



User Requirements to Design a Blood Pressure Monitoring Application

Muhammad Afiq Bin Mohd Murad

A18CS0117

Mohd Ainal Farhan bin Mohamad Johari

A18CS0113

Nur Hidayah binti Hamri

B19EC0046

Amir Imran bin Amiruddin

A18CS0028

User Requirements to Design a Blood Pressure Monitoring Application: Self-monitor Blood Pressure Application (SBP)

Muhammad Afiq bin Mohd Murad A18CS0117, Mohd Ainal Farhan bin Mohamad Johari A18CS0113, Nur Hidayah binti Hamri B19EC0046, Amir Imran bin Amiruddin A18CS0028

School of Computing, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia

Abstract

Objective: This paper present to explore the users' insights that contribute to behaviour change in blood pressure and the user requirements for a self-care application and analysis for someone with high blood pressure or low blood pressure, which are also known as hypertension and hypotension, respectively. **Methods/Statistical Analysis:** We distributed a survey questionnaire to the public, which is made by Google Form and getting a total of 60 respondents. A survey questionnaire is a research tool that consists of a series of questions to gather information from respondents. The response collected for analysing through statistical analysis. The questionnaire is then filtered to remove trolls from the report. We phone-interviewed a doctor from Hospital Sultanah Aminah, Johor Bahru. We did an open-ended interview to stimulate the discussion. The questions are scripted and categorised thoroughly. The tone and expression were observed and taken into consideration. **Findings:** Results indicated that hypertension and hypotension could be prevented through proper lifestyle changes, if and only if the person is willing to change his/her behaviour. The participants well accepted the idea of a self-care application and the components to be included in the self-monitoring application were identified. The identified elements are such as self-monitoring, exercise, activity planning, analysis, goal setting, social support, voice command and reminders. For those who already suffered hypertension, taking medication has become the second-highest priority where else it holds lesser priority among prehypertension. Most of the respondents would want to have a feature that will give them ways to prevent both hypotension and hypertension from occurring.

Keyword: Blood pressure, hypertension, hypotension, interview, questionnaire, self-monitor application

1. Introduction

The blood vessels in our body is 95, 000KM long if you line them up (The Franklin Institute, n.d.). It carries an equivalent of 7500 litres of blood. 4 – 5 L of blood were recycled over and over again, and transport oxygen and nutrition in our body tissues such as amino acid and oxygen. Blood pressure is when the blood exerts forces on the muscular wall of the blood vessel (Whittier). That force is blood pressure. Blood pressure rise and fall based on heartbeats. During systole, it is the highest which the heart contracts to force blood into the artery. This is called systolic blood pressure. During diastolic, blood pressure is the lowest, which is when the heart rest (Davey, 2011). A typical healthy individual produces systolic blood pressure between 90-120 mm Hg and diastolic pressure between 60 – 80 mm Hg. One of the big problems with high blood pressure is that it hardly ever come up with symptoms (Davey, 2011). It may go unseen until it causes one of its later problems, such as heart attack or stroke. Despite that, [nosebleeds](#) and ruddy complexions are hardly ever caused by high blood pressure. Severe hypertension can cause symptoms such as comma, headache, confusion and sleepiness. High blood pressure, also known as hypertension, happens when blood flow in the arteries is higher than the regular forces (What Is Hypertension, n.d.). Hypertension cause Atherosclerosis, where the fatty deposits gathered up in the artery walls, which causes to other, more severe conditions such as kidney problem and heart attack (Atherosclerosis: symptoms and treatments, 2014). There is no exact known of high blood pressure, but there are several roles which may cause to blood pressure problem, including lack of physical activity, obesity smoking, consume too much alcohol, salt, older age, genetics and thyroid disorders and sleep apnea. Treatment may depend on your condition. Treatment includes changing of lifestyles to improve general health, eating a healthy diet (limit the intake of salt, cholesterol, and all fat types, and increase fibre intake), exercise regularly, limit alcohol consumption, maintaining a healthy weight, quit smoking, monitoring of blood pressure and visit the doctors for regular check-ups to manage your condition and avoid any potential complications (Patel, 2017). For more severe cases, antihypertensive medications must be taken regularly permanently. Some known medicines help to overcome the blood pressure issue, which includes ACE inhibitors that stop the production of a hormone called angiotensin II, which makes the blood vessels narrow (BS, 2008). As a result, the vessels expand to improve to flow of the blood. If your blood pressure could not be handled with simple medication, your doctor will probably use a medicine of this type. Next, Angiotensin-II receptor antagonists that work in a similar way to ACE inhibitors (Stegbauer, 2012). The production of angiotensin II is stopped by blocking its action to allows the blood vessels to expand, improve the blood flow and to reduce blood pressure. Other than that, Beta-blockers cancels out the effect of the hormone adrenaline and the sympathetic nervous system on the body (Beta-blockers). Beta-blockers decompress the heart, thus slowing the heartbeats. Alpha-blockers makes the blood vessel to relax and expand. Combining them with beta-blockers has a more meaningful effect on the resistance in the circulation. For this paper in particular, we will focus on the self-monitoring blood pressure based on interview session with a doctor and questionnaire from 60 users, the meaning of hypertension and hypotension that user understand and how an application can provide such self-monitoring blood pressure. In conclusion, today's technology can provide such alternative that can be used to monitor blood pressure without even go to any hospitals or clinics that may cause money and a lot of time whereas an application that uses both voice recognition and image recognition can be done to check blood pressure. There are no constraints on the innovation and creativity that comes from people in this era.

