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

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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**
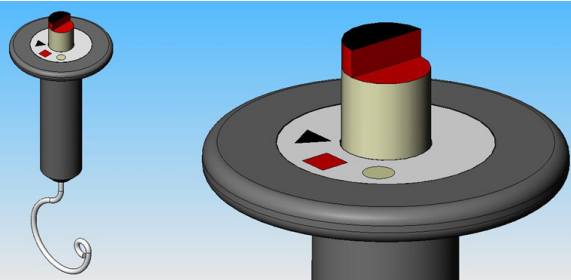
- Classifies infants into three birth weight categories:
  < 2000 grams   2000 – 2499 grams   2500+ grams
- Step indicator on top allows use in low-light conditions
- Color-coded, no need for literacy

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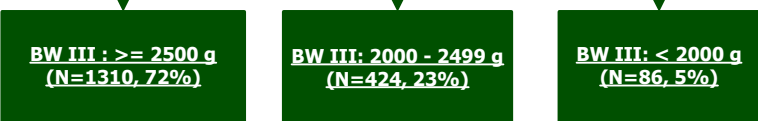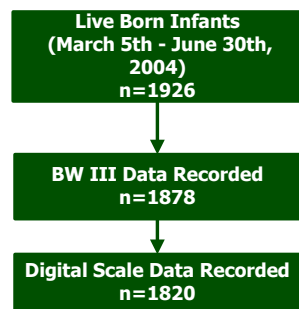
Design
- Community-based validation study of hand-held scale as compared to digital scale
- Gold Standard: SECA 727 Neonatal Digital Scale, precise to 2 grams
- Test Scale: BWIII
- Project workers followed pregnant women until delivery
- Newborn infants were measured in the home
- Sensitivity, specificity,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

Project worker weighs an infant with the BWIII

PARTICIPANTS / STUDY FLOWCHART

- **1820 infants in the study**
- **Approximately 10 minutes passed between test and gold standard measures**
- **90% of infants measured within 72 hours of birth**

- **Gold standard LBW prevalence = 28.1%**

Live Born Infants (March 5th - June 30th, 2004) n=1926
↓
BW III Data Recorded n=1878
↓
Digital Scale Data Recorded n=1820
↓
- BW III : >= 2500 g (N=1310, 72%)
- BW III: 2000 - 2499 g (N=424, 23%)
- BW III: < 2000 g (N=86, 5%)

LOW BIRTH WEIGHT INFANTS

	Gold Standard Classification		
BirthWeigh III Scale	**LBW**	**Normal (≥ 2500 g)**	**Total**
LBW	479	31	510
Normal (≥ 2500 g)	32	1278	1310
Total	511	1309	1820

Sensitivity	93.7 (91.3, 95.7)
Specificity	97.6 (96.7, 98.4)
Positive Predictive Value	93.9 (91.5, 95.8)
Negative Predictive Value	97.6 (96.6, 98.3)

INFANTS LESS THAN 2000 GRAMS

	Gold Standard Classification		
BirthWeigh III Scale	**< 2000 g**	**≥ 2000 g**	**Total**
< 2000 g	79	7	86
≥ 2000 g	11	1723	1734
Total	90	1730	1820

Sensitivity	87.8 (79.2, 93.7)
Specificity	99.6 (99.2, 99.8)
Positive Predictive Value	91.9 (84.0, 96.7)
Negative Predictive Value	99.4 (98.9, 99.7)

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**