LITERATURE REVIEW

Effectiveness of Chatbot to Reduce the Risk of Coronary Heart Disease using Android-based application

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ABSTRACT

Background: An innovative approach in the form of a discussion platform designed to help users deal with health issues related to coronary artery disease. Chatbot platforms allow the collection of users' data, which is analyzed through natural language processing and behavioral analysis, to provide each user with a customized solution based on their current situation. The data collected and analyzed is accessible. The platform is developed using chatbot technology. Users can interact with chatbots to generate personal chat data stored on the platform. Conflicting information and sensitivity to Coronary Heart Disease (CHD) issues hinder effective communication. Recent technological solutions to maintain weight loss are limited. A chatbot would be suitable to support weight loss as it requires no human intervention, is available 24 hours a day, and supports natural communication while maintaining anonymity. The health system needs an effective and low-cost way to provide optimal health outcomes using conversation-enabled Artificial Intelligence (AI). Humans can interact well with this AI in the form of a fully automated and self-contained text-based mobile tutoring service. CHD is a serious health problem worldwide with multiple and interrelated causes. At the same time, chatbots are becoming more popular for interacting with users in mobile health apps.

Objective: We evaluated an Android application. Its main goal is to prevent lifestyle-related diseases that are a risk for CHD, which has been considered at risk for multiple coronary artery disease (CAD), with the overarching goal of gaining compassion through mobile health improvements. The insights gained in this preview article will be used to plan future health care systems and to design an AI capable of advanced healthcare, chronic disease prevention, and self-treatment.

Results: The Role of Artificial Intelligence in preventing Coronary Heart Disease (CHD) is done through health screenings. The app warns the user to exercise regularly and maintain food intake by reducing foods high in calories and adding foods high in fiber.

Conclusion: Usage of AI in healthcare is associated with CHD prevention, which alters healthy lifestyles. It can also encourage a change in attitude, a high level of user concern for health, and obtain complete health information. Research on artificial intelligence and its use in telemedicine needs to be continued, with clinical trials examining the impact on blood pressure, body mass index, smoking, diabetes mellitus, and user engagement and feedback.

Keywords: Coronary Heart Disease, Education, Chatbot, Artificial Intelligence, Connected Health, Health Communication, Smartphone, mobile health

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Introduction

Industry and research professionals have used such data to improve the user experience of their applications or to collaborate with other research parties to address large-scale societal problems, such as those encountered in public health.

One of the growing public health problems is CHD. Obesity is defined herein as the abnormal accumulation of excess body fat relative to a body mass index (BMI) >30 (WHO, 2020). Obesity is one of the most devastating public health problems as it is the most important risk factor for chronic diseases such as type 2 diabetes, cardiovascular disease, coronary artery disease, and certain cancers. Obesity can lead to difficult and debilitating psychological problems, as CHD people disproportionately suffer from mood disorders such as depression and anxiety (Gariepy, 2010). Obesity harms CHD society's well-being. It requires the development of innovative approaches to address this problem.

Many cookie-cutter approaches to public health problems apply the same interventions to everyone. Although personality traits and emotional experiences vary widely, both can significantly hinder the effectiveness of public health interventions.

Deep learning techniques and the availability of more user-generated datasets and powerful computers have opened up new possibilities for corpus-based models. These models search through large data of conversations between humans, which should have been done using the information retrieval (IR), which is based on the systems that replicate the human's responses from the old to the newest conversations, or machine translation paradigms could be used as another alternative such as having word embeddings and A sequence-to-sequence neural network of attention mechanisms, as shown, is used to learn to associate user utterances with system responses (Jurafsku, 2020). These models have three main components: Embeddings can be word types or other forms of tokens such as characters or n-grams. The embedding layer converts the input into a continuous numeric vector that represents the input. Encoder At this stage, we encode the input embeddings (vectors) to produce intermediate states, which are fixed-length vectors. The decoder takes the fixed-length codes generated by the encoder and uses beam search decoding to create variable-length sets.

Non-Communicable Diseases (NCDs) are a global and national concern. This is because the morbidity and mortality of NCDs tend to increase. WHO reports in the Global Status Report on Non-Communicable Disease 2014 that NCD is the most average cause of death worldwide or 38 million of 56 million (68%) deaths in 2012. More than 40% are early deaths below the age of 70 years. About 82% of deaths occur in low, and middle-income countries. Deaths from NCDs are more than deaths from other diseases combined. Deaths from NCDs are estimated to increase from 38 million in 2012 to 52 million in 2030 (WHO, 2014). An important factor that causes the increase in NCDs is the socio-cultural epidemiological transition. Economic development causes a drastic mutation in people's lifestyles and nutritional patterns. These changes impact increasing obesity and diabetes rates, leading to NCDs (Low, Lee, & Sammy, 2015).

