Telemedicine Use and Associated Factors Related with HbA1c Level Among Type 2 Diabetes Outpatients During COVID-19 Outbreaks in Jakarta, Indonesia: A Cross-Sectional Study

Miss Novi Sulistia Wati

A Thesis Submitted in Partial Fulfillment of the Requirements
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การใช้โทรเวชกรรมและปัจจัยเกี่ยวข้องกับระดับน้ำตาลสะสมในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในช่วงการระบาดของโควิด-19 ในเมืองจาการ์ตา ประเทศอินโดนีเซีย: การศึกษาภาคตัดขวาง

น.ส.โนวี่ ซุลิสเทีย วาติ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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By	Miss Novi Sulistia Wati
Field of Study	Public Health
Thesis Advisor	Pokkate Wongsasuluk, Ph.D.

Accepted by the COLLEGE OF PUBLIC HEALTH SCIENCES, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Public Health

.... Dean of the COLLEGE OF PUBLIC HEALTH SCIENCES
(Professor SATHIRAKORN PONGPANICH, Ph.D.)

THESIS COMMITTEE

.... Chairman
(MONTAKARN CHUEMCHIT, Ph.D.)

.... Thesis Advisor
(Pokkate Wongsasuluk, Ph.D.)

.... External Examiner
(Nipunporn Voramongkol, M.D. MPH.)

โนวี่ ซุลิสเทีย วาติ :
การใช้โทรเวชกรรมและปัจจัยเกี่ยวข้องกับระดับน้ำตาลสะสมในเลือดของผู้ป่วยเบาหวานชนิดที่ 2 ในช่วงการระบาดของโควิด-19 ในเมืองจาการ์ตา ประเทศอินโดนีเซีย: การศึกษาภาคตัดขวาง. (Telemedicine Use and Associated Factors Related with HbA1c Level Among Type 2 Diabetes Outpatients During COVID-19 Outbreaks in Jakarta, Indonesia: A Cross-Sectional Study) อ.ที่ปรึกษาหลัก : อ. ดร.ปกเกศ วงศาสุลักษณ์

การประกาศบังคับใช้มาตรการจำกัดทางสังคมขนาดใหญ่ (Large-Scale Social Restriction) ในประเทศอินโดนีเซีย ตั้งแต่เดือนเมษายนปี พ.ศ. 2563 เพื่อรับมือกับการระบาดของไวรัสโควิด-19 นั้น ได้มีข้อจำกัดต่างๆ ที่อาจส่งผลต่อการดูแลตนเอง และการควบคุมระดับน้ำตาล ในผู้ป่วยโรคเบาหวาน การใช้โทรเวชกรรม (Telemedicine) จึงเริ่มใช้กันอย่างแพร่หลายมากขึ้น เพื่อดูแลผู้ป่วยเบาหวาน ในช่วงของการระบาด ในการศึกษานี้ มีวัตถุประสงค์เพื่อศึกษาการใช้โทรเวชกรรม และปัจจัยที่เกี่ยวข้อง ในการควบคุมระดับน้ำตาลในเลือด ของเบาหวานชนิดที่ 2 (T2DM) ในช่วงการระบาดของโควิด-19 การศึกษาภาคตัดขวางนี้ ได้ดำเนินการในช่วงเดือนมีนาคม ปี พ.ศ. 2564 โดยใช้แบบสอบถามออนไลน์ เก็บข้อมูลอาสาสมัครที่เป็นผู้ป่วยโรคเบาหวาน ซึ่งอาศัยอยู่ในจาการ์ตา ทั้งหมด 264 คน ที่มีอายุระหว่าง 25-54 ปี แบบสำรวจนั้น ประกอบด้วยคำถามเกี่ยวกับลักษณะทั่วไปของประชากร ภาวะของโรคเบาหวาน การปรึกษาแพทย์ การดูแลตนเองของผู้ป่วย การสนับสนุนจากครอบครัว และระดับ HbA1c สำหรับการวิเคราะห์ทางสถิตินั้น ได้ใช้ไคสแควร์ โดยซอฟต์แวร์ SPSS เวอร์ชัน 22 ผลการศึกษา จากผู้ป่วยเบาหวาน ทั้งหมด 264 ราย พบว่า 60.2% มีระดับ HbA1c สูงกว่า 7% พบปัจจัยที่เกี่ยวข้อง คือ เพศหญิง (odds ratio [OR]=2.170; p=0.038) มีน้ำหนักเกินหรือเป็นโรคอ้วน (odds ratio [OR]= 5.740; p<0.001) มีปัญหาเกี่ยวกับอินซูลินที่ต้องรับประทานยา (odds ratio [OR]=3.083; p=0.016) บริโภคอาหารทอดเป็นประจำ (odds ratio [OR]= 5.204; p=0.005) ปัจจัยป้องกันคือ มีประสบการณ์การใช้โทรเวชกรรมก่อนเกิดโรคระบาด (odds ratio [OR]=0.372; p=0.049) การออกกำลังกายเป็นประจำ (odds ratio [OR]=0.036; p<0.001) การปรึกษาแพทย์โดยใช้โทรเวชกรรม (odds ratio [OR]= 0.193; p=0.029) หรือการไปพบแพทย์ด้วยตนเอง (odds ratio [OR] =0.065; p<0.001) อย่างไรก็ตาม ในการศึกษานี้พบว่ามีผู้เข้าร่วมเพียง 19.7% เท่านั้นที่ใช้โทรเวชกรรมเพื่อปรึกษาแพทย์ในช่วงโควิด-19 ระบาด การควบคุมระดับน้ำตาลในเลือดของผู้ป่วยเบาหวาน ในช่วงการระบาดของ COVID-19 นั้น มีแนวโน้มที่จะแย่ลง จากผลการศึกษา สรุปได้ว่าการกินเพื่อสุขภาพ และการออกกำลังกายเป็นประจำ เป็นปัจจัยสำคัญ ที่ช่วยให้ผู้ป่วยเบาหวาน ควบคุมระดับน้ำตาลในเลือดได้อย่างเหมาะสม และสามารถป้องกันภาวะแทรกซ้อนจากโรคเบาหวานได้ นอกจากนี้ การใช้เทคโนโลยีต่างๆมาสนับสนุน และช่วยเหลือผู้ป่วยโรคเบาหวานในการดูแลตนเอง ดังเช่นการใช้โทรเวชกรรม จัดเป็นทางเลือกที่มีประโยชน์อย่างยิ่ง ในช่วงสถานการณ์การระบาดโควิด-19

สาขาวิชา	สาธารณสุขศาสตร์	ลายมือชื่อนิสิต	....
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Novi Sulistia Wati : Telemedicine Use and Associated Factors Related with HbA1c Level Among Type 2 Diabetes Outpatients During COVID-19 Outbreaks in Jakarta, Indonesia: A Cross-Sectional Study. Advisor: Pokkate Wongsasuluk, Ph.D.

Introduction: The Large-Scale Social Restriction (PSBB) has been implemented in Indonesia since April 2020 as a response to the COVID-19 outbreaks. This prolonged restriction could impact routine diabetes care and glucose control among diabetes patients. Telemedicine is expected to be a solution to the disrupted diabetes care amid the pandemic. This study aimed to determine the telemedicine use and associated factors to glycemic control among type 2 diabetes mellitus (T2DM) outpatients during the pandemic. Methodology: This cross-sectional study was conducted online during March 2021. A structured questionnaire was administered to 264 subjects who were 25–54 years old, diagnosed with T2DM, domiciled in Jakarta. The survey included questions about general characteristics, diabetes conditions, consultation factors, self-care, family support and latest HbA1c level (%). For statistical analysis, chi-square was performed using SPSS software version 22. Result: The result from total of 264 T2DM outpatients found that 60.2% had HbA1c ≥7% during COVID-19 outbreaks. They were more likely to be overweight or obese (odds ratio [OR]=5.740; $p<0.001$), prescribed with combination of insulin and oral medication (odds ratio [OR]=3.083; $p=0.016$), and consumed fried foods frequently (odds ratio [OR]=5.204; $p=0.005$). The protective factors were having experience in using telemedicine before the pandemic (odds ratio [OR]=0.372; $p=0.049$), regular exercise (odds ratio [OR]=0.036; $p<0.001$) and consult with a doctor using telemedicine (odds ratio [OR]=0.193; $p=0.029$) or in-person visit (odds ratio [OR]=0.065; $p<0.001$). However, only 19.7% of the participants used telemedicine to consult a doctor. Conclusion: Glycemic control among T2DM outpatients during COVID-19 outbreaks tends to be suboptimal (HbA1c ≥7%). The findings highlight suggested that healthy eating and regular exercise ensure optimal glycemic control and prevent diabetes complication. Further, endorsement and technical support are needed to help diabetes patients in adopting telemedicine use for remote diabetes care which can be useful in an outbreak situation like COVID-19.

