

# Malaysian Cardiovascular Risk Diagnose Mobile Apps: An Awareness Tool

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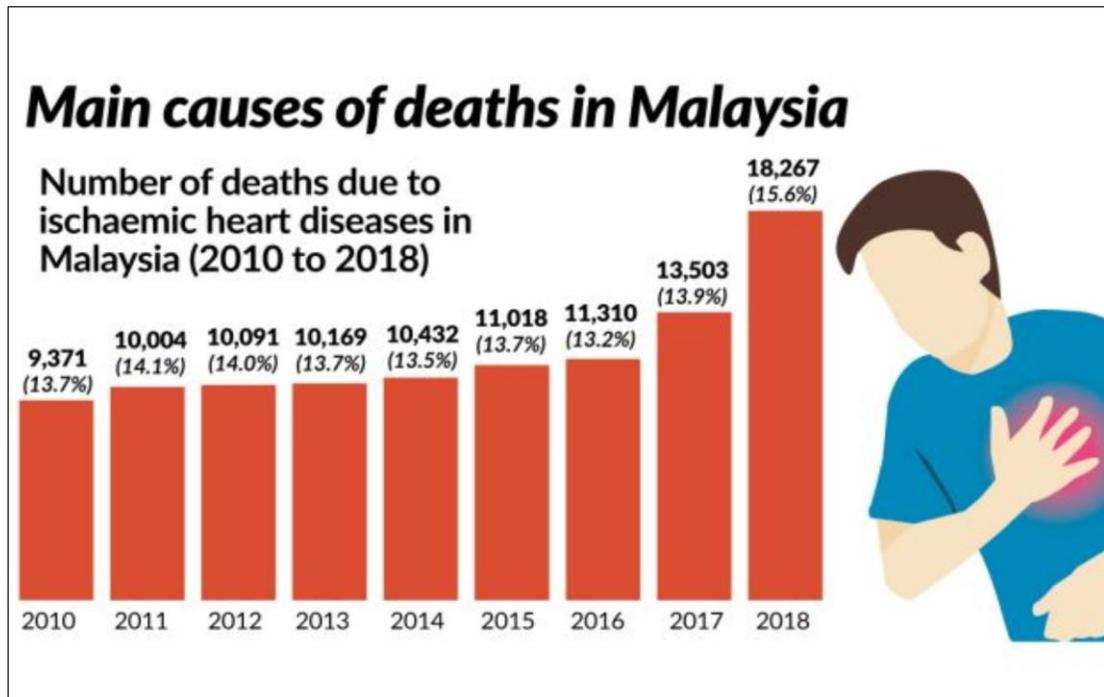
**Abstract.** Cardiovascular or heart disease has contributed to number one mortality in Malaysia since over a decade. Cardiovascular or heart disease mobile apps is no more exclusive activity of the medical and health field. Massive amount of cardiovascular related mobile apps available around the world in order to provide information, early diagnosis, monitoring and management of the disease. Existing contents of the cardiovascular or heart disease related mobile apps are not suitable to address Malaysian circumstances because all of the criteria and measures were done outside of the country using their local respondents that are very different from Malaysia environment. Malaysian Cardiovascular Risk Diagnose (MCRD) mobile apps shall provides general diagnosis and guidelines on awareness of reducing disability and premature deaths from cardiovascular or heart related disease in people at high risk (Malaysian), who have not yet experienced a cardiovascular event. The diagnosis and guidelines aim on prevention of cardiovascular disease that have been divided into two that are the projected Cardiovascular Risk condition, assess by the 10-year Cardiovascular Disease (CVD) risk, using the Framingham risk scoring (FRS) models and, seven Malaysian cardiovascular risk percentage by categories that are by age, gender, ethnic group, smoking habit, diabetic status, Body Mass Index (BMI) and hypertension factors. The data for Malaysian risk categories were collected from National Cardiovascular Disease Database (NCVD). This article is going to present the initial study and general design of the MCRD mobile apps. The MCRD mobile apps will specifically contributing to Smart Selangor aspirations that are to enhance quality of life for Selangor communities so that together they shall be able to strive to reach the vision of Selangor that is to become a “smart state” by 2025, and generally contributing to Malaysian as one tool of cardiovascular awareness in reducing mortality due to the disease