The increase in NCDs in Indonesia compared to infectious diseases is influenced, among others, by environmental imbalances, people's lifestyles, demographic changes, technological advances, and economic and socio-cultural growth. NCDs that continue to grow will increase the burden on the community and the government because of the high cost and technology needed to treat the disease. Data from the Social Security Administration for Health (BPJS) in 2017 showed that 10,801.787 billion people, or 5.7% of JKN users, received

critical illness services, and Rp. 14.6 trillion or 21.8% of the total cost of health services. 50.9% heart disease rating or 7.4 trillion (P2ptm.kemenkes, 2019). The increasing incidence of NCDs has become a heavy burden not only for the community but also for the government. This is because of the expenditure on healthcare and the high technological advances required for NCDs treatment surgery. This can be seen from the 2017 BPJS data collection, where 5.7% of NHS participants, or around 10,801.787 billion people, received catastrophic disease services. 21.8% of the cost of health services or around Rp. 14.6 trillion was spent on services for diseases and heart disease (50.9%) or Rp. 7.4 trillion. (P2ptm.kemenkes, 2019).[4]

To reduce morbidity, it is necessary to prevent and control non-communicable diseases on an ongoing basis, involve all departments, and work together to appropriately reduce the risk factors that cause the main causes in the community. In Indonesia, where the economic class, education level, and social level are different, it is very difficult to educate people equally from an early age. Therefore, a comprehensive education system is needed that covers all levels of society from an early age to recognize and adapt to a healthy lifestyle to reduce the risk of NCDs.

CHD is a non-communicable disease. NCDs are currently a public health problem. It is known that about 36 million people die each year from NCDs (63% of all deaths). (Ministry of Health RI, 2014) [7]

The global policy for controlling the cardiovascular disease is contained in WHO regulations through nine NCDs targets. These goals include technology and drug availability, preventive medicine, reduction of diabetes and obesity, salt intake, reduction of alcohol use, reduction of mortality, physical activity, reduction of smoking behavior, and reduction of hypertension. These nine NCDs goals are expected to be achieved by 2025 through six global strategies to address NCDs. The six strategies include identifying prevention and control priorities, strengthening the nation's capacity, lessening risk factors, strengthening the health systems, conducting quality research, and monitoring disease trends (WHO, 2013).

1. **Implementation**

   Data Usage

   Based on the requirement of the chatbot platform, data to be collected and used in this work include physiological information like blood pressure, heart rate, and BMI by measurement on smart mobile phones. Captured data is stored, enriched, then semantically fused to enable a unified and unique data access interface.

Feature 1. Account at Application dokterkit

Methods

This research method is a literature review, where the researcher searches, summarizes, and analyzes the scientific literature, then the researcher compiles the results of the analysis according to the research objectives. Search for literature sources using the Science Direct, PubMed, Google Scholar, and ProQuest database using the keywords: 'coronary heart

disease,' 'non-communicable disease,' 'Artificial Intelligence, 'chatbot,' 'Connected Health,' and 'Health Communication.' The literature used in this study is limited from 2007 to 2021.

Result

Dokterkit mobile phone app at Google Play Store was designed to provide emergency call services immediately to go to the nearest hospital to get help due to heart disease, so there is an emergency button in the application by simply pressing the phone to connect directly and the ambulance to get access to the location of the intended patient. This system will be helpful ten years from now, but the development of this application needs to be progressing for its implementation. This application can be a benchmark for hospital doctors to find out the identity of patients who have arrived at the hospital, with access to the Dokterkit application, personal health, and medical history features filled in by patients who have used the Dokterkit application service.

Dokterkit results can be seen on the Youtube tutorial https://youtu.be/N5vojl7Lfx8 or https://youtu.be/vSPWSZVC5u0. Dokterkit provides health education features, patient barcodes, emergency calls, notes, medical history, and self-help with the SOCS program for school children. The purpose of this application is to create a community that has the same vision and mission, to live a healthy life by having a positive impact on oneself, to have identity data and previous medical checkups that are neatly arranged, to provide nutritional guidelines for children so that parents play a role in providing balanced nutrition for their children, educating on the prevention of lifestyle-related diseases, especially heart disease, and a neat health care system to serve patients equitably.