Field of Study:	Public Health	Student's Signature ....
Academic Year:	2020	Advisor's Signature ....

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Novi Sulistia Wati

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CHAPTER I
INTRODUCTION

1.1 Background and Rationale

A. Novel Coronavirus Disease (Covid-19)

COVID-19 is an emerging infectious disease caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The first case of COVID-19 was found in Wuhan, Hubei Province, central China on 31st December 2019. It was categorized as a global pandemic on 11th March 2020 by the World Health Organization (WHO) after affected more than 114 countries and killed over 4,000 people (WHO, 2019). As of 16 December 2020, there have been 71,919,725 confirmed cases of COVID-19 in the world with 1,623,064 deaths.

The first case of COVID-19 in Indonesia was found on 3rd March 2020. The number of cases keeps increasing until it has surpassed the total case of COVID-19 in mainland China with more than 1,894,025 confirmed cases and 52,566 deaths, as of 11th June 2021. The average of daily new COVID-19 cases in Indonesia still greater than 5,000 (Satgas, 2020). The provinces with the highest COVID-19 cases in Indonesia are Jakarta (23.4%), West Java (17.3%), Central Java (11.2%) and East Java (8.4%) (Satgas, 2020).

In response of COVID-19 pandemic, the government has proactively implemented Large-Scale Social Restrictions (PSBB) since 10th April 2020 started from Jakarta, Indonesia and followed by the other region (MoH, 2020). The restrictions are executed by local governments with the approval of the Ministry of Health (MoH). During the restrictions, people are advised to stay at home unless there is an urgent matter. Hospitals remain open but the government urged the public to use telemedicine to consult a doctor unless for those who need the emergency medical care. This recommendation is given to protect health workers and people who vulnerable from COVID-19 transmission e.g., elderly and individuals with comorbidities (Acharya & Porwal, 2020).

B. Diabetes

People with underlying health conditions or comorbidities are the most vulnerable and have shown worse prognosis of COVID-19 (Edler et al., 2020; Garg et al., 2020) such as hospitalization, admission to the ICU, mechanical ventilation, and death. Among all the chronic conditions, people with diabetes (PWD) has the highest risk of dying from COVID-19 compared to those without diabetes (Barron et al., 2020). The reason is multifactorial from age, sex, ethnicity, comorbidities, obesity, a pro-inflammatory and pro-coagulative state which reflecting the syndromic nature of diabetes. Diabetes become the highest underlying case among people who died from COVID-19 (9.9%) in Indonesia, data per 31st May 2021 (Satgas, 2020).

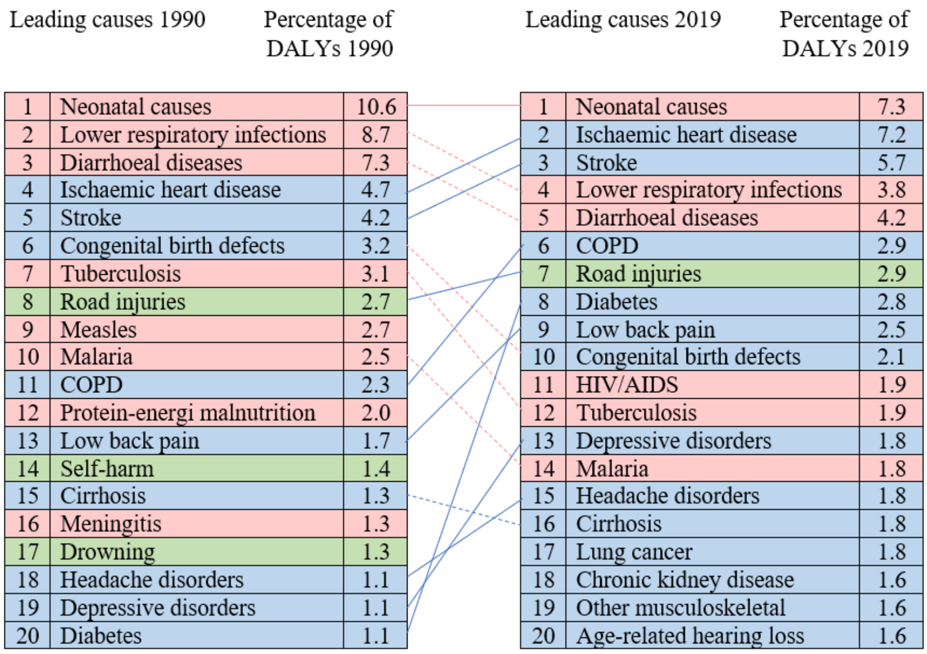


Figure 1.1 Global Leading Cause of DALYs 1990-2019, all ages (GBD, 2020)

Diabetes also has been known as a leading causes of disability-adjusted life years (DALYs) with the highest increase from 1990 to 2019 (Chen et al., 2019; GBD, 2020). Data from WHO stated that around 422 million people in the world have diabetes with 4.2 million deaths in 2019 (WHO, 2020). It is projected that the prevalence of diabetes will increase to 570.9 million in 2025 (X. Lin et al., 2020) and to 700 million by 2045 (IDF, 2019). Among all countries in the world, Indonesia is on the 4th ranked as the country who has highest diabetes prevalence (21 million). Based on Basic Health Survey (Riskesdas) 2018, there is an increase of diabetes prevalence from 6.3 (2013) to 8.5 (2018). The data is based on examination of blood sugar levels in people aged ≥15 years (MoH, 2018). The provinces which have the highest prevalence of diabetes in Indonesia in 2018 are Jakarta (3.4), Yogyakarta (3.1), East Kalimantan (3.1), North Sulawesi (3.0), and East Java (2.6).

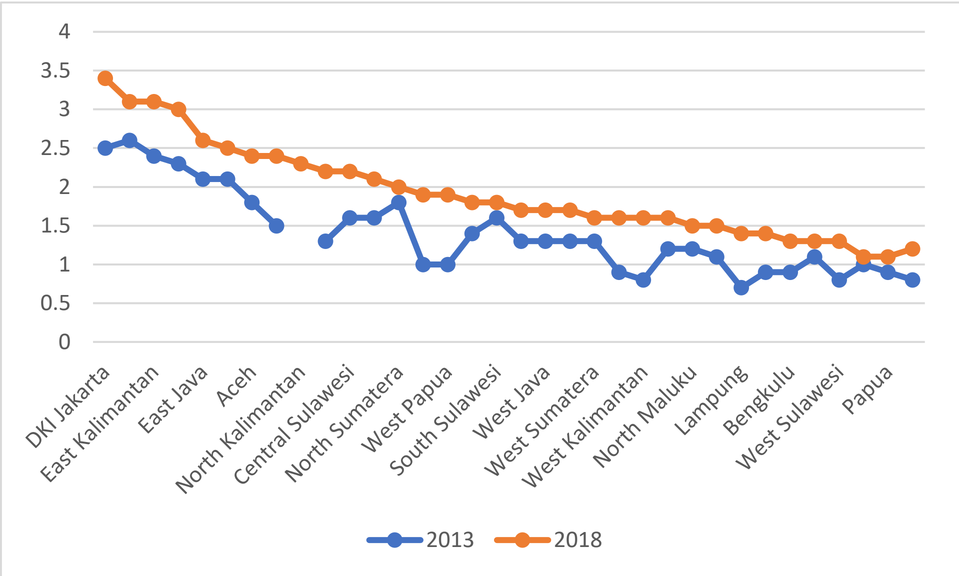


Figure 1.2 Diabetes Prevalence in Indonesia, 2013-2018 (MoH, 2018)

Diabetes occurred when the pancreas does not produce enough insulin or when the body cannot use it effectively and lead to the increase of blood sugar, known as hyperglycaemia. If it left untreated, high blood sugar in the body can cause long-term damage and complication (IDF, 2019). Diabetes requires a comprehensive and continuing care to improve health outcomes (ADA, 2002). Unfortunately, during lockdown or quarantine measures due to COVID-19, diabetes care has been severely disrupted (WHO, 2020). This unexpected situation resulting in a reduction of access to usual care (Chudasama et al., 2020). A published mathematical simulation from India showed that the duration of lockdown will impact on worsening of glycemic control and complications (Ghosal et al., 2020). Therefore, actions to adapt diabetes care delivery during restrictions due to COVID-19 outbreaks were needed. Indonesia Association of Endocrinologists (PERKENI) recommend hospitals and clinics to provide remote consultation or known as telemedicine using email, WhatsApp, videocall, or telephone for diabetes outpatients who could not visit their physicians for routine clinic follow-ups (PERKENI, 2020).