**Keywords:** Cardiovascular, Heart, Diagnose, Mobile Apps, Awareness tools

## 1.0 INTRODUCTION

Chung (2020) reported: In year 2017, Malaysia had lost over 200,000 potential productive years that worth estimated total of 15.3 million working days due to the premature deaths of employees with non-communicable diseases (NCDs). These attributes of the three types of NCDs, are namely cardiovascular or heart diseases, diabetes and cancer. As one of the NCDs, the heart related disease has showed serious issues of Malaysians in particular the Ischaemic heart disease. Ischaemic heart disease also known as Coronary artery disease occurs when the blood vessels that supply blood to the heart muscle become hardened and narrowed as a result of cholesterol and other materials building up in the inner wall of the vessels that cause the blood supply to the heart muscle decreases further lead to chest pain the blood supply is critically cut off, and this is when a person gets heart attack (Ngeh J. et. al., 2009).

National Heart Institute (IJN) reported, Malaysians are developing heart disease at a much younger age, that is 58 years in 2017 compared to Mainland Chinese, the average heart disease is at 63 years, Thais at 65 years, citizens from Western countries at 66 years and Canadians at 68 years (Fong, 2019). Heart attack remained the number one killer in Malaysia from year 2005 until 2019, that is fourteen years in a row, and 50 people dying from the heart disease daily (Zainal, 2020). These numbers of average heart disease discovery in Malaysia is decreasing and start showing those in their 20s and 30s were now exhibiting the symptoms. Zainal (2020) also reported health experts highlighted the prevalence of (NCDs) among Malaysians is leaving them at a higher risk of developing complications from Covid-19. Figure 1 Numbers of deaths due to heart diseases in Malaysia, depicted the increasing heart disease numbers in Malaysia (Fong, 2019).



**FIGURE 1.** Numbers of deaths due to heart disease in Malaysia (Fong, 2019)

## **1.1 Research Gap**

Existing contents of the cardiovascular or heart disease related mobile applications are not suitable to address local factors because all of the factors and its measures were done outside of Malaysia using their local respondents that are very different from Malaysia in terms of Cardiovascular Risk measure, age, gender, ethnic group, smoking habits, diabetic status, Body Mass Index (BMI) and hypertension circumstances. A low awareness of criteria contributing to the heart disease is another factor that contributing to the high mortality due to the disease in Malaysia. There are also not enough initiatives of cardiovascular or heart disease, that can reach Malaysian in order to provide understanding, and thus promote prevention of the no one killer among Malaysian. The percentage of Malaysian cardiovascular risk by categories only provided by annual report in National Cardiovascular Disease Database (NCDV) website that is not appropriate for various level of Malaysian to access in order to understand the risk and take necessary precautions to avoid the disease.

## **1.2 Research Aim**

The the aim of this study is manipulate the cardiovascular risk factors and develop a Malaysian Cardiovascular Risk Diagnose (MCRD) mobile apps that able to project general heart related disease in ten years' time and generate Malaysian current risks by categories as an awareness of the disease. The mobile apps then able to provide analysis of risks and propose immediate action to be attended according to the risk diagnosed such as proceed to seek medical advice from medical doctors or change to healthy life style by taking healthy food intake, exercise regularly and manage stress wisely. As research is still progressing, researcher will share the study formation until designing the MCRD mobile apps in this article.

## **2. 0 PROPOSED SOLUTION**

Medical researchers are proposing awareness and educating Malaysian towards fighting the heart disease. Su T. T. et. al., (2015) in their study of cardiovascular disease (CVD) risk in Malaysia revealed low awareness of the disease among Malaysian and proposed public health education. A better understanding of the underlying health risk of potentially preventable cardiovascular disease risk factors is important, therefore, professionals and policy makers to establish substantial effort to formulate the public health policy and community-based intervention to minimize the upcoming possible high mortality towards the disease (All Answers Ltd., 2018). To support this condition, Malaysia health care system are slowly moving into prevention and screening of risk factors instead of focused heavily on the treatment of disease (Chung, 2020).

