Repeatability of Pulse Oximetry Measurements in Children During Triage in 2 Ugandan Hospitals

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Background: In low- and middle-income countries, health workers use pulse oximeters for intermittent spot measurements of oxygen saturation (SpO2). However, the accuracy and reliability of pulse oximeters for spot measurements have not been determined. We evaluated the repeatability of spot measurements and the ideal observation time to guide recommendations during spot check measurements.

Methods: Two 1-minute measurements were taken for the 3,903 subjects enrolled in the study conducted April 2020–January 2022 in Uganda, collecting 1 Hz SpO2 and signal quality index (SQI) data. The repeatability between the 2 measurements was assessed using an intraclass correlation coefficient (ICC), calculated using a median of all seconds of non-zero SpO2 values for each recording (any quality, Q1) and again with a quality filter only using seconds with SQI 90% or higher (good quality, Q2). The ICC was also recalculated for both conditions of Q1 and Q2 using the initial 5 seconds, then the initial 10 seconds, and continuing with 5-second increments up to the full 60 seconds. Lastly, the whole minute ICC was calculated with good quality (Q2), including only records where both measurements had a mean SQI of more than 70% (Q3).

Results: The repeatability ICC with condition Q1 was 0.591 (95% confidence interval [CI]=0.570, 0.611). Using only the first 5 seconds of each measurement reduced the repeatability to 0.200 (95% CI=0.169, 0.230). Filtering with Q2, the whole-minute ICC was 0.855 (95% CI=0.847, 0.864). The ICC did not improve beyond the first 35 seconds. For Q3, the repeatability rose to 0.908 (95% CI=0.901, 0.914).

Conclusions: Training guidelines must emphasize the importance of signal quality and duration of measurement, targeting a minimum of 35 seconds of adequate-quality, stable data. In addition, the design of new devices should incorporate user prompts and force quality checks to encourage more accurate pulse oximetry measurements.