Automated Respiratory Rate Counter to Assess Children for Symptoms of Pneumonia: Protocol for Cross-Sectional Usability and Acceptability Studies in Ethiopia and Nepal

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Abstract

Background: Manually counting a child's respiratory rate (RR) for 60 seconds using an acute respiratory infection timer is the World Health Organization (WHO) recommended method for detecting fast breathing as a sign of pneumonia. However, counting the RR is challenging and misclassification of an observed rate is common, often leading to inappropriate treatment. To address this gap, the acute respiratory infection diagnostic aid (ARIDA) project was initiated in response to a call for better pneumonia diagnostic aids and aimed to identify and assess automated RR counters for classifying fast breathing pneumonia when used by front-line health workers in resource-limited community settings and health facilities. The Children's Automated Respiration Monitor (ChARM), an automated RR diagnostic aid using accelerometer technology developed by Koninklijke Philips NV, and the Rad-G, a multimodal RR diagnostic and pulse oximeter developed by Masimo, were the two devices tested in these studies conducted in the Southern Nations, Nationalities, and Peoples' Region in Ethiopia and in the Karnali region in Nepal.

Objective: In these studies, we aimed to understand the usability of two new automated RR diagnostic aids for community health workers (CHWs; health extension workers [Ethiopia] and female community health volunteers [Nepal]) and their acceptability to CHWs in Ethiopia and Nepal, first-level health facility workers (FLHFWs) in Ethiopia only, and caregivers in both Ethiopia and Nepal.

Methods: This was a prospective, cross-sectional study with a mixed methods design. CHWs and FLHFWs were trained to use both devices and provided with refresher training on all WHO requirements to assess fast breathing. Immediately after training, CHWs were observed using ARIDA on two children. Routine pneumonia case management consultations for children aged 5 years and younger and the device used for these consultations between the first and second consultations were recorded by CHWs in their patient log books. CHWs were observed a second time after 2 months. Semistructured interviews were also conducted with CHWs, FLHFWs, and caregivers. The proportion of consultations with children aged 5 years and younger where CHWs using an ARIDA and adhered to all WHO requirements to assess fast breathing and device manufacturer instructions for use after 2 months will be calculated. Qualitative data from semistructured interviews will be analyzed using a thematic framework approach.

Results: The ARIDA project was funded in November 2015, and data collection was conducted between April and December 2018. Data analysis is currently under way and the first results are expected to be submitted for publication in 2020.

Conclusions: This is the first time the usability and acceptability of automated RR counters in low-resource settings have been evaluated. Outcomes will be relevant for policy makers and are important for future research of this new class of diagnostic aids for the management of children with suspected pneumonia.