

BIOEN 400 - Group 13

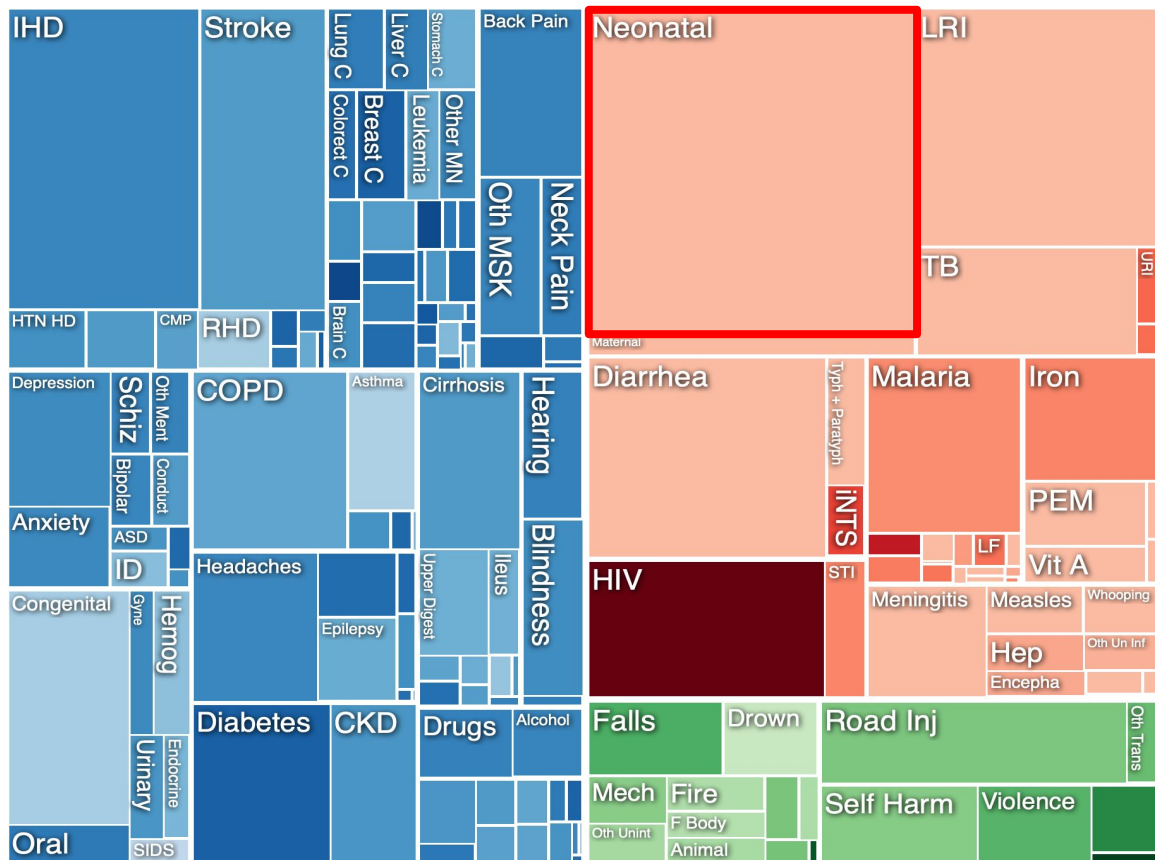
Neonatal Asphyxia

in Low-Resource Settings

Presented by:

Anna M. Craig,
Seong H. Han,
Jayleen Leon,
Tashi Sherpa

Neonatal Disorder Proportion in Low-Middle SDI



SDI

Socio-Demographic
Index

DALYs

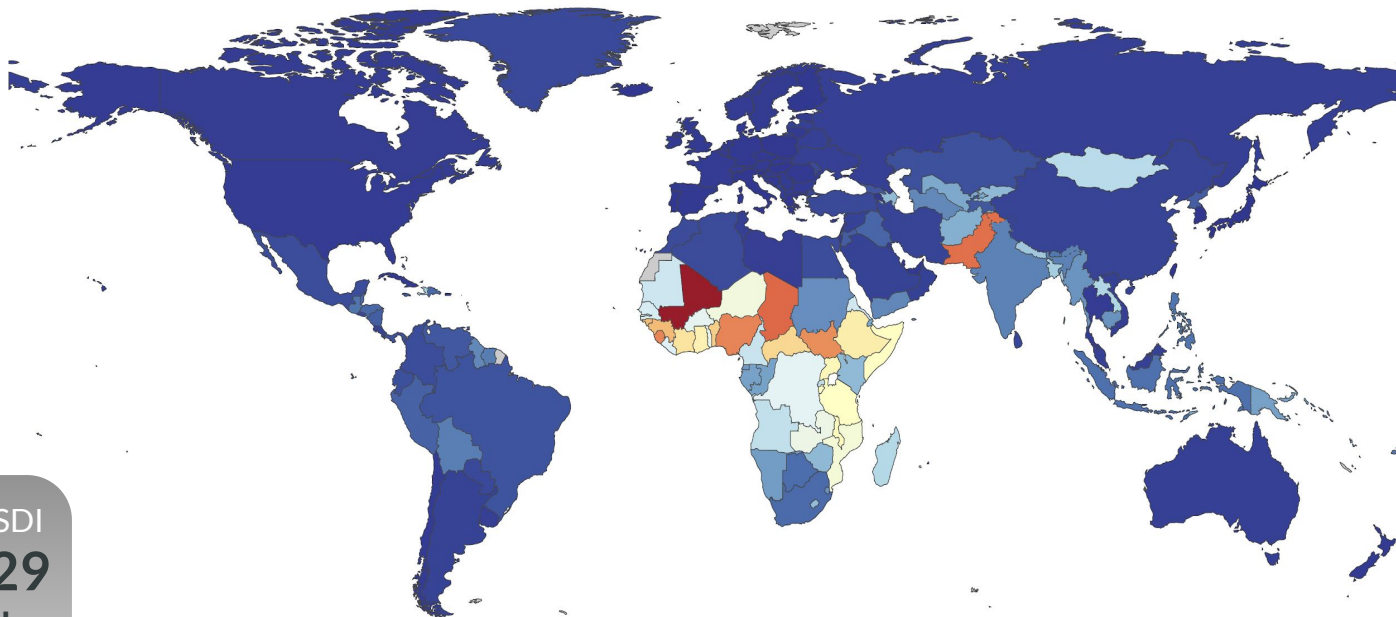
Disability-Adjusted
Life Years

Global Neonatal Encephalopathy

birth asphyxia + trauma

Low SDI
68.82
deaths
per
100,000

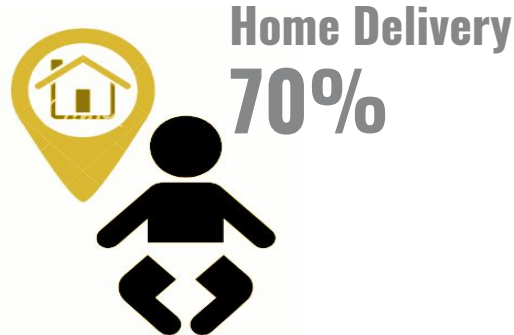
High SDI
13.29
deaths
per
100,000



Problem & Need

Mission

Develop an inexpensive, portable method to prevent mortality and long-term disabilities caused by neonatal asphyxia in low-middle income countries



19,088,384



Hypothermia Therapy

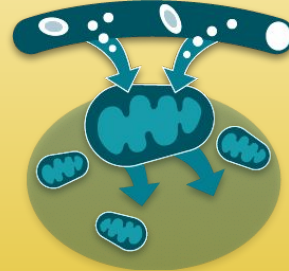
1. **Reduction in cerebral metabolism** → **Suppresses oxygen free radical release**
2. Inhibition of the caspase enzymes → **Suppress apoptotic processes** in the developing brain
3. Suppress the release of pro-inflammatory cytokines and interleukins, suppression of microglial activation (reduce neuroinflammation) → **reducing direct neurotoxicity**



