A low-cost, color-coded, hand-held spring scale accurately categorizes birth weight in low-resource settings

Luke C Mullany1, Gary L Darmstadt1,2, Patricia Coffey3, Subarna K Khatry4, Steven C LeClerq1,4, James M Tielsch1

1Johns Hopkins Bloomberg School of Public Health, Baltimore MD; 2Save the Children-US, Washington, DC; 3Program for Appropriate Technology in Health (PATH); 4Nepal Nutrition Intervention Project, Sarlahi (NNIPS), Nepal

BACKGROUND

- Neonatal mortality rates are highest in resource-poor settings where community members have limited access to health care
- Low birth weight (LBW) infants are at highest risk, but survival can be improved with targeted life-saving interventions
- Community health workers need affordable and accurate tools to classify infants into birth weight categories
- Surrogate anthropometric measures (chest, mid-upper arm, thigh circumference, etc) must be established separately for each community, limiting their utility at scale
- Program for Appropriate Technology in Health (PATH) developed a new low-cost scale, the BirthWeigh III

RESEARCH OBJECTIVE

To evaluate the accuracy of a low-cost, hand-held spring scale (BirthWeigh III) relative to a gold standard newborn weighing scale

STUDY DESIGN AND IMPLEMENTATION

Setting / Study Population
- Sarlahi District, Nepal
- March – July 2004
- Sub-set of newborns enrolled in a trial of the impact of antiseptics on neonatal morbidity and mortality

Design
- Community-based validation study of hand-held scale as compared to digital scale
- Gold Standard: SECA 727 Neonatal Digital Scale, precise to 2 grams
- Test Scale: BWIII
- Project workers followed pregnant women until delivery
- Newborn infants were measured in the home
- Sensitivity, specificity, and predictive values were estimated for BWIII

Infants less than 2000 grams (LBW)

<table>
<thead>
<tr>
<th>BirthWeigh III Scale</th>
<th>Gold Standard Classification</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2000 grams</td>
<td>Normal (&gt; 2500 g)</td>
<td>510</td>
</tr>
<tr>
<td>2000 – 2499 grams</td>
<td></td>
<td>1310</td>
</tr>
<tr>
<td>2500+ grams</td>
<td></td>
<td>1820</td>
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Sensitivity 93.7 (91.3, 95.7)
Specificity 99.6 (99.2, 99.8)
Positive Predictive Value 93.9 (91.5, 95.8)
Negative Predictive Value 97.6 (96.6, 98.3)

CONCLUSIONS

- This lightweight and affordable scale consistently and accurately classified newborns into birth weight categories
- For LBW, sensitivity and positive predictive values were greater than that achieved under most rules for anthropometric surrogate measures
- Offers facility to classify into multiple weight categories extending use to weight-dependent interventions (antibiotics, vitamin A dosing, topical emollient therapy)
- Incorporating this inexpensive technology within community-based initiatives could decrease health inequities by enabling the targeted delivery of life-saving interventions to those in greatest need

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