Detecting Stress in Pregnant Women and New Mothers

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ABSTRACT
The transition into parenthood can be physically and emotionally demanding. This can create new stresses in the lives of new mothers. In this paper, we have created two Android applications to analyze the Microsoft Band 2's potential to detect stress in new mothers. Each application will use a surveying method to ask questions about the participant's stress levels while collecting output from the Microsoft Band 2. These survey methods are the Experience Sampling Method and retrospective diary. In the future, these applications will be used to study wearable technology's potential to detect stress.

1. INTRODUCTION
Imagine you are a new mother to a baby boy or girl and have a myriad of emotions running through your body. With all of the diaper changes and feedings, sleep deprivation quickly becomes a reality. One of the major issues facing new mothers today is stress. An infant adds a new element of stress and anxiety to a mother’s life. In today’s society, technology is becoming more prevalent and is being used to help a variety of populations through mobile applications and wearable technology. What if wearable technology could detect stress in new mothers? Our study aims to use wearable technology such as the Microsoft Band 2 to detect stress in new mothers.

Currently the research on technology and new mothers is limited to the mothers’ time during pregnancy and the new child. Additionally, there is a lack of research on not only the daily lives of new mothers but also on the new challenges and obstacles they are facing as new mothers.

Both the physical and mental health of a new mother are vital. A lack of physical health such as a sudden drop in hormones could have further implications on the mother’s mental well-being and lead to Postpartum depression. There is an overwhelming amount of technology that focuses on the infant’s health and well-being as opposed to the mother’s. There is a technological hole that we aim to fill.

Past research has shown the usage of the Experience Sampling Method (ESM) and its effectiveness in producing valid results [7]. The ESM and the Daily Diary retrospective sampling methods will be utilized in the form of mobile applications in our study to assist in stress detection of new mothers. In this paper we will show the correlation between the Microsoft Band 2's output and the stress level of the participant collected from both the ESM and Daily Diary applications. We will aim to validate or invalidate the Microsoft Band 2's ability to accurately detect stress with its heart rate detection feature. The contributions this paper will provide to society are:

- A detailed account of the validity of the Microsoft Band 2's ability to detect stress in new mothers.
- The effectiveness difference that ESM vs. retrospective surveying methods have on detecting stress in new mothers.

2. RELATED WORK
Combining technology and surveying methods to detect stress is an explored field with a vast library of resources in the form of articles and journals. (Rephrase this sentence...go into more about ESM. it has been used to understand a variety of health phenomena. describe how it is an appropriate method. Show that it has been used with similar populations but for similar phenomena. the wearable is the new aspect.) However, the niche of bridging technology and surveying methods to detect stress in pregnant women and new mothers has yet to be delved into. The related work found has given a solid foundation for the research in this study, first of which is wearable technology.

(Talk about how the easiest thing to detect is activity level and heart rate. The big question is will the Microsoft Band
2 be able to detect stress accurately and not just a high heart rate, which could be caused by a variety of things. Wearable for health that is more research based, also detects sleep - actigraph. Most devices coming out are not clinically validated. We are not clinically validating it but trying to provide some validation.) Wearable technology is a relatively new found medium of data collection. In order for wearable technology to prove useful in providing statistically significant data, it must possess certain traits. The technology must have seamless integration into a user’s everyday life. This is done through minimization in design [6]. It must be both small and fashionable in order to prove effective in utilization by users [5]. A minimalist design is not the only form of motivation needed to produce effective results.

The time of implementation can also prove to be a deciding factor in successful data collection. The technology, no matter the form, needs to be introduced at a time that brings no greater harm or stress to the user than before [3]. The ease of usability of the technology is additionally a key factor in the success of a study.

The user interface is an integral part of any medium of technology. Similarly to the design of wearable technology, the technology must be easy to use. If the technology proves too complicated, the risk of lack of utilization arises. When technology is simple, benefits will arise both for the user and the study as a whole [2]. Furthermore, with the simplistic design of technology, one can utilize it to assist others [4]. Another aspect of technology is the data collected from it and one form of this is survey methods.