Feature 2. Application Dokterkit at Google Play Store

4.1 The Role of Artificial Intelligence in Preventing Coronary Heart Disease

Service advancements have been created using technology to improve efficiency and health systems, including self-management of chronic diseases (Wischer, 2014). For example, applications have been used for disease prevention, monitoring, treatment, patients, health support, health promotion, and diagnosis (Ali, 2016). technology has increased the efficiency of health care workers in hospitals, clinics, health centers, and others, for example, the use of electronic health records (Chen, 2009), but has not been able to increase direct patient interaction, namely by having empathy and interacting correctly through applications. concentration of care to better health outcomes (Bramley, 2014).

Research has prioritized evaluations in weight control made by AI, namely collecting behavioral data indirectly, predicting someone's behavior errors, and providing

feedback to improve behavioural self-control with encouragement.

4.2 Coronary Heart Disease Risk Factors

CHD is a non-communicable disease resulting from the interaction of genetic, lifestyle, and environmental factors. Risk factors that cannot be tolerated: gender, age, and genetics. Risk factors may be affected: hypertension, smoking, dyslipidemia, diabetes, obesity, and physical inactivity. Other risk factors: are stress, alcohol, diet, and nutrition.

Various epidemiological studies have shown that people with more than one coronary artery disease risk factor (such as high blood pressure, diabetes, or obesity) have a 2 to 3 times higher risk of coronary artery disease than 70 people without these risk factors. There are risk factors.

4.3 Risk factors that cannot be changed (Non-modifiable)

4.3.1 Age

Age is a risk factor for CHD; whereas age increases, the risk factor for CHD also increases, which generally begins at the age of more than 40 years. This is also based on research conducted by Zahrawardani et al. that there is a significant relationship between age and the incidence of CHD. The relationship between age and cases of death in CHD patients is known to be experienced by men aged 35-44 years and increases with age. Other data shows that one in nine women aged 45-60 years suffers from CHD, and one in three women over 60 suffers from CHD, while one in two women will die due to CHD and stroke.

4.3.2 Gender

CHD is more common in men than women, although CHD is the main cause of death in both men and women. It is known that, in the United States, symptoms of CHD before the age of 60 are found in one in five men and one in seventeen women. This means that men risk CHD two to three times greater than women. Another study conducted by Zahrawardani et al. found that women and men over 50 have the same risk of developing CHD. This happens because of the influence of a decrease in the hormone estrogen, which plays an important role in protecting blood vessels from damage that causes atherosclerosis.

4.3.3 Descendants (including race)

Research conducted by Narrida states that a family history of heart disease with age under 55 years is a risk factor that must be considered as well as risk factors for CHD that can be inherited such as hypercholesterolemia, hypertension and diabetes mellitus. Another study by Rosmiatin found that a family history of CHD will be passed on to other families, in this case, a family that has direct blood relations and is usually under the age of 70 years.

Regarding race, it is known that the white race is more likely to experience CHD than the African American race. The white race with middle age has a high risk of developing CHD.

4.4 Modifiable risk factors

4.4.1 Hypertension

Yusuf et al., in their research, found that adults aged 40 to 69 years if they experience an increase in systolic blood pressure of 20 mmHg and an increase in diastolic blood pressure of 10 mm Hg. This can increase the risk factor for

death from CHD. From the results of research conducted by Zahrawardani et al., it was found that there was a significant relationship between hypertension and the incidence of CHD. The risk of CHD is directly related to blood pressure, where for every five mmHg decrease in diastolic blood pressure, the risk of CHD can be reduced by about 16%.

Continuous and persistent high blood pressure will cause the arterial system to be damaged slowly. The damaged arteries will harden due to fatty deposits on the artery walls so that the lumen of the blood vessels will narrow and blood flow will be slow. If this occurs in the coronary arteries, it can cause coronary atherosclerosis, which is the beginning of CHD.

4.4.2 Smoking

According to Doll et al., mortality from CHD is known to be higher in smokers, which is around 60%. Passive smokers continuously exposed to cigarette smoke also have a high risk of CHD, around 25%-30%. WHO estimates that the incidence of CHD is more than 20% caused by the risk factor of smoking.

The risk of CHD in smokers is two to four times greater than in nonsmokers. It is known that cigarettes contain several toxic substances such as tar, nicotine, and carbon monoxide (CO). The content of substances contained in cigarettes will cause a decrease in O2 levels in the heart, an increase in blood pressure and pulse, a decrease in High-Density Lipoprotein (HDL) levels, and an increase in blood collection and damage to the endothelium of coronary arteries.

The risk of CHD due to smoking will decrease and decrease by up to 50% at the end of the first year after quitting smoking and return without the risk of CHD due to smoking after 10 years of quitting smoking.

