

Neonatal vital signs monitor

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Technology description

Unmet Need

Over 2.9 million newborns die annually within the first 28 days of life, with mortality rates highest in the first 7 days. The majority of these deaths occur in rural areas of developing countries, and are largely due to preventable causes such as sepsis, pneumonia, and hypothermia. Timely identification of symptoms and referral to community health workers (CHWs) can prevent infant deaths. Typically, CHWs in developing regions are responsible for screening and referring ill infants, but the number of CHWs remains insufficient to provide timely post-natal checkups to most newborn infants. Overburdened CHWs may not be able to visit infants during their critical first week of life, so infants with signs of severe illness may not be identified until it is too late to impact survival. Infant mortality most commonly occurs at home, where there is no access to equipment to monitor infants' vital signs. Reliance on CHWs is not adequate, so the burden of identifying infants' symptoms lies on other caregivers, particularly the mothers. Attempts to train mothers to recognize signs of infant illness show mixed results as oftentimes warning signs such as "chest indrawing," an indicator of life-threatening pneumonia, are difficult for trained health workers, let alone non-medical professionals, to accurately recognize. Thus, there is a need for a low-cost, easy-to-use monitoring device that notifies mothers of critical signs of illness in their infants and motivates them to seek assistance from CHWs or regional hospitals in a timely manner.

Technology Overview

Neonatal Monitoring (NeMo) is a two-part system comprised of a physical paper sensor to monitor infants' respiratory rate and temperature and a smartphone-based application to guide the mother through a clinical assessment of the baby. The paper sensor strip is fastened across the newborn's abdomen with a small belt, and is produced by printing conductive ink through a desktop inkjet printer onto photo paper. The printed sensor functions as a thermometer and a flex sensor to monitor respiratory rate. An audio cable is clipped to the paper sensor and connected to the audio-jack of a smartphone equipped with the NeMo app. The resistive properties of the conductive ink enable the infant's abdominal flexion to be analyzed by the NeMo app. The app software is simple to use and delivers data about the newborn's temperature and breathing. Mothers are prompted to answer yes-or-no questions that assess seven signs of neonatal illness recognized by the World Health Organization, including danger signs that the child might be displaying, such as convulsions and

reduced breast feeding. Positive tests for illness trigger a direct referral to the CHW and instruct mothers to seek medical attention for their infant. By using NeMo, families do not have to rely on CHWs to visit before detecting critical symptoms; instead, the device empowers mothers to promptly seek out medical aid during the critical 7-day period following birth, reducing the risk of undetected illnesses that result in infant mortality. The paper, ink, and wires used in the sensors are low-cost and easily distributed in mass quantities by hospitals, and the NeMo app is compatible with low-cost smartphones that cost \$40, making the device highly accessible in rural communities. The current model of this technology is able to detect potential signs of illness as reliably as CHWs, and includes a pre-programmed guide to help families assess danger signs.

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