2. Materials and Methods

For materials and methods, we conducted an interview by phone with Graduate Medical Officer, Dr.Balqis Muhammad Kassim. besides, we also make a questionnaire survey for 60 participants that selected from public through google form.

Phone Interview

The data needed for our application is collected using one to one interviews. Call was the method being used to interview Dr Balqis Muhammad Kassim, UD41 Graduate Medical Officer from Hospital Sultanah Aminah Johor Bahru. Before we start the interview session, we prepared a structured interview question to ask the doctor to ease the interview process.

First, we introduced ourselves, and so does the doctor. We continued the interview by asking the questions we had prepared. This interview was voice-recorded and was transcribed. We also took notes to ease our content creation in the result section. It also was compared for accuracy with the voice-recordings.

This interview was to transpire in-depth about the purpose of creating this application, but more research has to be conducted. A relationship can be concluded from the interview and the answer from the questionnaire.

Questionnaire survey

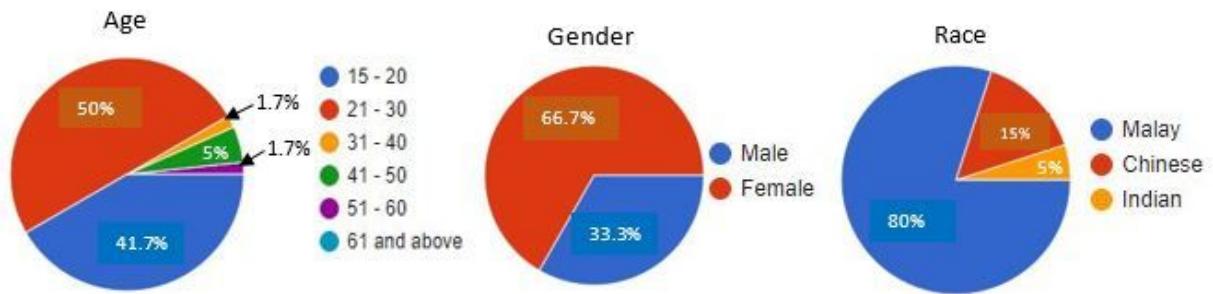
Questionnaire survey is used to ease the monitoring of all the questions and to make a graph. Sixty people participated in answering this survey question. These participants consist of various age groups, genders and ethnicities, whether suffering or not from hypertension or hypotension.

The survey has four sections; each of it has its significance. The first section, which is Section A, it is about the respondent background to know the group of age that suffer from hypertension or hypotension. Section B is about respondent knowledge. This section is to test the knowledge of the participants about these diseases.

Next is Section C, which is uniquely for participants who have hypertension or hypotension disease only. The last section is critical for us to build this application. Section D is to find out the participant's opinions about our application interface and what they like the most about it. In conclusion, all the information that is obtained through the questionnaire is shown in the results section.