C. Telemedicine

Telemedicine refers to the health care delivery services in a distance by doctor using technologies to communicate with patients via chat, call, and video (WHO, 2010). This innovation is widely used to exchange information for medical care include health promotion, diagnosis, and treatment. In Indonesia, telemedicine has been developing for several years but the number of users is minimal due to data privacy, diagnostic accuracy, legal protection concerns (Deloitte, 2019), and reimbursement issue (Alromaihi et al., 2020). A report survey found that only few people (28%) want to manage their health through a single touchpoint via an app on a smart device in 2019. Most of them (70%) prefer in-person visit (BAIN, 2020) because they consider it as more reliable way to consult a doctor. Only few people have reported have used health applications (67.6%) to consult a doctor (14%) (Deloitte, 2019).

Telemedicine become new norm in healthcare delivery and considered as the most ideal solutions to address the changing of chronic disease management during COVID-19 outbreaks. Evidence has shown that telemedicine can improve self-management care (Mileski et al., 2017), disease monitoring (Paré et al., 2007), and clinical outcome compared to in-person visit for infectious disease (Burnham et al., 2020), hypertension, and diabetes (Bongaerts et al., 2017) management. A previous study have found the benefit of telemedicine in improving diabetic management and help achieving glycemic target in type 2 diabetes patients (Whitlock et al., 2000). Further, all the benefits of telemedicine in diabetes management can offer the potential for cost-effectiveness, personalized interaction, and convenience for both patient and physician (Whitlock et al., 2000).

1.2 Problem Statement and Research Gap

Diabetes is a chronic illness that requires continuing medical care and patient self-management to prevent and reduce the risk of long-term complications (ADA, 2002). Unfortunately, because of the implementation of PSBB during COVID-19 since 10th April 2020 in Indonesia, diabetes care has been severely disrupted. This situation will impact lifestyles of PWD and would have probably led to worsening of their glycemic control.

Several studies have examined the association between diabetes management and glycemic control during COVID-19 outbreaks, but the results are not consistent. Some previous studies found that lockdown implementation may improve the glycemic control among type 1 and 2 diabetes (Capaldo et al., 2020; Maddaloni et al., 2020), but some others found otherwise (Khare & Jindal, 2020; A. Verma et al., 2020). Therefore, this study aims to determine the HbA1c level and its associated factors among type 2 diabetes mellitus (T2DM) outpatients during COVID-19 outbreaks in Jakarta, Indonesia.

1.3 Research Question

a. What is HbA1c level among T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks?
b. Is there any association between general characteristic, diabetes condition, consultation factors, self-care, and family support among T2DM outpatients in Jakarta, Indonesia with HbA1c level during COVID-19 outbreaks?
c. What are the factors contributing to glycemic control among T2DM outpatients during COVID-19 outbreaks?

1.4 Research Objective

a. To determine HbA1c level among T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks.
b. To find association between general characteristic, diabetes condition, consultation factors, self-care management, and family support among

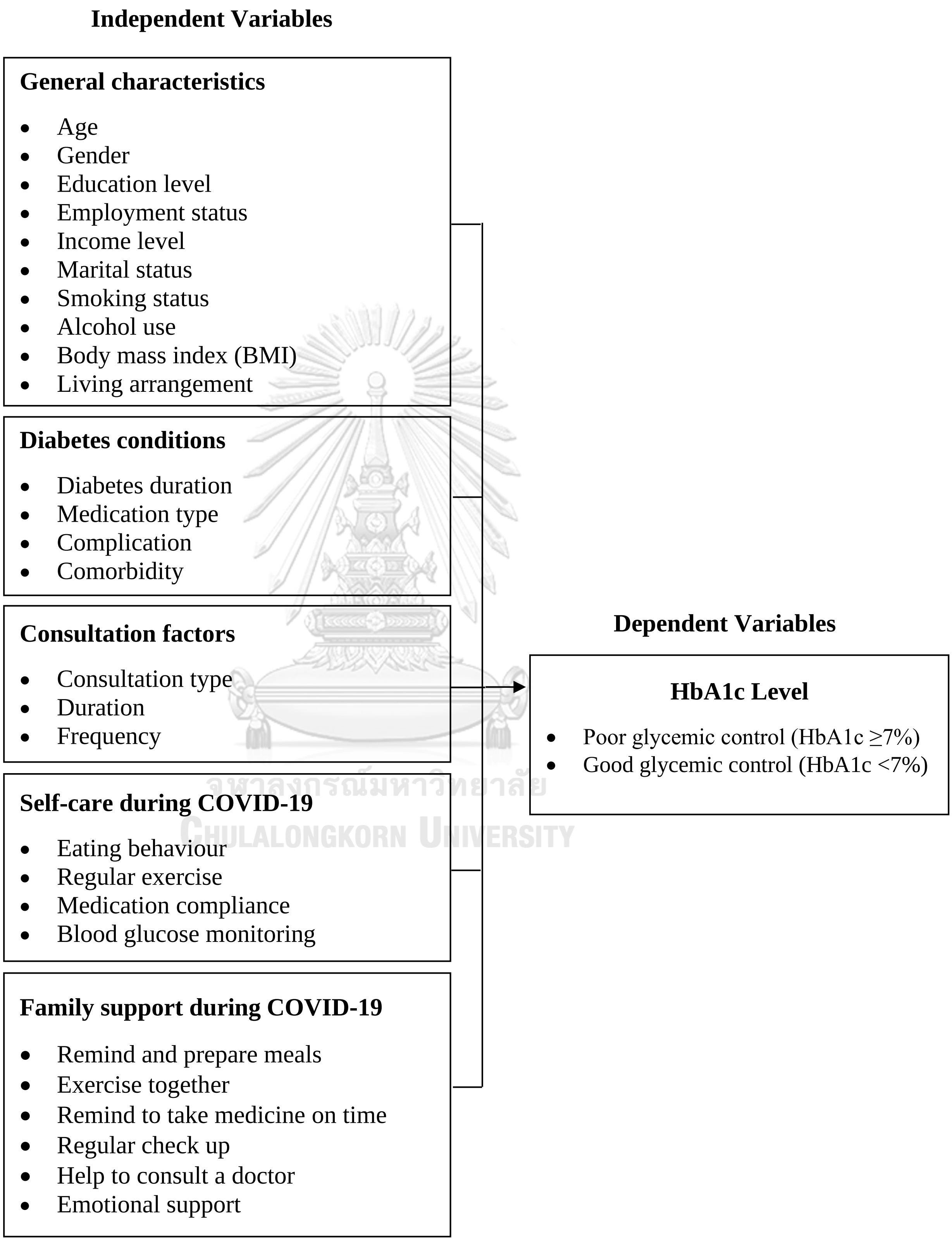
T2DM outpatients in Jakarta, Indonesia with HbA1c level during COVID-19 outbreaks.

c. To identify factors contributing to glycemic control among T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks.

1.5 Research Hypothesis

a. There are some T2DM outpatients in Jakarta, Indonesia who have HbA1c level higher than recommended target (≥7%) during COVID-19 outbreaks.
b. There is any association between general characteristic, diabetes condition, consultation factors, self-care, and family support among T2DM outpatients in Jakarta, Indonesia with HbA1c level during COVID-19 outbreaks.
d. There are any factor contributing to glycemic control among T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks.

