UNIVERSITI TEKNOLOGI MARA

REMOTE MONITORING SYSTEM FOR TYPE-2 DIABETIC PATIENT USING MOBILE APPLICATION

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ABSTRACT

Physical activity (PA) is an established treatment for diabetes patients. Mobile health (mHealth) technology shown in previous studies has demonstrated its effectiveness in reducing glycosylated haemoglobin (HbA1c) levels. Health experts from International Islamic University Malaysia (IIUM) have identified types of PA that are suitable for Type-2 Diabetes (T2D) patients. The tailored PA are quite long where it can be challenging for T2D patients especially the elderly to remember each activity. Moreover, the health experts also have discovered that monitoring heart rate during PA can be instrumental in determining an appropriate intensity level for individuals with diabetes. Previous studies on mHealth for T2D patients are lack in the specific types of PA and the heart rate measurement during PA. The tailored PA and heart rate measurement are crucial in helping the T2D patients to improve their health condition as identified by the health experts. Therefore, a remote monitoring system consists of a mobile application and a smartwatch (Xiaomi Mi Band 7) is developed. The mobile application consists of step-by-step guidance of the tailored PA, while the smartwatch is used to measure the patient's heart rate during PA. Furthermore, the patient's healthcare professional (HCP) can remotely monitor their patient's progress and the heart rate. The mobile application was developed using technologies such as Flutter framework, Nodejs, Express, Heroku and Database Management System (DBMS) MongoDB. Next, the measurement of heart rate is transmitted from the smartwatch to the mobile application through Google Cloud console, Zepp Life mobile application and Google Fit mobile application. Next, the mobile application was analysed using three different testing which are the performance, effectiveness, user acceptance. Firstly, three experiments were conducted for performance testing, which the aim of the testing is to identify the system's performance for remote monitoring purposes. Secondly, the objective of effectiveness analysis is to measure the effectiveness of the mobile application based on the changes of patient's weight, and Glycosylated Hemoglobin (HbA1c) levels. Three months program were conducted with five participants and one HCP. The results showed a statistically significant reduction in weight (0.98kg) and HbA1c levels (5.31%) in the participants. Next, for the user acceptance testing, online questionnaires were developed using Google Forms. This testing is to gain different perspective or opinion about the system from the public and the participants. Based on the feedback from the respondents, the results show a high level of satisfaction of the mobile application. In conclusion, the developed mobile application is a novel approach to addressing the challenges of diabetes self-management, offering tailored guidance and heart rate monitoring for remote physiotherapy.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Diabetes Mellitus (DM) is a group of metabolic diseases where it is caused by the pancreas producing less insulin resulting in persistently high blood glucose levels [1]. Diabetes also can be categorized as a chronic disease, which if not treated, the disease can cause serious problems to the human body, such as heart disease, nerve damage, strokes, hearing loss, hypertension, blindness, and kidney failure [2]. Therefore, diabetes necessitates regular medical attention and treatment to help regulate blood sugar levels. The prevalence rate of people who are diagnosed with diabetes in Malaysia is 17.5 % (3.5 million people) and is expected to reach 31.3 % by 2025 [3]. This escalating trend underscores the critical need for innovative approaches in diabetes treatment and management. Moreover, based on Figure 1.1, the prevalence rate of people diagnosed with diabetes in Malaysia has 4.9% increment from 2015 (13.4%) to 2019 (18.3%) [4].

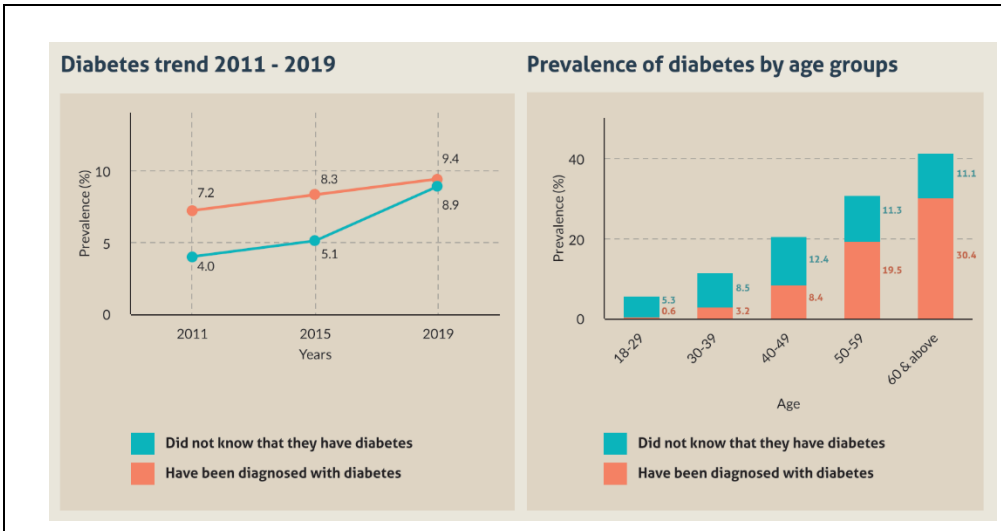

Figure 1.1 Diabetes Trend in Malaysia From 2011 to 2019 (National Health and Morbidity Survey 2019)

The treatment of DM involves a multifaceted approach aimed at managing symptoms, preventing complications, and improving overall quality of life. Central to