3. Results

Respondent Background

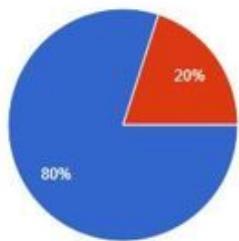


Pie chart 1 shows the age, gender and race of the respondents

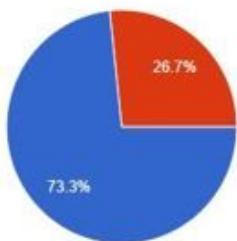
Based on the Pie chart 1, there is a total of 60 respondents where 40 (66.7%) of them are female, and the rest are male. Half of them are age 21 to 30 years old, and 41.7% of the respondents are from 15 to 20 years old. This shows that teenagers were mostly answering the survey. The third graph presents that most of the respondents' race are Malays with 80% out of the 60 respondents, while 15% are Chinese and the rest are Indians

Respondent Knowledge and Behaviour

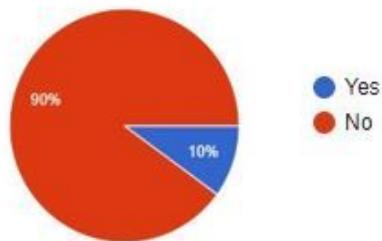
1) Do you know what hypertension means?



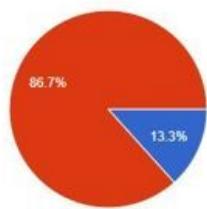
2) Do you know what hypotension means?



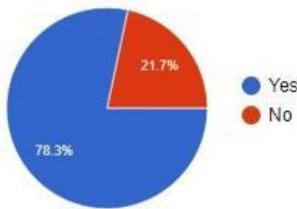
3) Do you have high blood pressure?



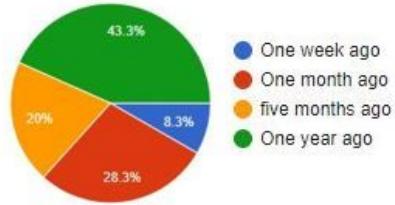
4) Do you have low blood pressure?



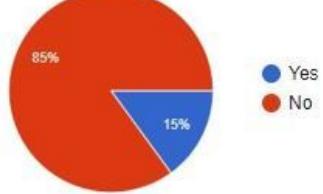
5) Has any of your family members experienced high or low blood pressure?



6) When is the last time you checked your blood pressure?



7) Are you a Hypertension or Hypotension patient?

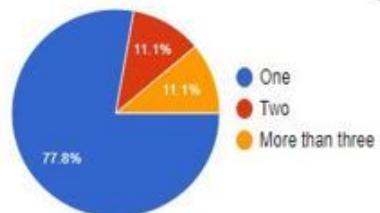


Pie chart 2 shows the respondent knowledge and behaviour

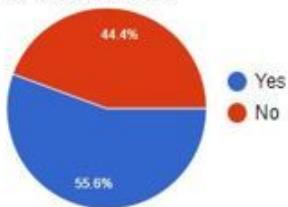
From the graph of question 1 and 2 from Pie chart 2, we notice that the majority of our respondents have a general idea on what are hypertension and hypotension. Then, we saw that about 90% of the respondents have hypertension and 86.7% of respondents have low blood pressure. Due to the majority of our respondents are from 15 to 30 years old, we notice that this category of age is more likely tends to have hypertension or hypotension. Meanwhile, 47 out of 60 respondents admit that their family members have experienced either hypertension or hypotension. To add to that, almost half of the respondents (43.3%) had checked their blood pressure a year ago. Only a minority of the respondents (8.3%) checked their blood pressure about a week ago. From question 7 graph, we can see that only around nine respondents admit that they are either hypertension or hypotension patient.

Hypertension and Hypotension Patient Behaviour

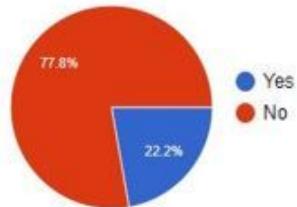
How many time(s) a week you visit your doctor?