1.6 Conceptual Framework



1.7 Operational Definition

PWD	Abbreviation from "people with diabetes"
T2DM	Abbreviation from "type 2 diabetes mellitus"
PSBB	Abbreviation of "Large-Scale Social Restrictions", originally from Indonesian language "Pembatasan Sosial Berskala Besar".
HbA1c level	The level of HbA1c which categorized into "good glycemic control (HbA1c level <7%)" and "poor glycemic control (HbA1c level ≥7%)".
HbA1c level target	American Diabetes Association (ADA)-recommended to PWD to achieve HbA1c level <7%. It is also adopted by Indonesia Association of Endocrinologists (PERKENI).
Employment status	A working status of respondent before COVID-19 outbreaks (before March 2020) and during COVID-19 outbreaks (after March 2020).
Living arrangement	The number of people who live with the participants during COVID-19 outbreaks which related to family support in diabetes management.
Diabetes duration	Duration of having diabetes diagnosed by a doctor.
Medication type	Prescribed medicine to manage diabetes include oral medication, insulin injection, or combination.
Complication	Health problems that develop rapidly (acute) or over time (chronic) caused by diabetes include retinopathy, nephropathy, neuropathy, foot problems, heart attack, stroke, cancer, cardiovascular disease, and oral complications (IDF, 2017).
Comorbidity	Chronic disease that already present when diabetes was diagnosed. It includes hyperlipidaemia, hypertension, depression, thyroid gland diseases,

	chronic obstructive pulmonary disease (COPD), and coronary artery disease.
Consultation factor	Determinants of consultation that may affect HbA1c level consist of consultation type, duration and frequency of consultation.
Consultation type	Type of doctor consultation used by the respondent during COVID-19 which categorized into telemedicine or in-person visit only.
Telemedicine	Defined as the use of m-Health app or other platforms (e.g., WhatsApp) used by respondents to consult with a doctor in a distance during COVID-19 outbreaks.
In-person visit	Regular care by doctor through face-to-face contact.
Duration of consultation	Length of time for the respondent to consult with a doctor using telemedicine and/or in-person visit within 12 months.
Frequency of consultation	Number of consultations for the respondent to consult a doctor using telemedicine or in-person visit within 12 months.
Eating behaviour	Meal plan, diet restriction, cooking habit, frequency of eating and snacking, and frequent food consumed of the participants during COVID-19 outbreaks.
Regular exercise	Regular exercise defines as daily physical activity minimum 30 minutes during COVID-19 outbreaks. It includes type, frequency, and duration of exercise in the last 12 months.
Medication compliance	Compliance on medication in the last 12 months.
Self-monitoring blood glucose (SMBG)	Practice in self-blood sugar testing at home in the last 12 months and the target recommended by a doctor.
Meal plan	Healthy-eating plan to manage blood sugar levels.
Remind and prepare meals	The role of family in reminding and preparing healthy meals for the respondent to manage diabetes.

Exercise together	The role of family in accompanying the participants to do exercise to engage in physical activity during COVID-19 outbreaks to manage diabetes.
Remind to take medicine	The role of family in reminding the respondent to take prescribed medication on time.
Help to consult a doctor	The role of family in making sure the respondent to keep contact with doctor for follow up include recommend telemedicine and/or accompany them when visiting healthcare facility.
Emotional support	The role of family in listening to the respondent's concern about their diabetes without blaming.

CHAPTER II
LITERATURE REVIEW

2.1 COVID-19

A. Situation

On 31st December 2019, 'viral pneumonia of unknown cause' was identified in Wuhan, China. The report was further investigated for the possibility of global outbreaks. The first death was reported on 11th January 2020 and the imported cases was found in Thailand and Japan. The disease was named as COVID-19 on 11th February 2020 and characterized as a pandemic on 11th March after affected more than 114 countries and killed over 4,000 people (WHO, 2019). As of 16th December 2020, there have been 71,919,725 confirmed cases of COVID-19 in the world, including 1,623,064 deaths.

The first case of COVID-19 in Indonesia was reported on 3rd March 2020. After the confirmed cases keeps increasing and the first death was reported on 11th March 2020, the government announced the status of Public Health Emergency and identified COVID-19 as a National Disaster. As of 11th June 2021, there are 1,894,025 confirmed cases and 52,566 deaths of COVID-19 (Satgas, 2020). The provinces with the highest COVID-19 cases in Indonesia are Jakarta (23.4%), West Java (17.3%), Central Java (11.2%) and East Java (8.4%) (Satgas, 2020). In response of COVID-19 pandemic, the government has proactively implemented Large-Scale Social Restrictions (PSBB) since 10th April 2020 started from Jakarta and followed by the other region in Indonesia (MoH, 2020). The restrictions are executed by local governments with the approval of the Ministry of Health (MoH).

B. SARS-CoV-2

COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), formerly named as the novel coronavirus (2019-nCov). The virus belongs to the subfamily *Coronavirinae* of the *Nidovirales coronaviridae*, and are classified as SARS-like species, but belong to different clusters with SARS-CoV

(Yang et al., 2020). A primary host of SARS-CoV-2 were bats (Zhou et al., 2020) but the COVID-19 can spread easily from human-to-human transmission.

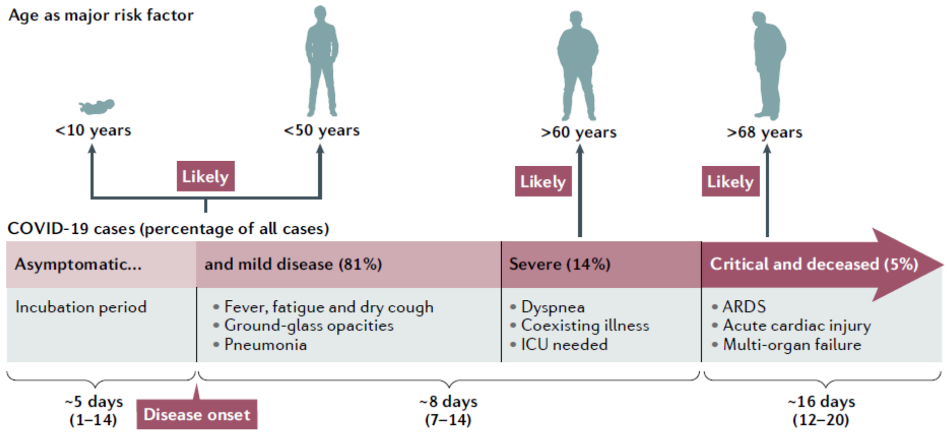


Figure 2.1 Clinical features of COVID-19 (Hu et al., 2020)

Typical clinical symptoms of COVID-19 are fever, dry cough, fatigue, difficulty in breathing (dyspnoea), and pneumonia with average 14 days incubation period (Hu et al., 2020). Some people may have no COVID-19 symptoms or asymptomatic (Oran & Topol, 2020) but still can spread the virus and have longer duration of viral shedding than the symptomatic patients (Long et al., 2020). To prevent SARS-CoV-2 infection, people should practice hand hygiene (G. K. L. Huang et al., 2020), using a mask, and physical distancing of at least 1 meter (Chu et al., 2020).

C. Impact on Healthcare

COVID-19 outbreaks not only pose great challenges to socioeconomic systems (Martin et al., 2020), but also medical and public health. Healthcare system postponed and/or scaled-down routine chronic disease care, outpatients visit, and non-urgent surgery to reduce unnecessary hospital visits, reduce hospital burdens, and prevent infection risk (Palmer et al., 2020). In a recent McKinsey Consumer Healthcare Insights survey, some patients (40%) have cancelled upcoming appointments e.g., regular check-ups and chronic medical conditions care (Cordina et al., 2020). Further, this situation resulting in a change of daily living routine (Saqib et al., 2020) and reduction in access to usual care (Chudasama et al., 2020) that will lead to increased pain, decline in quality of life, increased anxiety and depression (Sarzi-Puttini et al., 2020). To avoid a rise in non-COVID-19 related morbidity and mortality, it is important that patients with chronic diseases continue to receive care during the COVID-19 outbreaks.

2.2 Diabetes

Diabetes is a chronic health condition where blood sugar levels elevated due to the inability of the body to produce and/or use insulin effectively. There are two types of diabetes, which are type 1 diabetes (known as autoimmune disease), type 2 diabetes (mostly caused by unhealthy lifestyle), and gestational diabetes (occurred during pregnancy). Without proper treatment, diabetes can lead to serious complication such as neuropathy, cardiovascular disease (CVD), and eye problem.

A. Diabetes in the World

About 422 million people worldwide have diabetes, and around 351.7 million PWD are in 20-64 years (IDF, 2019). The prevalence of diabetes is expected to increase to 700 million by 2045 (WHO, 2016), and 417.3 million by 2030 and 486.1 million by 2045 in adults (20-75 years) The prevalence is higher in women aged 20-79 years (9.6%) than men (9.0%). Approximately there are about 17.2 million more men who have diabetes than woman in 2019. Compared to rural area, the prevalence of diabetes is much higher in urban area (310.3 million) than in rural area (152.6 million) (IDF, 2019).

