“Car Part” Incubator: An Innovative Solution

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Background

• Four million infants die annually within a month of birth; 98% of these deaths occur in poor countries[1]

• 95% of medical equipment in poor countries is donated and non-function within five years[2]. For example, in Aceh, Indonesia none of the ten incubators donated after the Tsunami were functional as of November 2008

• Neonatal incubators are of limited utility and longevity due to lack of replacement parts, maintenance, and training of personnel

• Our project aims to reduce neonatal mortality by developing higher performing, low-cost, neonatal incubators with key components from automotive and other locally available parts

Method

• A multidisciplinary team of clinicians, designers, and engineers was assembled to explore the feasibility of using the “car part” opportunity with respect to building an effective incubator

• We integrated feedback from health providers in Indonesia, Nepal, Zambia, and India, with interactive design reviews and focus groups with domain experts

• We conducted a systematic evaluation of incubators currently used to assess their benefits and limitations

• Engineers and designers interacted with clinical teams in a rapid feedback cyclical design to develop prototypes

Photos (top to bottom): Midwife documenting power use of an incubator in Aceh, Indonesia; Designers from Design that Matters, IDEO and Rhode Island School of Design (RISDI) disassembling a Toyota 4Runner

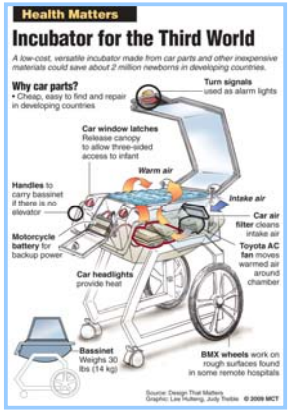
Results

• We conclude that automotive and off-the-shelf parts are capable of being repurposed to produce heat, light, air convection, filtration, a power reservoir, as well as auditory and visual alarms

• The “car part” incubator may function as a neonatal incubator, warming table, and blanket warmer

• The incubator incorporates human design factors such as a detachable base and ergonomic handles for mobility without elevators and over rough ground

• User-stimulated maintenance is promoted. For example, air filters are visible to the users and the headlight-based warmers are intuitive to fix



• Preliminary pricing is to place the incubator at $1000 or 3% the cost of the current top-of-the-line incubator in America

Photos from (top to bottom): Incubator design components explained courtesy of Design that Matters and McClatchy-Tribune (MCT) Graphics; “Looks like” and “works like” prototype design

Discussion

• Coupled to stimulate adoption and training, this approach can serve to enable a culture of innovation

• Building on existing local resources can be a model for decreased reliance on medical product importation and stimulate greater focus on building local infrastructure, economy, and clinical skills to maintain sustainable health care

• Approaches to product implementation and commercialization with local partners need to be explored.

Works Cited:

1. Lawn, J.E., et al., *4 million neonatal deaths: when? Where? Why?* Lancet, 2005. **365**(9462): p. 891-900.
2. Malkin, R.A., *Design of health care technologies for the developing world.* Annual Review of Biomedical Engineering, 2007. **9**: p. 567-87.