Survey methods can be both retrospective and in real time. However, it is commonly found that real time survey collection yields more accurate and useful results in detecting stress in an individual [7]. Survey questions on the topic of stress in an ESM are typically event based. This has the ability to give further insight into the correlation between stress and daily events. In the past, ESM applications have been run on PDA’s, which provide the mobile component to real time data collection [1]. The wireless connection allows the data collected from participants to be immediately sent to the evaluator. Thus any problems or issues can be addressed earlier and be remedied to not negatively influence the study’s results.

The related work provides both information on how to conduct a similar study as well as information as to what not to use in the implementation of technology. Technology has shown to be a useful tool in data collection in a population. This study aims to broaden the scope of that population to include pregnant women and new mothers. Data collected through survey methods both actively and retrospectively will create a viable data set, which will further research in determining correlation between daily events and stress.

3. METHODS

3.1 Informed consent

All participants will be trained on how to use the Microsoft Band 2 as well as the Android Diary Application. The initial interview will take place upon agreeing to participate in the study. The study is be approved by the Institutional Review Board at Indiana University.

3.2 Recruitment

Participants will be recruited in various forms. The recruitment process will include posting fliers and creating Facebook groups as well as sending emails.

3.3 Participants

There are certain criteria one must meet to be considered for participation in this study. The inclusion criteria includes being an English-speaking woman. Additionally, the woman must either be a first time mother of a child one month old or younger or currently be between 24 and 30 weeks pregnant.

3.4 Procedure

This study will be utilizing the Microsoft Band 2, as is shown in Figure 1. Each participant will be given a Microsoft Band 2 and the allotted to familiarize themselves with the device depends on their status as a new mother. If the participant is recruited during their pregnancy, they will have the last month of their pregnancy to learn the device and its features. Data collection on these individuals would not begin until one month after the child is born. However, if the participant has already given birth to the child, they will be given one week to get acclimated to the Microsoft Band 2 and its functionality.

The procedure for this study will begin by randomly grouping the participants into two groups, the ESM group and the Diary group. The ESM group will be asked questions throughout the day, whereas the Diary group will be asked a series once a day. All participants will take a short interview once every two weeks for the full duration of the study, which is eight weeks. We will be utilizing the Likert scale to rate the stress level of participants throughout each day. Participants in both groups will be asked a series of survey questions. These questions will be the same for each individual, regardless of their assigned group and the questions will be constant throughout the two-month study.

Figure 1: The Microsoft Band 2 wearable device

3.5 Prototype

There are currently two prototype applications in progress. The first application serves as a retrospective Daily Diary in which participants will reflect on their daily stress. The other application will utilize real-time surveying and send prompting notifications to complete the survey a total of six times a day. Both applications will take advantage of the Microsoft Band 2’s connectivity and heart rate monitor to collect data through the integration of the Microsoft Band 2's connectivity and heart rate monitor.
Band SDK into each mobile application. The data will be stored in an SQLite database as well as locally. It is to be noted that the participants will not be able to view past completed survey responses. Both of these applications will hopefully yield useful data in the implementation in phase of this study.

3.6 Implementation

Both the Android application and the Microsoft Band application will be used in the implementation of the study. The implementation phase of this study will not commence until the fall, so more information will be included in this document as it becomes available.

4. FUTURE WORKS

In this paper, the development of two Android applications was explored. While each app collects data in a different manner, they both have the same end goal of detecting stress. Both applications ask the new mother to fill out a survey about their stress levels while collecting Microsoft Band 2 sensor data.

Once the data is gathered, the implications are vast. The data set can be used to analyze the correlation between the Microsoft Band 2’s sensor data and the stress level of the user. While both applications will be utilized in stress detection of new mothers, the population does not have to be exclusive to new mothers. Both applications and this study have the ability to be slightly altered to fit different user populations. Furthermore, in this study we will delve into the concept of whether or not the Microsoft Band 2 can accurately detect stress in a user population. The data gathered is an integral part in validation as it is our basis for our argument either for or against the ability of the Microsoft Band 2.

5. DISCUSSION

Due to the study having not commenced, we do not have a discussions section and will not need one until the study has completed.

6. REFERENCES