B. Diabetes in Indonesia

Diabetes prevalence in Indonesia has increased from 6.3% in 2013 to 8.5% in 2018, based on examination of blood sugar levels in people aged ≥15 years, and 90% of them are type 2 diabetes (MoH, 2018). The age groups with highest diabetes prevalence are 55-64 years (6.3) and 65-74 years (6.03). Among 34 provinces in Indonesia, Jakarta (3.4%), Yogyakarta (3.1%), East Kalimantan (3.1%), North Sulawesi (3.0%), and East Java (2.6%) have the highest prevalence of diabetes. If not handled properly, the WHO estimates that incidence of diabetes in Indonesia will elevated dramatically to 21.3 million people in 2030 (Wild et al., 2004).

C. Type 2 Diabetes

Around 90% of diabetes cases are type 2, occurred when the body does not fully respond to insulin and makes the blood glucose keep increasing (hyperglycaemia). Although type 2 diabetes mostly occurred in older adults, diabetes can occur younger age due to lifestyle change e.g., physical inactivity and inappropriate diet. The symptoms of type 2 diabetes are frequent urination, excessive thirst and hunger, tiredness, weight loss, slower wounds healing, blurred eyesight, and numbness in hands or feet (IDF, 2019).

Table 2.1 Blood level laboratory tests for diagnosis of diabetes and prediabetes

Category	HbA1c Level (%)	Blood glucose level (mg/dL)	Plasma glucose 2 hours after Oral Glucose Tolerance Test (mg/dL)
Diabetes	≥6.5	≥126	≥200
Prediabetes	5.7-6.4	100-125	140-199
Normal	<5.7	<100	<140

Source: (PERKENI, 2015)

Criteria for diabetes type 2 diagnosis are (1) fasting plasma glucose examination ≥126 mg/dL, or (2) plasma glucose examination ≥200 mg/dL 2-hour after glucose tolerance test oral (TTGO) with a glucose load of 75 grams, or (3) examination of plasma glucose ≥200 mg/dL, or (4) HbA1c level examination ≥6.5% using standardized methods by the National Glycohemoglobin Standardization Program (Table 2.1). After diagnosed, PWD need to undergo treatment and healthy lifestyle to achieve targeted blood glucose level or HbA1c (<7%) recommended by doctor.

For the early treatment, people with type 2 diabetes should change their behaviour through diet planning, weight loss programme, and routine exercise. If it is needed, PWD need to take a medicine or oral combined therapy to help lowering blood sugar levels. The effectiveness of the medication depends on the duration of diabetes. The medication works best on people who just diagnosed (<10 years) with diabetes or does not dependent on insulin injection. Insulin therapy is another option for treating type 2 diabetes. It is recommended for PWD who has an initial HbA1C level more than 9 percent (ADA, 2002).

Without proper treatment, high blood sugar levels in the long-term can lead to a serious and life-threatening complications e.g., retinopathy, neuropathy, foot problems, nephropathy, gum disease and other mouth problems. PWD can also have other comorbidities, such as dyslipidaemia, hypertension, obesity, coagulation disorders, heart disease, stroke, heart failure, and chronic kidney disease (PERKENI, 2015).

D. Glycated Haemoglobin (HbA1c)

The primary goal of diabetes management is to achieve near-normal glycaemia. Glycosylated haemoglobin, also known as glycohemoglobin, or glycosylated haemoglobin (abbreviated as HbA1C), is a standard metric to capture patient health status and to predict the effectiveness of diabetes care (Whitlock et al., 2000). HbA1C is formed by non-enzymatic covalent addition of glucose moieties to haemoglobin in red cells. Unlike blood glucose level, HbA1c measurement is used for asses an average blood glucose levels for the past 3 months and is little affected by day-to-day variations (WHO, 2011).

On the patients who achieved recommended HbA1c level and have it stable are advised to check at least 2 times within 1 year (PERKENI, 2015), or every 3 months if the HbA1c level is uncontrolled. The normal level of HbA1c is less than 4% to 5%. In PWD, the percentage can reach 15% or more. Therefore, PWD are advised to get HbA1c level of less than 7% (ADA, 2002) because the higher HbA1c level, the higher risk of PWD to have complications (WHO, 2011). However, HbA1C cannot be used as a tool for evaluation in certain conditions such as anaemia, hemoglobinopathy, history of blood transfusions 2-3 last month, other circumstances that affect age erythrocytes and impaired kidney function (PERKENI, 2015).

Factors that are related to HbA1c level include:

Age. The relationship between age and HbA1c level are still unclear, but diabetes patients in older age (>60 years) are expected to have better glycemic control compared to younger patients (Nanayakkara et al., 2018). This might because older patients with diabetes tend to have better self-care (e.g., compliance in medication, meal planning, physical activity or exercise, follow-up appointment) and self-efficacy than younger patients.

Gender. Women who newly diagnosed of type 2 diabetes are less likely to reach glycemic control target after 1-year treatment compared to man (Choe et al., 2018). Between women and men with diabetes also found to have difference disease outcome (Arnetz et al., 2014) including cardiovascular risk (Rivellese et al., 2010).

Smoking status. Smokers are at higher risk to develop type 2 diabetes than non-smokers. Previous study showed that HbA1c level might be affected by unhealthy behaviour like smoking habit (Choi et al., 2018). Active smokers in middle-aged or elderly diabetic adults tend to have poor glycemic control (Peng et al., 2018) than those who are not smoking. More number of cigarettes smoked per day and pack-years of cigarette smoking would increase the HbA1c level among type 2 diabetes patients. Even although poor glycemic control found in men who quit smoking for <10 years, the risk is smaller compared to current smokers.

Alcohol use. Alcohol may affect HbA1c level (Hong et al., 2016). Alcohol consumption generally do not worsen glycemic control in PWD. Previous studies even shown the beneficial effects of moderate alcohol (Ahmed et al., 2008) such as lower A1C levels and risk of complications. In contrast, another study shown that in regular consumption, moderate amounts of alcohol (2–4 drinks per day) could affect glycemic control and increase the risk of complications. More studies are needed to confirm the effect of alcohol among diabetes patients. However, PWD should avoid heavy drinking or more than 10–12 drinks per day to prevent ketoacidosis and hypertriglyceridemia (Emanuele et al., 1998).

Body Mass Index (BMI). Body mass index affect glycemic control among diabetes patients (Sisodia & Chouhan, 2019). Therefore, the BMI and HbA1c level should be kept under strict control to prevent complications. BMI usually divided into four categories: underweight if less than 18.5, normal if between 18.5 to <25), overweight if between 25 to <30, and obese if more than 30 (WHO, 2004).

Diabetes Duration. PWD with longer duration (more than 10 years) were more likely to have poor glycemic control compared to those with duration of less than or equal to 10 years (Al-Akour et al., 2011). This may because of the progressive impairment of insulin secretion with time by ß- cell and increase in insulin resistance or sudden decrease in insulin secretion (Group, 1998).

Medication. PWD who receive pharmacological therapy was associated with a higher HbA1c level (El-Kebbi et al., 2001). It is because with more severe hyperglycaemia, PWD will be prescribed insulin or oral agents, and it affects their HbA1c level. A study shown that PWD who treated with diet alone had lower HbA1c level (6.4%) compared to those who treated with oral agents (8.0%) or insulin (8.3%) (Harris et al., 1999).

Comorbidity. Chronic disease that already present when diabetes was diagnosed. It includes hyperlipidaemia, hypertension, depression, thyroid gland diseases, chronic obstructive pulmonary disease (COPD), and coronary artery disease. These conditions may affect diabetes management and affect diabetes outcomes in different ways (Luijks et al., 2015). A previous study shown that comorbidity was significantly associated with poorer glycemic control (Mamo et al., 2019). It was related to the poor medication adherence because of additional medicine that might increase the pill burden to the patient.

Self-care. The desired therapy targets are difficult to achieve without appropriate self-care practice. Therefore, good self-care practice is expected among PWD to control and maintain their blood glucose levels and quality of life, while minimizing the fatal complications (ADA, 2002). Self-care practices include eating habit, exercise, medication adherence, and regular check-up (IDF, 2017).