4.4.3 Dyslipidemia

Dyslipidemia is a lipid metabolism disorder characterized by an increase or decrease in the lipid fraction in plasma. Abnormalities of the lipid fraction in dyslipidemia are called Triad Lipids, namely increased levels of total cholesterol, Low-Density Lipoprotein (LDL) cholesterol, and triglycerides, as well as a decrease in HDL cholesterol. These three lipid fractions have a close relationship with the occurrence of atherosclerosis in coronary arteries.

4.4.4 Diabetes Mellitus

Diabetes mellitus (DM) is a chronic disease that is still a major problem in the world of health in Indonesia. According to the American Diabetes Association (ADA) 2005, DM is a group of metabolic diseases characterized by an increase in blood sugar caused by a disturbance in insulin secretion, insulin action, or both.

A study conducted by Zahrawardani et al. found a significant relationship between DM and the incidence of CHD, where uncontrolled diabetes with elevated glucose levels in the blood could cause total cholesterol and triglyceride levels to tend to increase.

4.4.5 Obesity

Obesity or overweight is a condition where Indonesia's body mass index (BMI) ranges from 25.1 kg/m2 to above >30 kg/m2. Obesity can cause an increase in

the work of the heart and especially will make the accumulation of fat in the central part of the body, increasing the risk of CHD.

4.4.6 Physical activity

Physical activity, such as regular exercise, is very useful because it knows it can control total cholesterol levels, increase energy expenditure, and decrease LDL and triglyceride levels in the blood so that HDL levels increase.

According to Rosmiatun, people who do less physical activity will reduce blood flow in the collateral blood vessels and coronary arteries, which will reduce blood flow to the heart. Physical activity will improve the working system of the heart and blood vessels. It is recommended that a person do physical activity (exercise) for at least thirty minutes, done three to four times a week, to achieve the desired results.

4.5 Other risk factors for coronary heart disease

4.5.1 stress

Stress is a body reaction or mental state seen with a series of responses such as anxiety, worry, increased blood pressure, and the influence of unpleasant environmental conditions.

Stress and anxiety are known to be a cause of CHD. This is because stress can stimulate the release of high levels of adrenaline and catecholamine hormones; it can cause narrowing of the coronary arteries, so blood flow to the heart is disrupted. Stress can also indirectly increase the risk of CHD if the stress causes the desire to smoke or eat foods high in fat and sugar.

4.5.2 Alcohol

Alcohol is known to reduce the risk of CHD. According to the analysis of the International Center of Alcohol Policies (ICAP), consuming about one to two units of alcohol per day can reduce the risk of CHD. This is because alcohol can increase HDL cholesterol levels and reduce the risk of thrombosis in blood vessels. However, consuming too much alcohol can cause damage to the heart muscle because alcohol can cause obesity, increase triglyceride levels and increase blood pressure. It is recommended for men that consume no more than three to four units of alcohol, while for women, no more than two to three units.

4.5.3 Diet and Nutrition

An unhealthy diet can lead to an increased risk of CHD. Mozzafarian et al. stated that a diet high in fat (saturated fats such as meat, dairy products, chocolate, baked goods, and fried foods), sodium, sugar, and low in complex carbohydrates, fruits, and vegetables is a risk for cardiovascular disease. It is known that trans fatty acids can reduce HDL cholesterol levels and increase LDL cholesterol levels, thereby increasing the risk of CHD. A 2% increase in energy intake from trans fatty acids would increase the incidence of CHD by 23%.

4.5.4 Control Blood Pressure

Hypertension is also a risk factor for CHD. For this reason, it is recommended to check blood pressure regularly to find out if your blood pressure is increasing, normal or decreasing.

4.5.5 Controlling Blood Cholesterol

Increased blood cholesterol, especially LDL, is a risk factor for CHD, which can cause blockages in blood vessels. Blood pressure control is needed to avoid the accumulation of LDL in blood vessels. This is done by identifying foods that are high in cholesterol and reducing the intake of cholesterol consumed.

Discussion

Microintervention research was conducted on people who were older (between 40-57 years old) and had a BMI higher than normal (27-37 kg/m2). Timely micro-interventions can also have different effects on different behaviors. For example, the level of physical activity requires cues or cues to encourage, and these cues can reduce unhealthy eating by triggering unhealthy eating behaviors (Chew, 2021). This shows that we are still in the early stages of applying artificial intelligence to weight loss-related self-regulatory behavior because research is still on how behavioral self-monitoring systems are accurate and effectively predict and facilitate testing weight loss.

