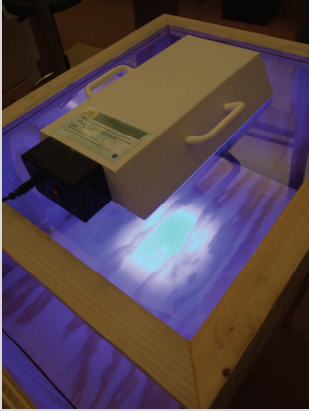
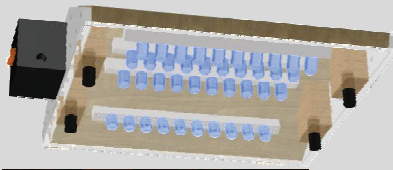


Phototherapy Lights

Phototherapy lights in use on the incubator

Neonatal Incubator and Bilirubin Phototherapy Device

Global Health Challenge

Premature and ill newborn babies often have trouble maintaining an appropriate body temperature and need to be placed in incubators where the temperature of the air that surrounds them can be elevated. More than 60% of newborns have neonatal jaundice which is the yellowing of the skin due to the accumulation of bilirubin in fatty tissues under the skin. In many cases, this condition clears up by itself, however, in severe cases, high levels of bilirubin can lead to brain damage. The most common way to treat neonatal jaundice in developed countries is phototherapy where an infant's skin is exposed to light with a wavelength of 430-490 nm and an irradiance of at least 30 $\mu\text{W}/\text{cm}^2/\text{nm}$. With phototherapy, bilirubin molecules are broken up and safely removed from the body. In developing countries, availability of appropriate incubators and phototherapy treatment is limited by high equipment costs (\$1500—\$2500 per item) and maintenance. Our challenge was to develop an effective, inexpensive, and easy to maintain incubator and phototherapy device to treat newborn babies.

Appropriate Solutions and Current Status

Two simple devices have been used to solve these problems. To address the incubator need, an existing design from Queen Elizabeth Central Hospital in Blantyre, Malawi was modified. This design, which can be built for less than \$50 and with material available in most developing countries, uses four light bulbs in the base of the covered crib, in a compartment away from the infant to warm the air in the area where the baby rests. By adjusting the intensity of the light bulbs, the temperature around the infant can be controlled.

To address the need for phototherapy, an innovative, yet simple, design was developed to deliver the appropriate light in an effective manner (30 $\mu\text{W}/\text{cm}^2/\text{nm}$ and a wavelength of 470 nm) for less than \$30. The device uses 8 rows of 10 10mm 470 nm LEDs. The long-lasting LEDs are mounted on breadboards, which makes it easy to replace a bulb if necessary. The device is designed to work with wall power, but can be adapted in future developments to work with battery power or solar power. Dr. Maria Oden from Rice University and Dr. Cabrera-Meza from Texas Children's Hospital and served as mentors in the development of this solution.

The cribs are being used in rural clinics in Nicaragua and Lesotho and the phototherapy lights have recently been delivered to Blantyre and Guatemala and demonstrated to interested physicians in Botswana and Lesotho.

BEYOND TRADITIONAL BORDERS

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"The incubator was a huge hit—the MINSAs physician for the area wants 16 of them! The Maria Luisa Clinic is the very first outside the big city hospitals in Managua (Nicaragua) to have an incubator."

- Dr. Janice Smith, UTMB
 Galveston, TX



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An initiative for the advancement of appropriate, high-value innovations in global health biotechnology