2.3 In-Person Visit vs Telemedicine

A. Definition

In-person visit is a traditional face-to-face consultation provided by healthcare workers (WHO, 2006) include doctor, nurse, pharmacies, hospital, labs, clinics, and many other entities to protect and improve health and well-being. Different with in-person visit that needs direct contact between health providers and patients, telemedicine enables the patient to communicate with the doctor virtually. Telemedicine is the use of technologies to provide health care services when health providers and patients are in a distance or at different locations. It is used to provide remote clinical support (e.g., referral to specialist, remote monitoring, and medical education) that can affect health outcomes (WHO, 2010). The use of telemedicine became accelerated, and it is claimed to increase 50% (March to April 2020) compared to before COVID-19 outbreaks (January to February 2020) based on internal report one of the leading mHealth company in Indonesia.

B. Type of Treatment

A survey showed that most of Indonesia people (70%) prefer physical health clinic as a single portal to manage healthcare (BAIN, 2019). It is because the direct contact with doctor provides a wide range of services which telemedicine has its limitations e.g., physical examination and operation procedure of any kind. In-person visit enables patient to get comprehensive healthcare services for all kinds of diseases from promotive, preventive, curative, rehabilitative and palliative based on their needs, by collaboration of healthcare providers involved. Meanwhile, telemedicine services divided into (WHO, 2010):

- Asynchronous, or store-and-forward, means that the data is pre-recorded, and the data will be uploaded for review by a clinical prior to a consult.
- Synchronous, or real-time, means that the interaction or consultation occurred simultaneously.
- Remote patient monitoring. It allows direct transmission of patient’s clinical measurement from a distance to the healthcare provider.

Telemedicine is not recommended when a patient has urgent medical conditions and need to perform an adequate physical examination.

C. Benefits

In-person visit provides better patient-provider interactions through information exchange, interpersonal relationship building, and shared decision making (Ong et al., 1995) compared to telemedicine. Doctors can carry out direct examinations and this is very necessary to make a diagnosis. While the advantage of using telemedicine include cost savings, more convenience, and could give access to care to those who live far from health facilities, enhanced patient-provider communication and educational opportunities, and potential to save expenditure in healthcare services (Jennett et al., 2003). This innovation could be an alternative to give comprehensive health care service and this will lead to improve clinical outcome. In diabetes management, telemedicine could potentially enhance self-care that will result in lower HbA1c level (S. W. H. Lee et al., 2017).

D. Limitations

The weaknesses of in-person visits are the long waiting time with the doctor (not proportional to the length of the consultation time) and the distance to health services. In certain situations, such as the COVID-19 outbreaks, in-person visits are not recommended except in emergency cases to reduce the risk of exposure and transmission of the virus. But where in-person visit is recommended during COVID-19 outbreaks, PWD should be aware of the precautions and infections control measure in place (Bakhai, 2020). Limitations of telemedicine usage is related to data privacy, diagnostic accuracy, legal protection concerns (Deloitte, 2019), and reimbursement issue (Alromaihi et al., 2020). While the potential barriers to telemedicine are internet connectivity, lack of support to use technology, access to devices, patient preference for in-person visit consultation, and patients with hearing or vision impairments (Abu-Ashour et al., 2017).

2.4 Self-care During COVID-19

Diabetes is a lifelong illness and there is not a cure yet. However, people with type 2 diabetes can maintain or improve their blood sugar levels to normal by changing their lifestyle (PERKENI, 2015). According to American Diabetes Association (ADA), standards of diabetes care includes comorbidities assessment, lifestyle management, glycemic control, medication adherence, obesity management, and prevention of diabetes complication (ADA, 2019).

A. Diet

PWD should pay attention to their diet because carbs, fat, protein, and fiber in food can affect their blood sugar level in different ways. The goals are to improve overall health, weight control, and delay or prevent diabetes complications (ADA, 2019). For this, a meal planning is widely used for individualized guideline to achieve more healthful eating. The best combination of macronutrients for diabetes patients are low carbohydrate, low fats, and protein intake with no meal skipping (Ghosh et al., 2020). Low glycemic index (GI) foods are recommended for diabetes patients to control blood glucose such as brown rice, sweet potato, mushroom, plain milk and yogurt , apple, and peanuts (WHO, 2017). PWD should be aware of foods containing a lot of carbohydrates and calories such as cakes, cookies, and sweet drink. To add sugar, PWD can use lo-calorie sweeteners rather than sugar, honey, or syrup to reduce the total calorie intake.

COVID-19 may affect financial situation among PWD and it unable them to adhere to a diabetes-friendly diet, also access to grocery stores, meal delivery, and food supply. Therefore, ensuring good nutrition with regular meals is more important than diet optimization during this time (Sy & Munshi, 2020). A previous study showed that eating two larger meals a day (consist of breakfast and lunch) is proven to be more effective than 6-smaller meals among type 2 diabetes patients (Kahleova et al., 2014). Three meals a day with a snack consumption also recommended for diabetes patients during COVID-19 outbreaks.

B. Medication

People with type 2 diabetes who are not controlled their blood glucose level only by diet and exercise need to take medication. It includes (IDF, 2019):

- Oral medication to help pancreas produce more insulin and increase the sensitivity of body's cells to its own insulin. PWD should take only prescribed dose and schedule.
- Insulin injection will be given if oral medication is unable to control blood glucose to the recommended levels. Insulin is a hormone in the body to convert sugar, starch, and other foods into energy for daily living. In type 2 diabetes patients, insulin can be given alone or combined with oral medication. With insulin injection, PWD need to monitor their blood sugar regularly to adjust the dosage of insulin injected to blood sugar level.

Those medications are given from a low dose, then increase gradually based on the response of blood sugar levels (PERKENI, 2015). During COVID-19 outbreaks, daily medications once or two daily dosing can be considered for PWD to reduce the treatment burden. It is recommended to ensure adequate prescription refills, for example a 90-day supply, to prevent crisis situations (Sy & Munshi, 2020).

C. Exercise

T2DM outpatients may lack of exercise during COVID-19 outbreaks due to the implementation of social restrictions movement along with closure of gyms and parks (Sciberras et al., 2020). All people, including PWD, also encouraged to stay at home except there is an urgent matter outside home. In this unexpected situation they can do exercise at home such as walking inside home, combining strength training (e.g., resistance bands), or join online exercise program for 10 minutes 3 times daily (Sy & Munshi, 2020). Other options are aerobics, flexibility workout, and strength muscle exercises (Wicaksana et al., 2020).

Regular exercise for at least 30 minutes a day, or total 150 minutes per week, are advised for PWD to improve glycemic control, weight control, also improved psychological well-being and quality of life (QoL). To prevent hypoglycaemia, exercise should be done post-meals when the level of blood glucose is higher. If not possible, PWD should decrease their medication dose to facilitate exercise without increasing caloric intake. Before doing exercise, people with type 2 diabetes who take insulin also need to adjust the dose to avoid hypoglycaemia. If the exercise is unplanned, they need to check their blood glucose levels and eat a carbohydrate snack before the exercise begin (ADA, 2019). People with heart disease of hypoglycaemia history should be noticed as particular circumstance before exercise (Banerjee et al., 2020).

D. Self-Monitoring Blood Glucose (SMBG)

PWD must maintain blood glucose levels during the outbreaks. Therefore, regular check and record blood sugar levels several times a day or a week is necessary to make sure it remains within the individual target range. Although the frequency of blood sugar level testing among type 2 diabetes patients vary depend on the pharmaceutical regimen or whether they are in an adjustment phase or at their target for glycemic control (Benjamin, 2002), most experts agreed that patients with insulin therapy should monitor their blood glucose levels at least 4 times a day when fasting, before meals, and before bed. The frequency of blood glucose monitoring can be decreased to once per day, or less frequent than before, if glycemic control is optimal during COVID-19 outbreaks (Sy & Munshi, 2020). Blood glucose levels should be recorded for a minimum three consecutive days and communicated with doctor through telemedicine or in-person visit consultation.

During COVID-19 outbreaks, PERKENI also recommends PWD in Indonesia to wash hands often and avoid touching face, stay at home unless for urgent matters, physical distancing, use mask when go outside, continue to take oral or injection drugs, maintain a healthy and balanced diet, check blood sugar at least 2-3 times per day, and consult a doctor for further instructions (PERKENI, 2015).

2.5 Family Support During COVID-19

Family support has a positive impact on a patient's ability to do self-management for managing their chronic condition (Beanlands et al., 2005; Jenning, 1999). It is important in the COVID-19 situation where isolation or quarantine measure can lead to a feeling of isolated, lonely, or depressed. This situation may affect PWD glycemic control and that is why family support is needed. Good social support has been associated with good medication adherence and improvement in glycemic control (DiMatteo, 2004; Stopford et al., 2013).

