

Life Support in a Blanket

Finding and making the best insulating fabric to make a blanket for babies suffering from hypothermia in developing countries



DESIGN

Identify the problem:

Hypothermia is a potentially dangerous drop in body temperature, caused by prolonged exposure to cold temperatures. Every human has a balance between heat production and heat loss, when heat is being lost faster than heat production hypothermia can occur.

Babies are easily affected by hypothermia due to exposure to an environment that is cooler to the womb, therefore the baby becomes subjective to the three basic mechanisms in which it loses heat. The extent to which newborns can control thermoregulation is limited, resulting in a reliance on the mother to heat the baby or insulating blankets/clothes.

Due to this over four million babies die in the neonatal period due to hypothermia, 28% of these deaths being in Sub-Saharan Africa. Overall 99% of deaths that occur in developing countries, are due to lack of resources, knowledge, home births, low birth weight babies and abandonment. With only 7% of hospitals having a heat controlled delivery room and 9% having a neonatal warmer, or any heat insulating resources. This complete lack of resources is mainly why 28% of deaths are from hypothermia in Sub-Saharan Africa. Thermal protection is still an underappreciated major challenge for newborn survival in developing countries.

Design brief: My solution and how its works?

The solution to this ever growing problem is a insulating and cost effective blanket that can be used in the neonatal period to keep a newborn from suffering from hypothermia or to recover and warm a baby suffering from it.

This blanket will make a massive difference to the lives of many newborns. The blanket will drastically change the amount of deaths from neonatal hypothermia and let more babies live a full life.

This blanket is based around the concepts of heat. Our bodies create heat to keep our internal temperature stable and excess heat is lost through our skin. The blanket traps this heat around the body of the baby and reduce heat loss and the chance of death. The two main factors are heat transfer and thermal insulation. A blanket can also use the heat of a mother or adult and insulate it into the blanket and essentially to the baby.

Babies lose 25% of their heat from respiration and the other 75% percent is from their body surface. This means a blanket is the most effective way of trapping heat because thermal conduction traps the dead air as a thermal barrier between your body and the environment.

Final decision

After going over the experiment it was clear that all fabrics had significant results in sustaining consistent temperatures, only dropping a degree or two in two hours. When choosing a fabric to make the blanket, it would also depend on other factors such as cost, resourcefulness and texture. Each fabric tested was chosen considering the positives and negatives of each. It was also decided to use two fabrics together in a layered system. The combination of polyester fleece and space blanket was made as well as cotton and space blanket.

Wool is one of the top three best insulating fabrics in the experiment. While searching to buy a wool blanket to use in the experiment most blankets were between \$100- \$200. This is too expensive for developing countries to buy.

Cotton is a cheap and useful fabric, as it would not only help with hypothermia but with jobs and money in Africa. The holes in cotton would let heat from the skin escape and the baby's temperature will drop faster. It also isn't the strongest fabric and not waterproof. Therefore cotton is not the ideal fabric to make this blanket

The polyester fleece was one of the best fabrics in this experiment. It's cheap, soft on the baby's skin and insulating. It kept a constant temperature and in experiment 1,4.

The space blanket is a cheap and waterproof fabric. It did insulate heat but not very well. The fabric had a drop in 3/4 experiments, followed by a slow decrease in temperature. It could be used with a combination of another fabric to keep the baby warm.

In conclusion, the results of this study indicate that a combination of polyester fleece and a space blanket is the best insulating fabric. It kept a steady temperature and the largest temperature drop with this combination was only two degrees. The space blanket will create a waterproof outer layer, while the polyester fleece will create a warm, soft and insulating inner layer. The polyester will be soft and gentle on the baby's skin.

Production process

After the fabric combination was chosen, I brainstormed shape and size ideas. Research was used to discover what parts of the body need to be warm and what size fits newborns. Major inspiration came from sleeping bags and baby straight jacket. As a part of the process as sealing method need to be chosen, after evaluation the last two velcro and ties, seemed the longest lasting, therefore they were used in prototyping.



A final shape was chosen. The blanket includes a hood to keep the baby's head warm and stop heat escaping. A round large closed bottom creates room for any size of baby up to around 6 months or longer depending on size of the baby.

Prototypes

Prototype 1

Prototype one is using two layers, consisting of space blanket on the outside and polyester fleece on the inside.



Evaluation:

The size was perfect and the shape was practical and effective. After fiddling with the blanket it was beginning to appear that the space blanket was thin and fragile. It was quite difficult to sew and would rip. It was also found that ties were fraying when pulled and tied. Positives of the blanket that will move forward to the next prototype was the size and shape although the idea of the space blanket on the outside makes the flimsy material an easy target to be damaged.

Prototype 2

Prototype 2 is using a three layer method and velcro.



Evaluation:

The overall concept of this blanket worked quite well. The velcro fitted well and was easy to sew onto the fabric. It can also be used to set different sizes and pull the blanket tighter for smaller or premature babies. The three layers will also trap and insulate more heat to the baby. Negatives is that the hood of the blanket doesn't fit tight around the head which will let heat escape. An elastic to pull the fabric tighter around the head could improve the design.

Final Product - Evaluation

For the final product will be using the three layered concept and velcro with a gathered hood. Blue fabric was used to hide dirt or stains. Velcro strips down the sides were used to pull the blanket tighter if needed for smaller babies.



The size of the blanket was perfect, the baby slid easily into it and its head was held tight with the hood. The Velcro created a seal to trap the heat loss and doubled as a way to pull the blanket tighter and more firm around the baby's skin.

For production of the blankets it will begin with me producing them but if revenue increases it is an idea that we can use charities or retirement homes to help produce the blankets. This idea was influenced from the existing program of elderly citizens knitting squares that are made up into rugs and blankets for the homeless.

Time	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00
Blanket	32.1	32	31.9	31.8	31.6	31.6	31.5	31.3	31.1

To fully evaluate the blanket I redid the experiment that I first used to decide on the materials. Using a balloon the size of a baby, I placed it inside the blanket and monitored the heat for every 15 minutes. Show above in the graph the blanket only decreased by 1 degree in the space of two hours. This is amazing and shows how the blanket reflects the heat from the water in the balloon back to the balloon, to sustain a safe temperature for the baby.