AMNIOTIC WRAP
A blanket that connects mother to child.
Niranjanaa Jeeva
Ella Stimson
Julie Yip
INTRODUCTION

Mental health has long held a stigma that results in underdiagnosis and a lack of awareness about various disorders. One such illness is postpartum depression (PPD), a temporary depression that occurs in mothers after childbirth. Though many women around the world suffer from PPD, many mothers either do not have the access to treatment, or are afraid to come forward. PPD is prevalent in roughly 15 percent of all births and even “potentially impacts nearly twice as many women in developing versus industrialized countries” (Brett et al., 2008). It commonly begins a week to one month after the birth and includes symptoms such as insomnia, fatigue, and trouble bonding with the newborn.

While counseling or medication is the best way to treat PPD, the Amniotic Wrap is cost-effective way to address some of the many issues faced by mothers as a result of PPD. It outfits the baby with a pair of socks which would monitor the baby’s heart rate and project its heartbeat onto a blanket for the mother to feel. It not only connects mother and child but also gives the exhausted mother a chance to sleep. The change in the baby’s heart rate as it wakes will be noted and the mother gently notified, giving the mother a chance to rest peacefully and without worry. This design would strengthen the bond between mother and child, and work to relieve the symptoms of postpartum depression.

NEEDS

In the United States alone, PPD affects roughly 10 to 20 percent of women against the Postpartum Depression Screening Scale (PDSS), which may appear significant. By comparison, these rates almost double in underdeveloped countries, such as Arica, Chile, in which PPD affects roughly 22 to 32 percent of women (Quelopana et al., 2011). Other studies using the Spanish version of PDSS indicate that these statistics may be higher, with 45 percent of postpartum Chilean women screening positive for this disease during check-ups at public clinics (Beck & Gable, 2005). Despite the commonality of this condition, PPD often goes undiagnosed in new mothers. The Chilean Health Service (Health Ministry of Chile, 2008) suggests women who exhibit signs of PPD obtain targeted screening, but symptoms of PPD may prove challenging to determine in new mothers who fail to adequately describe their specific symptoms to their physicians (Beck & Gable, 2002). Furthermore, this may have a substantial impact on surrounding family members, especially the infant.

Beyond its proliferation, postpartum depression is a distinct illness, given the broad range of symptoms which includes the following: feeling alone and detached from the child, after holding the baby in the womb for 40 weeks; extreme anxiety and irritability regarding the daunting responsibility to care for another human; a lack of feeling towards the child; and even thoughts of harming the child. Our goal is to mediate these numbers by improving the direct relationship between mother and infant, as well as how the mother feels towards the child. Current methods of treatment include support group counseling, antidepressants, and cognitive behavioral therapy, all of which require a reliance either on another individual or on a drug. With
these forms of treatment, women suffering from PPD may feel a deeper sense of melancholy if they feel too dependent on others, as if they are incapable of being good mothers on their own.

Postpartum depression may have an onset immediately after birth and can therefore negatively affect newborns at their earliest developmental stages. In the first three months postpartum, mothers have shown to be more hostile and less engaged, showing little to no warmth towards the child (Lovejoy, Graczyk, O’Hare & Nueman, 2000). If mothers have difficulty interacting with their infants, they may fall into two different styles of interacting, controlling and intrusive or highly passive and withdrawn (Field, 2006), the latter of which we are focused. Mother-infant interactions are the main forms of play for infants between three and six months, where infants learn how to communicate and develop their interactive social skills (Field, 2006).

Though mothers may be aware that they suffer from PPD, many show the symptoms but fail to ever seek medical attention because they may fear ostracization, are shy about revealing problems in their maternal experience as mothers, or simply lack the resources to seek health care. If methods continue to rely solely on the interaction with others in specific settings such as support groups, then PPD may continue to exacerbate the lives of these Chilean women.

Even more so, PPD severely affects women who are mentally distressed, for example, if they are already suffering from depression. A considerable number of women never seek initial treatment for their depression, further negatively affecting the spread of PPD as new mothers will often be unfamiliar with the condition and thus find more reason to not seek aid. In addition, new mothers who are young in age, who have experienced previous miscarriages or traumatic births, or who are at risk of having a child with birth defects or complications.

SOLUTION

In PPD, a woman can experience feelings of loneliness and have difficulty connecting with the child. This loneliness arises from the feeling of the baby not inside and close to them anymore and the lack of connection due to the baby being a reminder of the stress of the birth. Furthermore, all of this is even more difficult with little to no sleep due to PPD symptoms. Regardless, interaction and touch is vital for the health of the baby and the mother since it most importantly has an impact on the child’s relationships for the rest of their lives (evidence).

