saxena that the feasibility of large-scale echocardiographic screening for RHD hinges on the success of task-shifting; or moving echocardiographic screening into the hands of non-experts. Imperative to this approach would be creation of a highly sensitive and specific set of simplified echocardiographic screening criteria. A reasonable goal of these criteria would be identification of screen positive children, who would then receive an expert evaluation including a comprehensive echocardiogram, interpreted using the 2012 WHF guidelines (7).

Performance of simplified RHD screening guidelines will also need to be tested in the hands of non-experts. Dr. Mirabel and colleagues recently published an important study

comparing the combination of non-expert users, handheld echocardiography, and a simplified set of screening criteria (MR  $\geq$  2 cm or any AI) to a reference approach (expert users, standard portable echocardiography, and the 2012 WHF criteria), and found reasonable sensitivity (81%) and specificity (91%) for RHD detection (9). Our group has performed a similar, promising follow-up study in Uganda examining the performance of non-experts using simplified screening criteria and handheld echocardiography; which is currently under review. In order to be successful in task-shifting, investigations into standardized, replicable training programs for non-expert users will be imperative. A recently published pilot study (10) and the development of freely available interactive internet-based modules (<http://www.wiredhealthresources.net/EchoProject/>) are moving us closer to reaching this goal.

Lastly, we agree with Drs. Saxena and Rémond that the role of secondary prophylaxis in latent RHD is not fully understood. However, this remaining question largely applies to children found to have borderline RHD (2012 WHF criteria). Short-term follow-up of this borderline group suggests a potential for disease persistence and progression; 10% progressing to definite disease over 2 years (11). More importantly, echocardiographic screening reveals a true and meaningful burden of definite and previously undiagnosed RHD. Without early detection and prophylaxis, it is likely that many of these children will progress to advanced disease, and it is these children who may benefit most from the initiation of secondary prophylaxis.

There is clearly more work that needs to be done to understand the burden and impact of latent RHD. Handheld echocardiography represents an exciting advancement. While it is not perfect, it is more sensitive and specific for RHD screening than auscultation, and is more affordable than standard portable echocardiography. Task-shifting echocardiographic screening to non-experts is an essential step to practical and sustainable programs. Development and validation of simplified echocardiographic screening criteria, standardized training protocols, and competency training are critical future steps. Emerging data and continuing research on this subject is promising and may provide a practical solution for community-based RHD screening in the near future. Continued efforts to understand the natural history of latent RHD will be critical for refinement of screening protocols to target those at greatest risk for disease progression.

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### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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