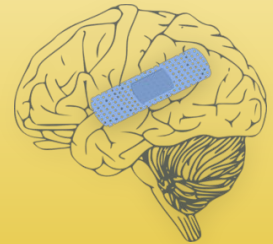
Newborn's body temp reduced to 33-34°C within 6 hours of birth



Body temp lowered for 72 hours



Decreased body temp slows down baby's metabolic rate



Cells are able to recover, preventing spread, severity and permanence of brain damage

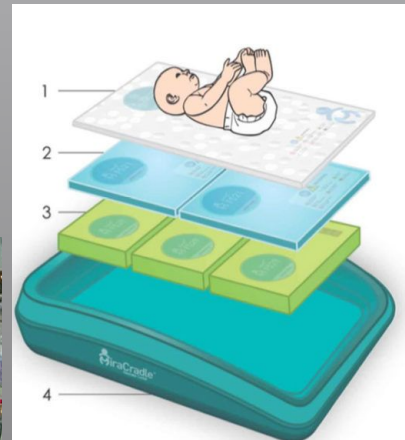
COMPETING SOLUTIONS

Blanketrol® III



- Many components
- High Maintenance
- Long Setup
- Not Portable
- Electrical Shock Hazard

MiraCradle®



1. Conduction Mattress
2. save® FS-21
3. save® FS-29
4. Cradle

Bulky

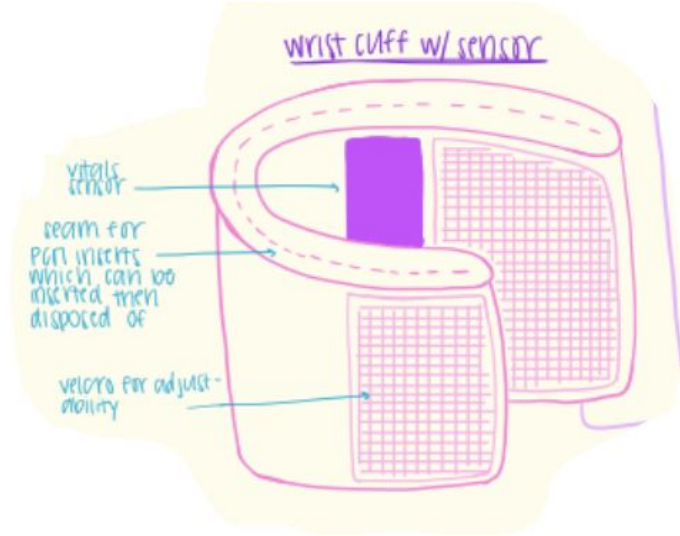
Not Easily
Transportable

1.6 lakhs Indian Rupees
(2,305.60 USD)