5.1 Predictive analytics

Proper and clean food consumption has been scientifically proven to reduce body fat (Dennis, 2012), ideal weight loss, and weight maintenance (Calugi, 2017) in obese individuals so as not to experience CHD. The study included factors based on self-recorded exercise routines or measured using an accelerometer (steps and duration), type of calories consumed (fat content and diet), adherence to counseling, Gender to predict weight-loss interventions, and sociodemographic data (age). Other studies have developed algorithms through the maximization of one's character framework to explain the irrationality of changes in human behavior in trying to lose weight (Bastian, 2017). This combination of behavioral concepts may influence future prediction models for diet and weight loss in public health.

5.2 Potential mechanism to improve self-regulation

The intervention's effectiveness should consider the effects of gender, comorbidities, and age, which is known to be significant factor in CHD.

5.3 Study Design

In Indonesia, according to data obtained from the Data and Information Center of the Ministry of Health of the Republic of Indonesia on the Situation of Heart Disease and data from the Basic Health Research (Riskesdas) in 2013, it was 0.5%, while according to a doctor's diagnosis or symptoms, it was around 1.5%. The same data also found that according to the doctor's diagnosis, the highest prevalence of CHD was found in Indonesia, namely in West Java Province with a percentage of 0.5%, and the lowest was found in North Maluku Province with a percentage of 0.2%.

In a study conducted by Zahrawardani et al about the Analysis of Risk Factors for CHD at the Central General Hospital, dr. Kariadi in Semarang from September to October 2011 showed that of the 128 existing patients, 103 (80.50%) suffered from coronary heart disease, and the rest suffered from other heart diseases. From the results of this study, it is also known that the risk factors that influence the incidence of CHD include age, total cholesterol, triglyceride levels, hypertension, and diabetes mellitus.

Research data was reported by one article with the number of participants 70 people who meet the standards to be the CDC's criteria for the Diabetes Prevention Program. The average user duration of the app was 15 weeks, and

the average user had 103 sessions during this study. The weight loss calculations included the number of meals recorded, the duration of AI use, and the number of counseling sessions. The percentage of healthy foods consumed by users increased significantly by 31%. The survey of user trust results for this application is positive and gets a 100% response from the total participants, with a satisfaction score of 87 out of 100 and a promoter score of 47. (Chew, 2021).

A retrospective study of 239 overweight or obese adults (BMI min 25 kg/m2) was conducted in Nevada and Southern California as one of six primary care facilities working with the Lark company. Patients are given the use of the HCAI application for free to patients who meet BMI requirements. Further selection criteria were the use of an Android or iOS mobile phone, and this application was first used between July 2016 and January 2017. Users can complete the research within 16 weeks. When using the application, users must provide identity data such as gender, age, height, and weight. Female users were 74.5% (35/74) with an average age of 47. Their initial average body weight was 98 kg and BMI 37 kg/m2. Wesers lost an average of 2.4kg or 2.4%.

5.4 Applicability in Chronic Disease Management

AI chatbots in mobile applications are future programs that can meet users' needs simultaneously by perfecting health care providers to have an impact to support behavior change in patients. This is supported by the results of systematic research, which can be concluded that telemedicine can manage the chronic disease so that it can direct patients to be able to care about their health and how to properly handle CHD, which is very crucial, thereby improving patient health outcomes, using a more modern service pattern, the cost of treatment is more affordable, there are no obstacles to meeting a doctor to get a consultation and at the same time getting high users on the application. (Stein, 2017)

Conclusion

In conclusion, many current studies have prioritized the potential use of AI in everyday life, especially to gain maximum access to health services and improve personal health through an easily accessible service system framework. However, it depends on several factors, environmental and emotional, of each user to consider in AI programming. Future research could compare the effectiveness of current app users with AI chatbots and behavior change programs for using app products, which can assess the efficiency of AI interventions.

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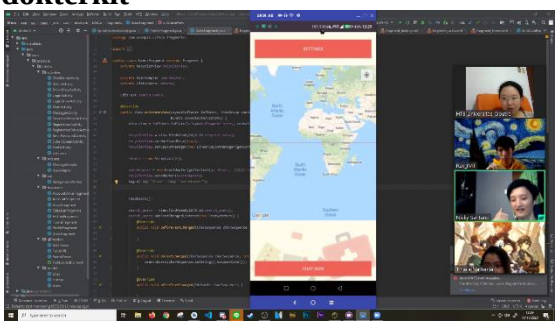
31.

Feature 3. Promotion Application dokterkit



Feature 4. Coding of application dokterkit