Triaging infection and pneumonia among <5 yrs. children

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Among 5.9 million annual deaths in children <5 years of age in 2015:
- 2.7 million neonatal deaths
  - > 400,000 newborn died due to sepsis and other infections
  - about 160,000 neonatal death from acute lower respiratory infections
- More than 900,000 children died from pneumonia under 5 years
  - accounting for 16% of under-five child mortality worldwide,
  - 3% of which are newborns.
Triaging Pneumonia

- WHO suggested fast breathing cut-offs help clinical diagnosis of pneumonia:
  - <2 months - ≥60 breaths/min
  - 2-11 months - ≥50 breaths/min
  - 12-59 months - ≥40 breaths/min

- Assessing fast breathing is crucial for triaging children’s pneumonia.

- Updated WHO guideline also recommends the use of a Pulse Oximeter to determine oxygen saturation ($\text{SpO}_2$).
Triaging infection/sepsis

- For triaging sepsis in neonates and young infants – two key vital signs
  - fast breathing (≥60 breaths/min), and
  - temperature ≥38°C or <35.5°C
Challenges with currently available diagnostic tools

Respiratory counter
- UNICEF ARI Timer
- Watch
- Counting Beads
- Cell Phone

- not reliable and may lead to miscounting;
- CHW needs to watch the child’s chest and belly for resp. count.

Pulse Oxymeter
- Single function device
- require different probes for different age groups;
- Expensive and not widely available in resource limited settings.

Thermometer
- May lead to subjective and unreliable temp. assessments
- Not long-lasting
Considering challenges of available tools for respiration count, as well as in response to UNICEF’s call for innovation for improved pneumonia diagnostics, we developed an automated respiration counting device and named as ChARM.

**ChARM is designed to** -

- be placed around the child’s belly,
- measure automatically respiratory rate, and
- classify fast breathing according to WHO guidelines.
Summary of ChARM study

- Root Mean Squared Error (RMSE) values (overall: 1.9 and balanced: 2.1) were close to 2
- Balanced percentage below 2 RPM as 83% which is higher than values revealed by clinician (73%);
- These study results indicate that ChARM device is at least as good as a trained physician for measuring breath count.
- Given these findings, ChARM device can be recommended an acceptably accurate and alternate method of breath count for under 5 children population.
What’s next ....

• An integrated, single device
  – For counting respiration, pulse rate, measuring oxygen saturation and temperature
  – To be used by health workers at point-of-care
Unique Features:
• Compensates for motion artifacts;
• Rechargeable unit to run several days with normal use (~10 measurements/day)
• Able to withstand the environmental conditions in rural areas
Impact

- Increased adherence to the WHO IMCI guidelines → to classify and diagnose and to reduce unnecessary referrals.

- More accurate diagnosis → reduce unnecessary treatment with antibiotics → less antibiotics resistance.
Predicted market size and service coverage

**Total Available Market**

Africa, LatAm, India, China, Asia Pacific:

>3M CHWs and >6.5M nursing and midwifery staff

*WHO & World Bank*

**Addressable Market Volume**

Estimate 40% of the CHWs and 30% of the facility segment to be addressable, resulting in 3M units.

330M neonates and young children annually

Assuming 10% of the addressable market at an average use of 3 times a day.
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