Replace PCM & Conduction
Mattress 3 years from the
date of first use

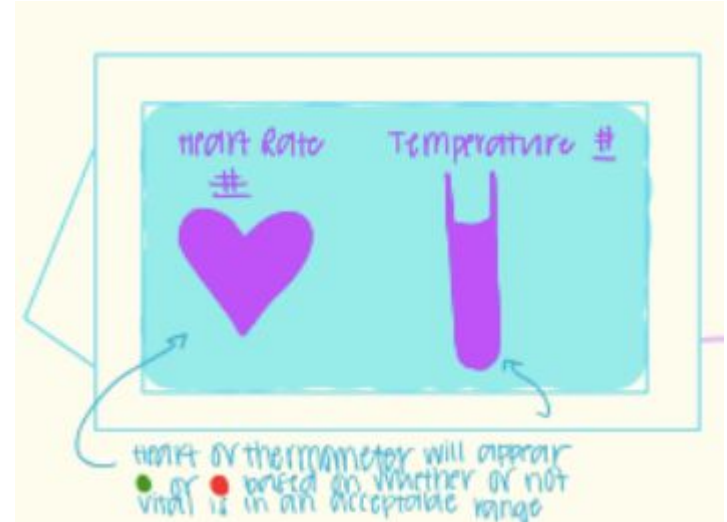
OUR SOLUTION

Cooling Cuffs™



Phase Change Material

Sensor and Monitoring



Adjustable cuff with strap

Alarm & red/green blinking light

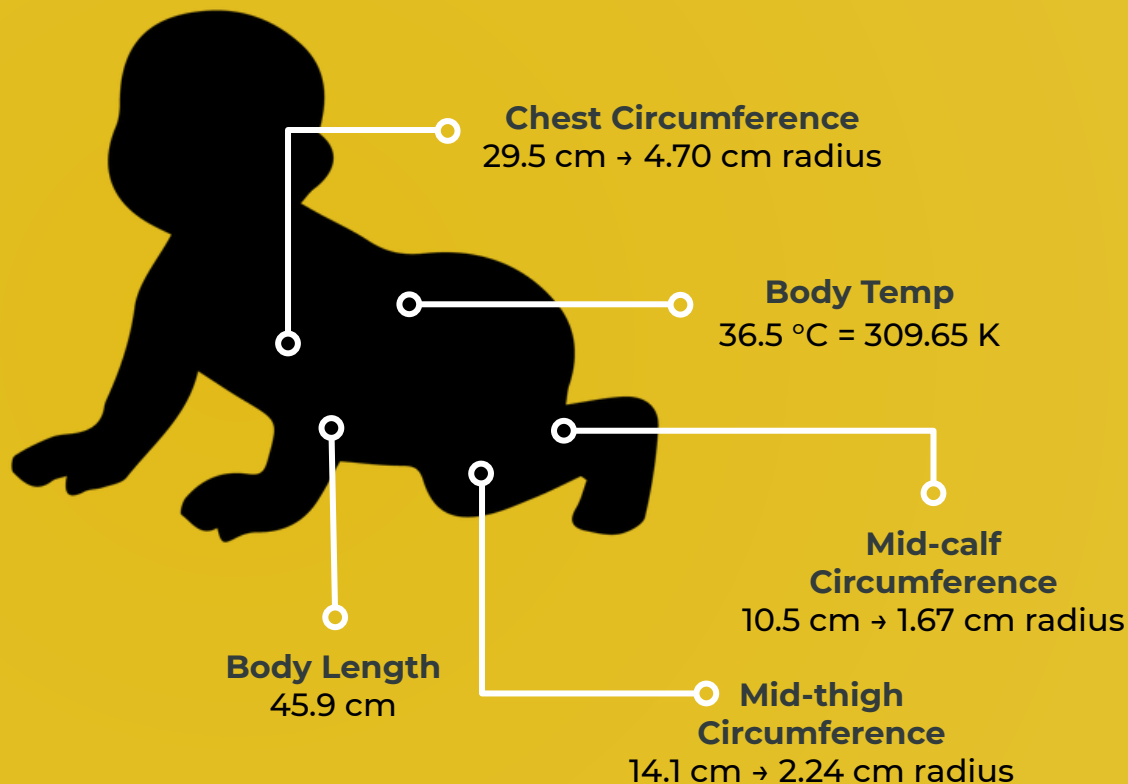