The Amniotic Wrap strives to eliminate these negative and depressive feelings felt by the mother, while also comfort in times of exhaustion. This two piece device consists of a blanket for the mother and a sock for the child and provides communication and connection between the two. The blanket, intended for the mother, wirelessly communicates the small sock, fit to the baby’s foot. While the baby sleeps, the sock measures heart rate and restlessness, providing the mother with heartbeat connection through vibrations of the blanket that match the pace of the measured heart rate. Then, when the baby awakens, the mother is gently woken up to be alerted of this fact.
Hearing another’s heartbeat helps with creating an emotional connection with another, similar to as if they were looking into one another’s eyes. In a study at the Eindhoven University of Technology, hearing biosignals of another’s heart beat can create a greater connection of intimacy and interpersonal distance. Furthermore, connection by sound of the heart beat had a “larger than the effect of gaze” (Janssen H. et al, 2010). In another study, Heart Rate Variability biofeedback has been proven to help major depression (Karavida K, et al, 2007). For a mother that has difficulty attaching emotionally with her baby or coping with the presence of it, the sound of her child’s heartbeat has promising chances of bridging the gap between the two and the biofeedback mechanism can be an effective for coping with the depressive emotions of PPD.

The blanket for the mother provides vibrational sensations that mirror the pattern of the heartbeat of the baby. This soothing rhythm helps the mother fall asleep and the rhythm stops after 15 minutes. In the corner of the blanket will be a button in case the mother wakes up and wants to feel and check upon this beat again. When the child wakes up and is in distress, the blanket will send gentle vibration alerts to the mother to wake her up and go to her child’s aid.

On the baby’s side, sensoring and monitoring of heart rate will be done through a sock with an infrared pulse monitors built in. The pulse monitor will track the baby’s heart rate and send this data to the blanket to mirror this rhythm to comfort the mother. Through the heart rate, alertness and sleep can be monitored.

IMPLEMENTATION

The most effective way to facilitate the diffusion of the Amniotic Wrap is to distribute it to hospitals or midwives who would then deliver it to mothers that they recognize are suffering with PPD. However, before the Amniotic Wrap could begin to be implemented, there are still design and manufacturing factors that must be further developed. As we maximize the efficiency and the cost of the project, we believe that we can bring the unit price down to about $10. We believe that the Amniotic Wrap could potentially be ready for consumption in one year.

Though this device was created with the needs of women with PPD in developing regions in mind, we believe that it could appeal to mothers everywhere, especially since it is so cost-effective. Though we would initially target a small region, perhaps Arica, Chile, where a striking number of mothers suffer PPD, we hope to eventually expand throughout the world.

<table>
<thead>
<tr>
<th>Component</th>
<th>Unit Cost</th>
<th>Estimated Cost Assuming Mass Production and No Profit-Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Cost 1</td>
<td>Cost 2</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Baby Socks</td>
<td>$3.00</td>
<td>$0.50</td>
</tr>
<tr>
<td>Infrared Emitters and Detectors</td>
<td>$2.00</td>
<td>$0.50</td>
</tr>
<tr>
<td>Total</td>
<td>~$45</td>
<td>~$10</td>
</tr>
</tbody>
</table>

**LIMITATIONS AND POTENTIAL PARTNERS**

Limitations for the product are focused around our concern for the infant’s safety. Working with devices such as Arduinos and electrode sensors put the child at risk for burns or electrical shock because of the basic needs of a newborn, such as if the baby wets its bed. We are highly concerned about the radiation of our materials, but we will ensure that the electrodes on our devices will be at incredibly low concentrations that no harm will come to the child. In addition, we will ensure the materials used in the mother’s blanket will be harmless by analyzing the character of the blanket’s material, including flammability, and the electric rates of the Lilypads we utilize. Given we have seen inspiration from other companies producing alternative baby monitors, such as Owlet Care’s Smart Sock, we may collaborate with them by offering our concern for global health, specifically this population of Chile.
TEAM MEMBER BIOS

Niranjanaa Jeeva is a 1st year Bioengineering: Bioengineering student. She was born in Chennai, India and grew up in Santa Barbara. She is a member of BMES and is a part of an Eleanor Roosevelt College residential life council. Niranjanaa is passionate about global health and using engineering skills to maximize solutions to medical issues.

Ella Stimson
Born and raised in Santa Barbara, California, Ella has spent much of her life enjoying engineering and health. An alumna from the Dos Pueblos Engineering Academy, she has enjoying exploring the world of engineering through design based projects. Her curiosity of the human body lead her to the field of bioengineering. She is a first year Bioengineering student at University of California, San Diego.

Julie Yip is a sophomore Bioengineering: Biotechnology student at UC San Diego, who discovered her passion for global health from the stories she heard as a child about her family and how they survived the Cambodian genocide the Khmer Rouge. The lack of access to basic needs her family experience instilled in Julie a desire to improve the quality of life in those in underdeveloped communities.

SOURCES