### **2.1 National Cardiovascular Disease Database (NCVD)**

Ministry of Health (MOH) has established the National Cardiovascular Disease Database (NCVD) in year 2006 to collect information about cardiovascular disease in Malaysia. The NCVD involves more than 15 Ministry of Health

(MOH) hospitals nationwide, universities and the National Heart Center. This initiative enables collection of records related to the incidence of cardiovascular disease (CVD), and furthermore to evaluate its risk factors and treatment in Malaysia. Ministry of Health Malaysia and National Heart Association of Malaysia (NHAM) are the sponsors of the NCVD. Every year Annual report derived from the database has been produced and published in the website of the NCVD. The annual report consists of various summary by criteria such as the mortality and risks of patients by age, age group, gender, ethnic group, smoking, diabetic, Body Mass Index (BMI) and hypertension factors. The annual report can be accessed at <https://www.malaysianheart.org/>.

## 2.2 Mobile Apps Solutions

In medical and health field, future health professionals should rely on mobile applications to help the patient by generate alarms for medications, education treatments, or procedures to patients during their consultations (Villarreal & Berbey-Alvarez, 2020). The recent developments in mobile and embedded devices have attracted considerable attention toward mobile health applications. From cancer, to diet, to diabetes: every condition and health management issue is dealt with across a number of smartphone apps, and heart disease is no exception. Development of computer methods for the diagnosis of heart disease attracts many researchers (Setiawan et. Al., 2009). Indeed, there are now a number of great apps available for both heart disease patients and individuals wishing to maintain a healthy heart (Istepanian, 2006; McCarthy, 2016). As of 2015, more than 165,000 mobile health apps were available on the Apple iTunes and Android app stores, and 34% of mobile phone owners had at least one health app on their mobile device (Fox & Duggan, 2012; Terry, 2015; Smith, 2015).

However, existing contents aimed at facilitating the realization of these mobile applications have shown to be not suitable to address local factors because all of these factors and its measures were done outside of the country using their local respondents that are very different with Malaysian. Therefore, the aim of this study is to explore local cardiovascular risk factors and develop a Mobile Cardiovascular Risk Diagnose (MCRD) mobile app that able to diagnose the risks. The source of data is from NCVD database since it has been established for more than 10 years and have details record of the CVD patients in Malaysia. This research is aligning with Selangor state direction on communities' healthcare where by Selangor has introduced a healthcare subsidisation scheme under its Budget 2017 estimated to benefit about a million residents in Selangor (Selangor Peduli Sihat, 2017). The mobile apps then able to provide analysis of risks and propose immediate action to the user.

This MCRD mobile apps development shall provides general diagnosis and guidelines on reducing disability and premature deaths from coronary heart disease, cerebrovascular disease and peripheral vascular disease in people at high risk, who have not yet experienced a cardiovascular event. People with established cardiovascular disease are at very high risk of recurrent events and are not the subject of the diagnosis and guidelines in the mobile apps.