3D Model Parameters Inventor

4.5 cm **extrusion**

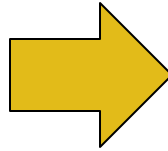
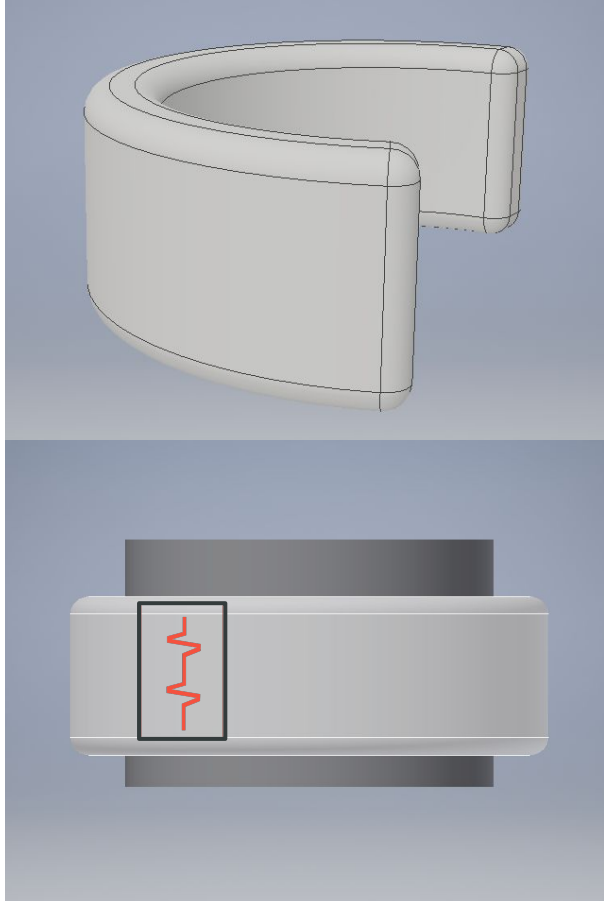
301.3 K - **PCM**

Material: water (liq)

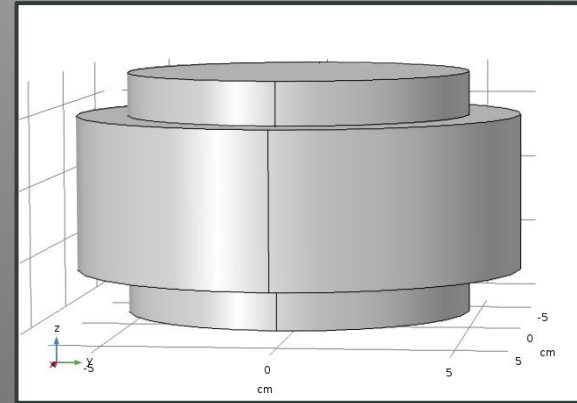
FEA: 3D - heat transfer -
time dependent study