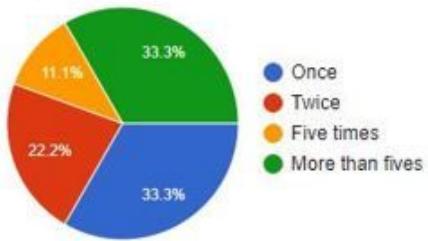
Do you ever been told to take prescribed medicine because of your blood pressure?



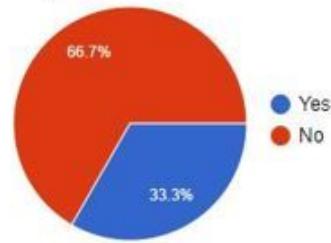
Are you now taking a prescribed medicine?



How often you take your blood pressure measurement at home during the last 12 months?



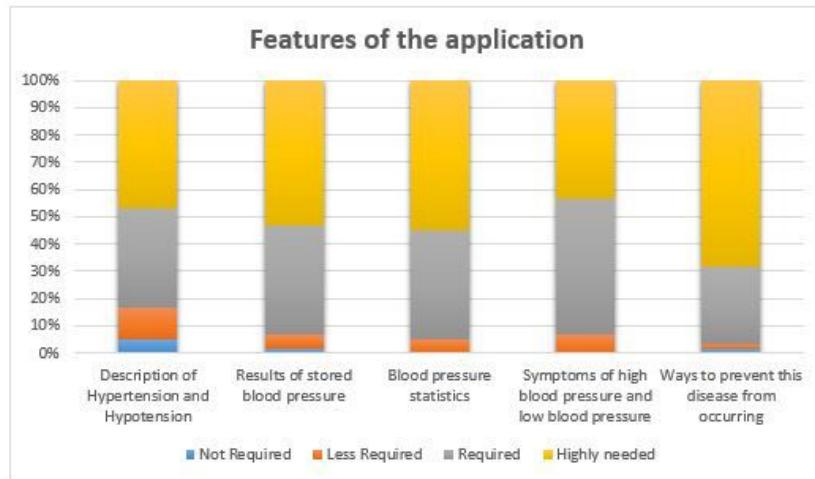
Did a doctor or health professional tell you to take blood pressure reading at home?



Pie chart 3 shows the patients behaviour

The graph above is from the response of nine people out of sixty. Nine respondents admit that they are either suffer from hypertension or hypotension. Five questions in total, were asked in this section in order to know the patient behaviour. 77.8% of the nine respondents are visiting their doctors for only one time per week, while the number of respondents who choose two or more than three times is only one of each. More than half of hypertension and hypotension patients (55.6%) are being told to take the prescribed medicine, and there is only 22.2% out of the nine of the respondents are currently taking prescribed medicine. 33.3% out of the nine respondent for both patients that were told to take the prescribed medicine and that have already take prescribed medicine, the number of respondents for choosing once and more than fives times of taking blood pressure readings at home is three respectively. The last graph shows that three of the respondents are being advised by a doctor or health professional to take their blood pressure reading at home.

Public Views on Blood Pressure Applications



Formula Percentage of the public views on the features of the applications.

Description of Hypertension and Hypotension

28 out of 60 (46.67%) of the respondents stated that the application need to have this feature and only 5% of them stated otherwise. This feature enables the application to describe information such as the definition of both hypertension and hypotension according to doctors around the world, differences between hypertension and hypotension, the cause, the percentage of Malaysian suffering either hypertension or hypotension or both, and in depth-details for what happen when someone having hypertension and hypotension at a microscopic level. This feature could help the users to gain information interactively and simple rather than just reading a paragraph. The info will be in points to make it easier for the user to read.

Result of stored Blood Pressure

53.3% of the respondents choosing highly needed and 40% choosing required for this feature to be included in the application. This feature was used to store the blood pressure reading into the application so that the user could refer for their plan, to compare the results and monitor their health routines. This feature provides both voice recognition and image captured recognition technologies. Through voice recognition, the user will only speak up their results of the blood pressure test to be stored in the application. The app will recognize the command from the users via Guided Command to save the result of the user's blood pressure. The user also can take pictures of the readings, and the application will recognize it and store in the app by using a specific algorithm. This feature can be considered a step ahead, whereas the result stored will automatically be compared to the desired blood pressure. Some recommendations will also be displayed to keep the user blood pressure maintained to be the desired level.

