PRESSURE SCREENING DEVICE FOR WOMEN IN LOW-RESOURCE SRETTINGS

Executive Summary

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Complications caused by hypertensive disorders of pregnancy affect approximately 5% of all pregnancies worldwide; they are responsible for over 30,000 deaths of expectant mothers and 500,000 unborn children every year [1,2]. If women in low-resource settings had an effective, affordable way to screen themselves for hypertension, they could drastically reduce morbidity and mortality for themselves and their unborn children [3].

There is a need for a non-invasive, threshold based hypertension screening device for pregnant women in low-resource settings to use at home.

User requirements and engineering specifications were generated with the support of doctors and nurses both in Ghana and the University of Michigan hospital as well as end users in Ghana. Using these user requirements, listed below, designs could be generated and ultimately one could be selected.

Functionality | *Affordability* | *Usability* | *Accuracy* | *Durability* | *Longevity* | *Safety* | *Fit*

Using brainstorming, brain writing, input from peers and an inspiration board, upwards of two-dozen designs were created. Quantitative Pugh charts provided a structure for selecting the concepts that best achieved the device's two functional requirements—applying pressure at a designated threshold and detecting flow once the pressure is applied. Although analysis was performed on both aspects, focus was placed on the flow detection device. The goal was to create a functional substitute for a stethoscope that an untrained person could use. A simple circuit with filters and amplifiers was able to correctly analyze the blood absorption to detect if there is flow or not. The design displays a red light when a pulse is present and a green light when there is no pulse. There is also a yellow light that flashes with the pulse to ensure that the device is functioning. The entire design would cost less than $2 in full scale implementation.

This device has been shown to alert the user when there is or is not blood flow with some degree of accuracy. It is an easy to use substitute for the stethoscope. When validating this design there are still some areas that need improvement. The placement of the users' finger was far from effortless to get consistent and accurate readings. This caused the device to not even function on some participants. This plans to be improved by using a clip design in the finger to ensure a secure, even and consistent fit. Another issue is that the device is always displaying a result and there is no way to tell a patient when to take the measurement. There needs to be some sort of communication or method to only allow the measurement to be taken when the appropriate pressure is being applied. There is still some uncertainty on the accuracy of the flow detection device around the patients' systolic blood pressure. It may in fact not perform well and consistently around those margins, but larger scale testing will need to be performed.

Moving forward, each challenge will continue to be address and the function of the flow detection device is optimized. There will also be efforts to strive for combine form and function in the coming months. The design team will also focus on the pressure application portion of this project. A new round of design generation will be performed and there will be increased communication with the pertinent stakeholders. The flow detection device that has been created is an exciting step towards expanding hypertension screening to more low-resource areas. Although this is a difficult challenge to address, meaningful and novel progress has been made and will continue to be made.