Family members can participate in PWD self-management and how they engage in behaviours that are supportive and controlling (Pesantes et al., 2018). Supportive behaviour is including emotional support such as empathy when listening to PWD distress in a positive manner. Paying attention to PWD medications e.g., remind to take medicine on time or helping them injecting insulin are another example of supportive behaviour towards PWD. Controlling behaviour is related to nagging behaviour of family members in watching what PWD eat and to be physically active. Other than supportive or controlling, family members can be also undermining PWD efforts in managing their lifestyle e.g., offered them with unhealthy foods. Therefore, number of people living with PWD (living arrangement) can be one important factor influencing their glycemic control. This is supported by a study that showed PWD who lives with others have better medication adherence than those who lives alone (DiMatteo, 2004).

2.6 Related Studies

A. COVID-19

There are several studies have been conducted related to diabetes management and glycemic control among PWD during COVID-19 outbreaks. Interestingly, the studies showed different result and stated that lockdown may improve or worsen glycemic control. In a previous study from Italy, glycemic control in adults with type 1 diabetes during COVID-19 tend to improve (Capaldo et al., 2020). The study showed that adults with type 1 diabetes had more time for self-care during lockdown e.g., including more regular mealtime and snacks. Even with no access to diabetes clinics, they could interact with a doctor using teleconsultation platform. The population of the study was 207 Italian adults with type 1 diabetes attending the Diabetes Outpatient Clinic of the Federico II University Hospital, Naples. The result measured using the CGM metrics includes the percentage of readings and time per day within the target glucose range (TIR), time below the target glucose range (TBR), and time above the target glucose range (TAR).

Another study also identified the possible benefits of lockdown among PWD, such as improvement of eating patterns (e.g., eat more homemade food), decreased workloads, also changed of type and length of physical exercise (Maddaloni et al., 2020). A study from India confirmed that type 2 diabetes patients also facing improvement on glycemic control during COVID-19 lockdown, especially for those who have long duration diabetes (>10 years) and physically active. It was the first large, prospective, and observational study which involved 2,240 people with type 2 diabetes patients who attended diabetes clinic prior lockdown regularly (Rastogi et al., 2020). The goals of the study were to analyse the effect of more than 3 months duration of lockdown on glycemic control.

Different result comes from a study In India (A. Verma et al., 2020). The study demonstrated negative impact of COVID-19 pandemic on glycemic control in type 1 diabetes patients due to non-availability of insulin or blood glucose testing strips, poor dietary compliance, and decreased physical activity. It was a cross-sectional study which conducted during March to May 2020 among type 1 diabetes patients who were on regular follow-up in Endocrinology Outpatient department (OPD). Data collected using a structured questionnaire and respondents telephonically called at the end of lockdown period and followed up within 15 days after lockdown. Another previous study from India also showed an increase of HbA1c level among 143 diabetic patients who had good glycemic control and were on regular follow up prior to lockdown (Khare & Jindal, 2020). The study focused on measuring the effect of lockdown to physiological stress, diet, exercise, sleep, and medication which further lead to worsen glycemic control. The result confirmed that lockdown during COVID-19 changed diabetic patient lifestyle which impact the glycemic control e.g., changed in amount and type of diet, lack of exercise, increased in psychological stress, irregular sleep, and missed medication.

B. Diabetes

Previous study in 2016 assessed factors associated with glycemic control among type 2 diabetes mellitus patients. It was a cross-sectional study used a random sample of 288 patients with type 2 diabetes from primary health care centre in Jazan city, Kingdom of Saudi Arabia. Data collected through face-to-face interviews using a questionnaire. Logistic regression used to identify predictors correlates with HbA1c and chi-square test used to identify the relationship between categorical variables. The result showed that higher HbA1c were found among patients with type 2 diabetes who lack of education, have longer duration of diabetes (≥7 years), active smoker, divorced, did not comply with diet or take medication as prescribed, and have poor family support to manage their condition (Badedi, 2016).

Higher HbA1c level also found in low-income patients compared to high-income patients with type 2 diabetes. The result comes from a previous study conducted in Scania region in the southernmost part of Sweden in 2008 to 2013. It was a population-based cohort study and involved a total of 3,794 patients with type 2 diabetes and latent autoimmune diabetes in the adult (LADA). Data of respondents retrieved from the longitudinal integral database for labour market research (LISA) register compiled by Statistics Sweden. Statistical analysis used in the study was logistic regression model to estimate ORs for HbA1c >70 mmol/mol (8.6%) at diagnosis (Martinell et al., 2017).

C. Telemedicine

A study in 2014 found that telehealth modestly improved glycemic control in patients with type 2 diabetes after more than 12 months of used compared to usual care (Steventon et al., 2014). Using the Whole Systems Demonstrator cluster randomised trial, the study involved 513 participants over 18 years old with type 2 diabetes. Their HbA1c level data collected from the general practice electronic medical record. Effect of HbA1c level were assessed using a repeated measures model during 12-month trial period and adjusted for differences in HbA1c readings recorded before recruitment. A previous study from Wang *et al* also found that telemedicine could effectively improve HbA1c level for type 2 diabetes patients. A total 212 patients with type 2 diabetes were randomly assigned to intervention and control group and were regularly followed up every 3 months for half a year. A glucometer was given to each patient in the intervention group for free. They were required to take their blood glucose at least 2 times 2-3 days per week. In the control group, patients received free glucometers without any other requirements (G. Wang et al., 2017). Regarding the use of telemedicine in people with type 1 diabetes during COVID-19, a study from Scott *et al* showed that remote appointments were well accepted with the majority (75%) stating that they would consider remote appointments after the pandemic end (Scott et al., 2020). But male respondents with poor glycemic control (>9%) were more likely to consider telemedicine as not useful. It was a cross-sectional study using online questionnaire which distributed via social media between 24 March to 5 May 2020 using an open-access web-based platform (Survey Monkey).

CHAPTER III
METHODOLOGY

3.1 Study Design

The study design was cross-sectional, in which variables studied are measured simultaneously at the time of the study (March 2021). The study used descriptive-analytic with quantitative research methods to measures the independent and dependent variables. Data were collected through an online survey using Google Form, then were analysed to identify the association between variables and factors contributing to glycemic control during COVID-19 outbreaks.

3.2 Study Area

The study area in this study were Jakarta, Indonesia. The reason is because Jakarta has the highest prevalence of diabetes in Indonesia with the highest increase in 2018 (3.4) compared to 2013 (2.5) (MoH, 2018). The number of COVID-19 cases in Jakarta is the highest (23.4%) among 34 other provinces in Indonesia with 440,544 cases as of 11th June 2021. Jakarta is the first province in Indonesia to implement the Large-Scale Social Restrictions (PSBB) since April 10, 2020, and it is still prolonged.

Figure 3.1 Map of Jakarta, Indonesia

Jakarta lies between 6°12'S and 106°48'E. The city is a lowland area with an average altitude of ±7 meters above sea level. The total land area of Jakarta is 662.33 km² and the sea area is 6,977.5 km² according to the Governor's Decree No.171 of 2007. There are four City Administrations in Jakarta, divided into South Jakarta, East Jakarta, Central Jakarta, West Jakarta, and North Jakarta, also one Administrative Regency named Thousand Islands. Based on Central Bureau of Statistics (BPS), the total population of Jakarta in 2020 is 10,557,810.