Blood Pressure Statistic

There are a total of 33 respondents (55%) state that this feature is highly needed in the application. This feature will display the up-to-date statistic of their blood pressure. This way, the user can be notified about their blood pressure levels. They also can compare it their old blood pressure and the new one.

Symptoms of high and low Blood Pressure

Majority of the respondents which is 30 of them choosing required for the importance of this feature to be included in the application. Most of the factors of blood pressure problems are still unknown, but the symptoms could be detected at an early stage. User can browse through what are the symptoms of both high and low blood pressure in the application. For example, the user type in what are the signs and the app will display out what the symptoms lead to, checking whether it is low or high blood pressure.

Ways to prevent high or low Blood Pressure from occurring

41 out of 60 (68.3%) respondents stated that this feature is highly in need. This feature suggests recommendation from doctors circling on the topics of low or high blood pressure to provide the user with prevention plans. This feature directly links the results of the user stored in this application and recommended ways of prevention if the user blood pressure either low or high.

Result of Interview Session

From the interview session with Dr Balqis Muhammad Kassim, UD41 Graduate Medical Officer from Hospital Sultanah Aminah Johor Bahru, nine questions were asked regarding blood pressure. The first one is asking regarding the definition of blood pressure. Dr Balqis said that blood pressure is the force exerted from blood in arteries, divided into systolic (when the heart contracts) and diastolic (when the heart is filling) pressure. For the next question, Dr Balqis answered that it is essential for our community to solicitude toward the blood pressure in the human body. Next, the symptoms of having hypertension and hypotension were asked. The symptoms that being mentioned by Dr Balqis for hypertension are a headache, blurring of vision, altered consciousness, and chest tightness while dizziness, nausea, lightheadedness, and loss of consciousness are the symptoms for having hypotension.

After that, we asked the implications for having high and low blood pressure. She said the complications of high blood pressure are hypertensive encephalopathy (brain), hypertensive retinopathy (eye), hypertensive nephropathy (kidney), and myocardial infarction (heart). As for the low blood pressure, the complications are syncope and risk to injury from falls. We continue the session by asking the necessary actions that should be conducted when having hypertension or hypotension. As mentioned by Dr Balqi, "hypertension is a diagnosis established by a medical doctor. You should be under proper follow-up and medication if you feel you are experiencing symptoms of hypertension".

Plus, we also inquire about the doctor's advice about taking the blood pressure reading every week. She said that if the person is hypertension, it advisable to have blood pressure monitoring at home and check blood pressure daily or five per week. As an additional question to gain some knowledge, we ask whether age is one of the factors that affect the chance for a person for having hypertension or hypotension is true or false, and Dr Balqis said it is true.

For the last phase of our interview session, we started asking the doctor about having an application to monitor the users' blood pressure is good or not. Plus, we described her the features of the app for advice, comment and suggestion toward our provided features. The features we mentioned are the same as in the features in our survey questionnaire. Dr Balqis responded by saying that by having an application that specializes in monitoring blood pressure is a good thing. She also said, "It's great if you guys can include management at home and how to recognize when to go to the hospital for treatment."

4. Discussion

From the survey, most of the participants would want to use technology as their aid in managing their lifestyle to prevent blood pressure disease, which is hypertension or hypotension. We could also conclude that the respondents do not take their blood pressure seriously since the majority of them do blood pressure checks only once a year. They also want to obtain and use self-monitoring application like this for easier monitoring and analyzing these diseases. This self-monitoring application can help them to save time and cost.

Majority of high blood pressure patients are unaware of the early symptoms, and the degree of the disease was tolerated. Some participants do not know the meaning of hypertension and hypotension. However, most participants are unaware of the word hypotension, which, in another word, is low blood pressure. The majority of participants had heard about high blood pressure only after their family members or close members had suffered from the diseases. They do not know about hypotension is because it is rare to find people that are suffering from these diseases. They also are unaware of the symptoms of the diseases. They thought that they are only tired and dizzy because of the lack of water consumption and does not have enough rest. They do not visit health professionals or doctor because it is a trivial matter for them.