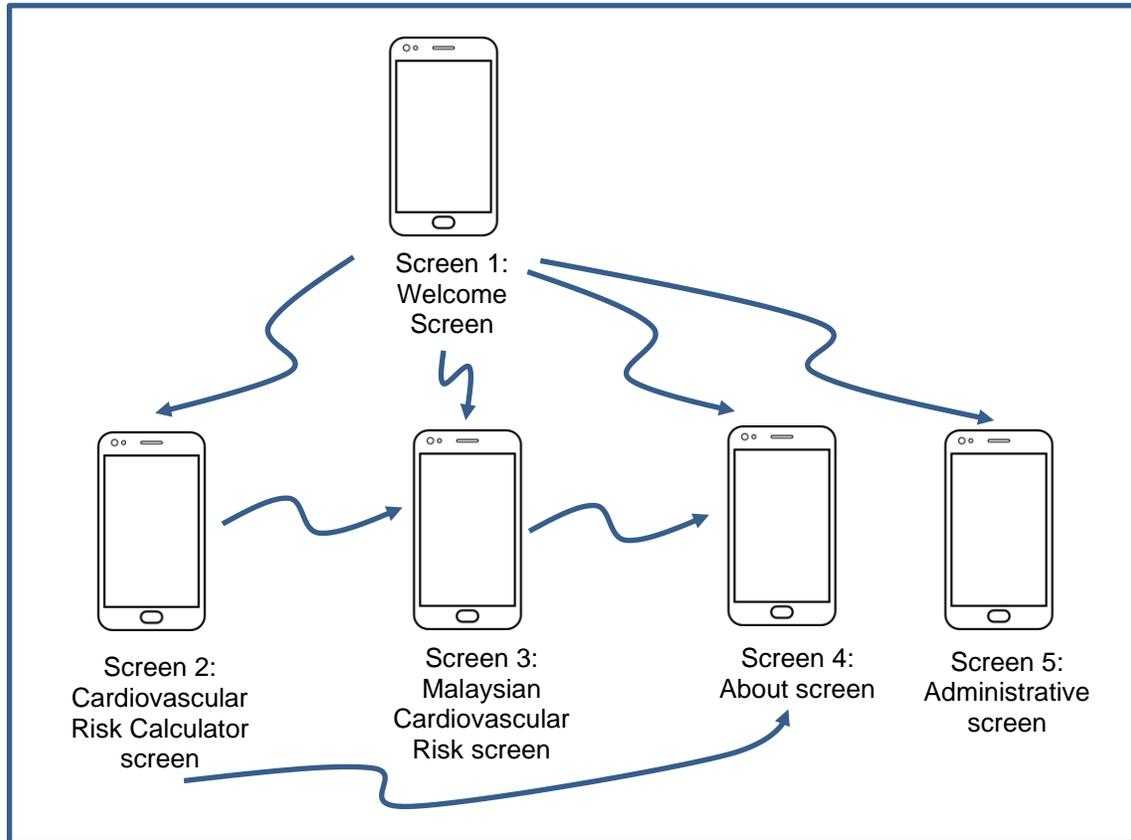
## 2.3 Framingham Risk Model

Framingham Risk Model is a Hard-Coronary Heart Disease formula that will generate projection of a 10-year risk calculation. Framingham Heart Study has originated the formula at <https://framinghamheartstudy.org> where details of the model can be found. The Framingham Global Risk Assessment tools have been used extensively among genders and with a number of ethnic groups. They are the best tools of heart related risk assessment that has been tested and accepted worldwide with predictors age, total cholesterol, High Density Lipoprotein (HDL), Systolic Blood Pressure (SBP), treatment for hypertension and smoking status (Coke, 2016). Full information can be accessed at <https://framinghamheartstudy.org/fhs-risk-functions/hard-coronary-heart-disease-10-year-risk/> and the details of evidence review is accessible at National Institute of Health (NIH), National Heart, Lung and Blood Institute, U.S. Department of Health & Human Services(2013). Framingham risk model also has been used in Clinical Practice Guidelines on Primary and Secondary Prevention of Cardiovascular Disease 2017 (Ministry of Health, Malaysia, 2017).

## 3.0 METHODS AND DESIGN

In the present methodology, this study employs three main phases namely requirement, application development and finally survey and overall evaluation. In requirement phase, we have determined the software that is android studio and set development for android user due to limited budget. The framework for development is rapid prototyping. The design was based on two reviews of cardiovascular mobile apps study that are by Villarreal & Berbey-Alvarez (2020) and Mortara et. al., (2020), also supported by a series discussion with medical expert that is a senior consultant (Cardiologist) in one MOH hospital in Malaysia.

The consideration of the design was to focus on two main contexts that are awareness and at the same time educate Malaysian to prevent the Cardio Vascular Disease (CVD). The interface design shall be using Bahasa Melayu language. Figure 2. depicted the MRCD Proposed design and flow.



