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Title: Improving the diagnosis of pediatric pneumonia at village level: Testing the accuracy of smart phone applications measuring respiratory rate and O_2 saturation

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Body: Background: Pneumonia is the commonest killer of children under 5 yrs; most deaths occur in the poorest regions. To help improve diagnosis in low-resource areas, we developed iPod/cell phone applications able to measure respiratory rate (RR) and saturation (SpO_2). RR is measured using RRate® software [(1)] which calculates RR from 5 taps of the touch screen corresponding to 5 breaths. SpO_2 is measured using an MS-2040 circuit board-in-cable attached to the iPod port. For the study, applications were run on an iPod Touch 4. We tested their accuracy against accepted standards. Methods: Two blinded observers, in each of three Indian hospitals, made paired observations on 344 children fulfilling WHO criteria for pneumonia. Observer 1 measured RR by 1 minute auscultation (RR.ausc), plus SpO_2 using Masimo Rad7 (SpO_2.mas). Observer 2 measured RR and SpO_2 by iPod application (RR.tap and SpO_2.ipod). Paired results compared by Bland-Altman technique. Results: There were no significant differences between RR.ausc and RR.tap or SpO_2.mas and SpO_2.ipod, either within or between institutions (table 1)

Table 1

	RR.ausc vs. RR.tap bias	SpO2.mas vs. SpO2.ipod bias
Bangalore 1	-1.3 +/- 6.4 bpm	0.6 +/- 3.0 %sat
Chennai	1.3 +/- 4.6 bpm	0.3 +/- 1.1 %sat

Bangalore 2	0.0 +/- 2.7 bpm	0.1 +/- 1.1 %sat
Pooled data	-0.4 +/- 5.2 bpm	0.4 +/- 2.4 %sat

Conclusions: SpO_2 and RR can be measured accurately and reproducibly using cell phone technology that is easy to use and teach. This has the potential to improve the diagnosis and management of children with respiratory diseases in under-served areas. Reference: 1. https://itunes.apple.com/ca/app/rrate/id581390517?mt=8.