For these reasons, we strongly feel that self-monitoring and analyze blood pressure application would be an excellent tool to prevent blood pressure disease, as the application uniquely personalized to each individual with their data to monitor their lifestyle privately. They could ask for support and advice from their doctor after they save the data in the application. Patients with this disease could reduce/increase the blood pressure process when they regulate healthy eating habits and exercises.

Some of them even find ways to cure this disease by using internet services. They often look for information without knowing the authenticity and validity of the articles which could even cause them more harm. Some of the information obtained should be taken into consideration, which they need to ask professionals and doctors advice about the information obtained. It could worsen the situation by sharing false pieces of information about hypotension and hypertension on social media without knowing its validity. Most social media users do not check the validity due to the lack of knowledge and their negligence. They did this because they think they could save both time and money from having an appointment from the professionals and doctors, especially for those who live in a rural area or are far away from the health centre.

Smartphones have been an essential part of most of our lives. The self-monitoring application could be used by everyone anytime and anywhere on their mobile phone. They only need to check their blood pressure at home and then key in the blood pressure reading in the self-monitoring application. After that, they could already analyze their blood pressure statistics. Besides that, they could ask for professional advice on the self-monitoring application. They could also see the nearest hospital/clinics to do a check-up or an appointment with the professionals.

5. Acknowledgment

Our thanks to Associate Professor Dr Nor Azman Ismail, Department of Software Engineering and Associate Chair (Research & Academic Staff), School of Computing Faculty of Engineering Universiti Teknologi Malaysia (UTM) for giving us valuable advice, encouragement, co-operation and ideas on this paper.

We would be also thankful for Dr Balqis Binti Muhamad Kasim, UD41 Graduate Medical Officer, who provide us with detailed information about disease related to blood pressure. It was with her answers that we could somehow manage to sort and improvise with making the self-monitoring application. This unflinching advice is one of the sources that give us the enlightened idea.

Most of all, we are thankful for everyone who participates in answering the questionnaire survey. We would also love to give the credits to the persons that we used their previous works project as our research and guidelines.

Last but not least, the co-operation and help received from our classmates and friends are gratefully acknowledged.

6. References

1. Heran BS, Wong MMY, Heran IK & Wright JM. 2008. ACE inhibitors for the treatment of high blood pressure.
https://www.cochrane.org/CD003823/HTN_ace-inhibitors-for-the-treatment-of-high-blood-pressure
2. Patrick Davey. 2011. High Blood Pressure (Hypertension).
<https://www.netdoctor.co.uk/conditions/heart-and-blood/a1142/high-blood-pressure-hypertension/>
3. Lindsay M. Biga, Sierra Dawson, Amy Harwell, Robin Hopkins, Joel Kaufmann, Mike LeMaster, Jon Runyeon. Anatomy & Physiology: Blood Flow, Blood Pressure, and Resistance.
<http://library.open.oregonstate.edu/aandp/chapter/20-2-blood-flow-blood-pressure-and-resistance/>
4. Franklin Institute. The Heart: The Engine of Life: Blood Vessels.
<https://www.fi.edu/heart/blood-vessels>
5. T.J. Niiranen *et al.*,. 2017. 'Risk for hypertension crosses generations in the community: a multi-generational cohort study' on page 2300. Understanding the role of genetics in hypertension <https://academic.oup.com/eurheartj/article/38/29/2309/3852720/>
6. Harvard Health Publishing, Atherosclerosis: symptoms and treatments. December 2014.
<https://www.health.harvard.edu/cholesterol/atherosclerosis-symptoms-and-treatments>
7. Khan Academy, What hypertension.
<https://www.khanacademy.org/science/health-and-medicine/circulatory-system-diseases/hypertension/a/what-is-hypertension>
8. Mayo clinic staff. Mayo Clinic, Beta Blocker.
<https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/in-depth/beta-blockers/art-20044522>
9. Johannes Stegbauer & Thomas M Coffman. 2012. New insights into angiotensin receptor actions: from blood pressure to aging. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3087382/>
10. High Blood Pressure: Cause, Symptoms, Treatment and Complication and Related Disease.
<https://www.pantai.com.my/ms-my/health-a-z/high-blood-pressure>
11. Adam Felman. What to know about high blood pressure.
<https://www.medicalnewstoday.com/articles/159283.php>