**FIGURE 2.** MRCD proposed design and flow

The two awareness are divided into different sections of the mobile apps that are:  
Section 1: A ten years risk assessment based on user input of age, total cholesterol, High Density Lipoprotein (HDL), Systolic Blood Pressure (SBP), treatment for diabetic, hypertension and smoking status.

Section 2: Cardiovascular risk factors for Malaysian projected to current year based on age, gender, ethnic group, smoking, diabetic, Body Mass Index (BMI) and hypertension factors from NCVD. A result of both shall be described in order for the user to understand the outcome value. An interface design consisting of 5 main screens for the mobile apps were proposed that are:

Screen 1: Welcome screen (Information of the apps)

This screen shall contain information and the objective of the mobile apps such as who are the intended user for this apps. No registration will be required since the objectives are to provide simple and easy interface design in promoting the context and understanding to intended user. This screen also shall consist of menu of the apps to be selected from two options that are to proceed to Cardiovascular Risk Calculator screening projecting the 10 years of cardiovascular risk or Malaysian risk screen consisting of seven categories of Malaysian cardiovascular risk value projected by data in NCVD. In all screen there are exit button for accommodate terminating the apps at any time.

#### Screen 2: Cardiovascular Risk Calculator screen (Framingham risk measures)

The first option of the MCRD mobile apps shall require use to input their data that are age, total cholesterol, High Density Lipoprotein (HDL), Systolic Blood Pressure (SBP), treatment for hypertension and smoking status. The result shall show percentage of risk value in ten years' time and explanation of the risk (Low risk for percentage less than 1%, Moderate risk for 1-5%, High risk for 5-10% and Extremely high risk for more than 10% value). The screen then will ask the user to seek medical advice for more accurate result and provide a link of healthy lifestyle tips.

#### Screen 3: Malaysian Cardiovascular Risk screen (Malaysian Seven Risk Criteria)

This screen shall generate the Malaysian seven risk categories projected by the current year based on records in NCVD that are by age, gender, ethnic group, smoking habit, diabetic status, Body Mass Index (BMI) and hypertension factors. From these risk values, user may compare if they are in the high-risk categories or very close to the high-risk categories. This result may also guide then to avoid the high-risk categories such as diabetic, obese and hypertension categories. This screen should have option to menu button or exit button in order for the user to proceed using or terminating the apps.

#### Screen 4: About screen (Information of the sponsor and developer)

The final screen user would go through is the about screen where information about the research project and sponsors located.

#### Screen 5: Administrative screen (Data entry of 20 years risk from NCVD database)

The administrative screen shall enable for up to 20 years of data entry related to the NCVD so that the projection of data is more accurate from year to year.

The second phase is development phase which involves developing a working MCRD mobile apps prototype. This phase also refers to acquire and prepare technologies for content presentation and interaction with users. Basic activities involve in this phase including development of system design, flowcharts, interfaces and screens, and integrating contents as well as continuous evaluation (Alpha and Beta testing will be used to test the prototype during the application development phase) to ensure that all elements work together to improve the design. The MCRD mobile apps is being developed using android studio development tools.

In the third phase, survey, we will verify the research objective and determine the target group. In this phase also, we will design and conduct the questionnaire for acceptance and usability evaluation. Prototype developed needs to test its usability to ensure that it is easy enough for users to interact with. Usability evaluation of the prototype will refer to Shackel (1991) to measure usability by its operational criteria, on four dimensions: effectiveness (performance in accomplishment of tasks), learnability (degree of learning to accomplish tasks, flexibility (adaptation to variation in tasks) and attitude

(user satisfaction with the system). For overall evaluation, we will combine the results and evaluate the strengths and weakness of the research.

#### 4.0 CONCLUSIONS

This research project is still progressing under the development of the prototype. Once complete user acceptance test shall be conducted with medical expert and users before improvement of the MRCD mobile apps and submission to sponsors (Selangor State). The MCVD mobile apps is one alternative of increasing awareness of Selangor in particular and Malaysian in general towards the no one killer in Malaysia for healthy generations to come.

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