Inventor Models

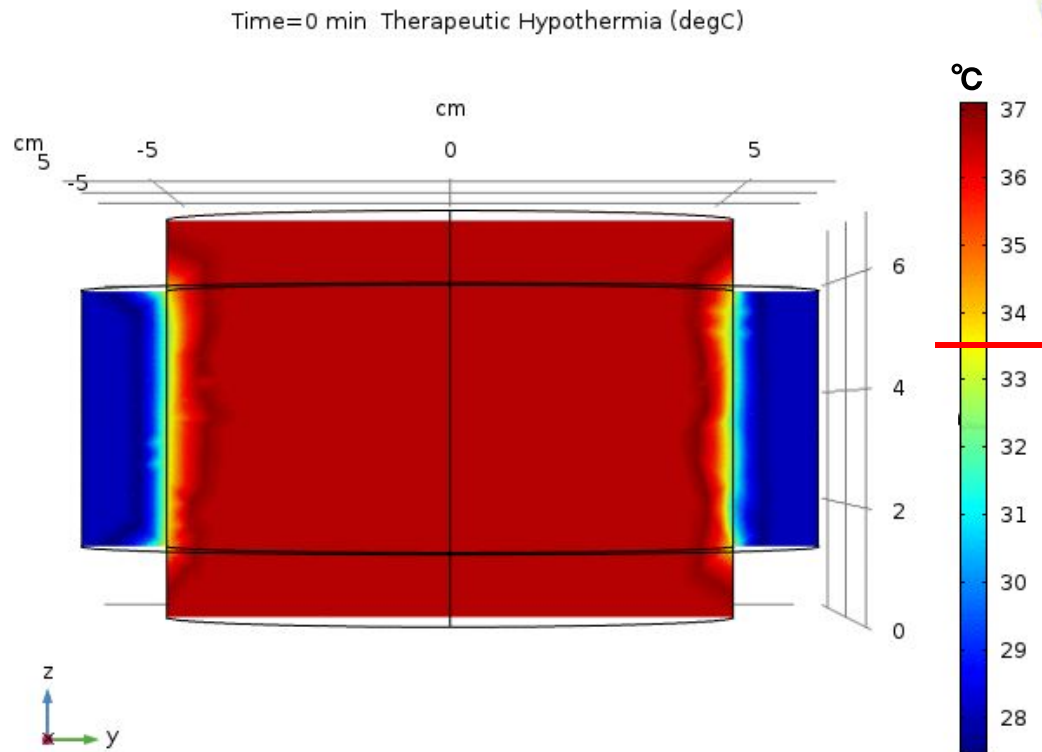
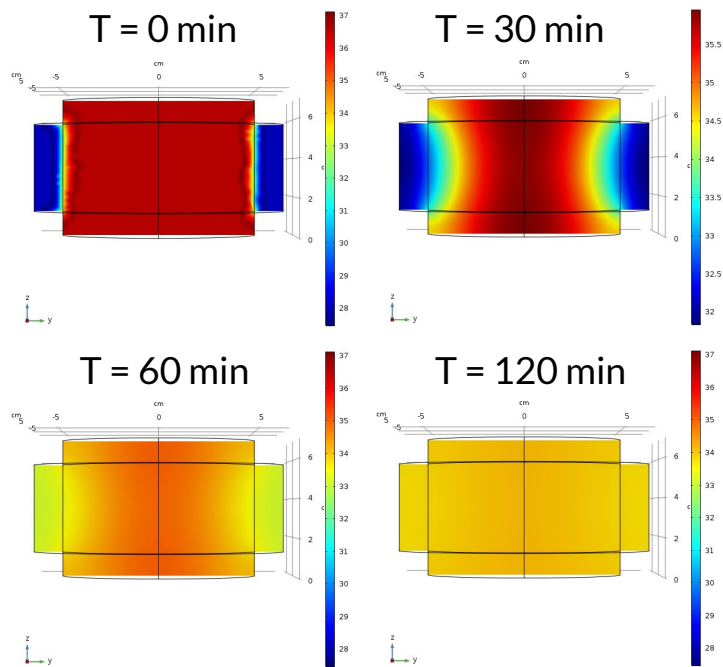


COMSOL Assembly



COMSOL Model

Therapeutic Hypothermia



Cooling Cuffs > Competing Solutions

	Cooling Cuffs	MiraCradle	Blanketrol III
Affordability	\$300	\$2,300+	\$10,000+
Portability	●	◐	-
User-Friendly	●	●	-
Parent-Child Interaction	●	-	-

Acknowledgement

We would like to thank Dr. Lutz, Dr. Boyle, and our TAs for giving us guidance and advice throughout the development of our project.

We would also like to thank Dr. Srijana Dongol for providing us with images of the Blanketrol III being used in Dhulikhel Hospital in Nepal.

References

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Mishra, Shiva Raj, et al. “Variation in Prices of Cardiovascular Drugs in Public and Private Pharmacies in Nepal.” *Health Services Research and Managerial Epidemiology*, vol. 2, 2015, p. 233339281456650., doi:10.1177/2333392814566508.

Yurtoğlu, Nadir. *Identification of a Surrogate Anthropometric Measurement to Birth Weight in High-Risk Low Birth Weight Newborns in a Developing Country*, vol. 10, no. 7, 2018, pp. 241–264., doi:10.9737/hist.2018.658.

MiraCradle®. “MiraCradle®- Neonate Cooler .” *India's Largest Online Medical Devices & Consumables Store*, www.colmed.in/miracradler-neonate-cooler.html.