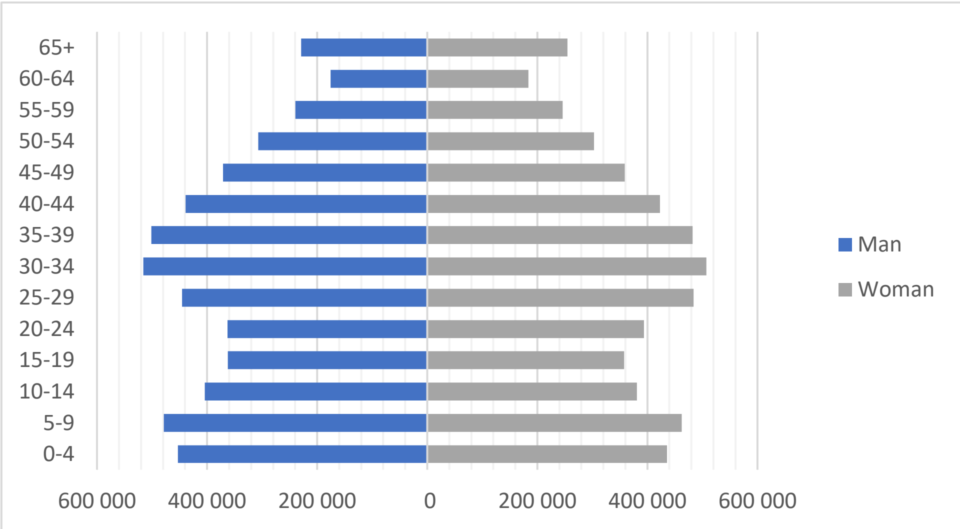


Figure 3.2 Distribution Jakarta population by age and sex (BPS, 2019)

There is no significant difference between the male (50.4%) and female (49.6%) population in Jakarta. The largest number of populations is at the productive age 20-29 years (9%), 30-34 years (10%), and 35-39% years (9%). Based on National Socio-Economic Survey (SUSENAS, 2019), the latest education attainment is mostly graduated from senior high school (44.95%), followed by junior high school graduation (20.73%), higher education (16.68%), and elementary school (13.23%). About 4.41 percent of the population 15 years and over who do not have a school certificate.

The total workforce in Jakarta is 5,157,878 people. The age group that has the highest number of working populations is the age group 30-34 years with as many as 729,843 people. The age group that has the highest number of unemployed people is the age group 25-29 years with a total of 71,560. The average monthly net salary for formal workers in Jakarta is IDR4,216,379 or equivalent to 295 USD, based on data 12th May 2021 (BPS, 2019).

The Department of Population and Civil Registration of Jakarta classified the marital status into four categories, namely unmarried, divorced, widowed, and married. In 2019, the largest population of Jakarta was in the married category, amounting to 49% or as many as 5,427,938 people. This number was followed by residents of Jakarta who were categorized as unmarried, namely 47% or 5,166,050 people. The remaining 3% or 333,221 people are widowed, and 1% or 131,735 people are divorced.

3.3 Research Subject

The population in this study are diabetes outpatients located in Jakarta, Indonesia. Based on Basic Health Survey (Riskesdas) 2018, the prevalence of diabetes in Jakarta is 3.4% or approximately 250 thousand people ≥15 years who have diabetes diagnosed by a doctor (MoH, 2018). Approximately 22% people with diabetes undergoing outpatient care in regional public hospital (RSUD) and primary healthcare (Puskesmas) in the 2nd quarter of 2020 (Department of Communication, 2020). Sample size estimation for dichotomous outcome to ensure precise estimate of overall risk of unknown population:

$$n_0 = \frac{z^2 \times p(1-p)}{e^2} \text{ (Lemeshow et al., 1990)}$$

$$n = \left(\frac{1.96}{0.05}\right)^2 0.22\ (1 - 0.22) = 263.6 \sim 264 + 10\% = 291$$

n = sample size

z^2= significant level at 95%

p= prevalence of diabetes patients who undergoing outpatient care (0.22)

e= margin of error (5%), power 90%, reduce 10% possibility of false result

<u>Inclusion criteria</u>

- Age 24 – 54 years old (as the 3rd highest prevalence and avoid confounding because aging become factors which affect HbA1c level).

- Diagnosed type 2 diabetes by doctor before 2020
- Check HbA1c during COVID-19 (April 2020 – March 2021)
- No COVID-19 (suspect or confirmed case)
- Live in Jakarta for at least 6 months without moving to another cities

Exclusion criteria

- Pregnant woman
- Hospitalization for any cause
- Patients who have cognitive and psychiatric problem

3.4 Measurement Tools

A. Questionnaire

The structured questionnaire was self-constructed which consists of 6 variables include general characteristics, diabetes conditions, consultation factors, self-care management, family support, and HbA1c level during COVID-19 outbreaks. Respondents were asked about their condition in the past 12 months (April 2020–March 2021) during the implementation of Large-scale Social Restrictions (PSBB) as a response of COVID-19 outbreaks in Jakarta, Indonesia.

General characteristic which consists of 11 questions:

a) Age (item 1) collected as continuous data and presented using mean (SD), n (%), and median in the table. The data collected were not normally distributed, so the cut off point of this factor were using Median (50 years). For analysis purpose, this data was classified into two categories:
   - <50 years
   - ≥50 years
b) Gender (item 2), it classified into male and female.
c) Education level (item 3), it classified into 6 categories which consists of elementary school, junior high school, senior high school, bachelors' degree, master's degree, and doctoral degree. For analysis purpose, this characteristic was transformed into two categories:

- Senior high school or lower
- Bachelor's degree or higher

d) Employment status (items 4) before and during COVID-19 pandemic. The data were compared during both time and classified into two categories: "no changed" and "changed".

e) Income (item 5) before and during COVID-19 pandemic which collected as continuous data and presented using mean (SD) and n (%). Both data were compared for categorical data and classified into: "no changed" and "decreased" because some of participants lost their job due to the pandemic.

f) Marital status (item 6) consists of 5 categories include married, single, divorced, widowed, and separated. For analysis purpose, the data was classified into "married" and "others".

g) Smoking status (item 7) had 3 categories which consists of never smoking, ex-smoker, and active smoker. For analysis purpose, this variable classified into 2 categories "not smoker" and "active smoker".

h) Alcohol use (item 8) was classified into "no" and "yes" answer.

i) Body mass index or BMI (items 9, 10) were collected as continuous data from height (cm) and weight (kg). The data was formulated into kg/m^2 and then classified based on WHO criteria for BMI:
   - Underweight (below 18.5)
   - Normal (18.5-24.9)
   - Overweight (25-29.9)
   - Obesity (>30)

   The data then categorized into 2 categories for analysis purpose which consists of "underweight or normal" and "overweight or obese".

j) Living arrangement (item 11) collected as continuous data and presented using mean (SD), n (%), and median. This data classified into 2 categories using median (5 people) as cut-off point since it was not normally distributed:
   - <5 people
   - ≥5 people

Diabetes condition (5 questions) include factors that may impact HbA1c level: diabetes duration, medication type, complication, and comorbidity (Al-Akour et al., 2011; Harris et al., 1999; Mamo et al., 2019; PERKENI, 2015).

a) Diabetes duration (item 12) is the length of time participants had been diagnosed with diabetes by a doctor (in year). Data was collected as continuous data and presented using mean (SD), n (%), and median. The data was not normally distributed, so median (5 years) was used as a cut off point. For analysis purpose, the data was transformed into two categories:
    - <5 people
    - ≥5 people
b) Medication type (items 13, 14) consist of 4 answers include oral medication, insulin therapy, combination, or did not get any medication. For analysis purpose, the collected data was transformed into:
    - Oral medication
    - Others (insulin therapy and combination)
c) Complication (item 15) had “no” or “yes” answer. Participants who answered “yes” were asked about their type and number of complications.
d) Comorbidity (item 16) had “no” or “yes” answer. Participants who answered “yes” were asked about their type and number of comorbidities.

Consultation factors (11 questions) inspired by a study from Faruque *et al* about “*Effect of telemedicine on glycated haemoglobin in diabetes: a systematic review and meta-analysis of randomized trials*" (Faruque et al., 2017). The questionnaire of this study consisted of whether the respondent consulted with a doctor (item 17) with “yes” or “no” answer, experienced in using telemedicine before COVID-19 outbreaks (item 18) with “never” and “ever” answer, type of consultation platform used e.g., telemedicine or in-person visit only (item 19), platform in used e.g., health apps or others (item 20, 26), communication type e.g., text, call, or video (item 21), frequency of consultation (items 22, 24, 28) and duration of consultation (items 23, 25, 27).

Self-care during COVID-19 (14 questions). The questionnaire was self-constructed to assess diabetes self-management practice during COVID-19 outbreaks based on recommendation from PERKENI and several studies (Banerjee et al., 2020; Gupta et al., 2020; PERKENI, 2020). It consists of questions about diet (items 29, 30, 31, 32, 33, 34, 35), physical activity (items 36, 37, 38, 39), medication compliance (items 40, 41), and blood glucose monitoring (items 42). The data collected differently for each question in every section. Continues data was presented using mean (SD), n (%), and median.

a) Diet consisted of questions about meal planning (item 29) and diet restriction (item 30) with “no” or “yes” answer. If the answer was “yes”, the participants were asked about their compliance with "never", "sometimes", or "always" answer. If “no”, they continue to the next question. Other questions were about cooking habit (item 31) and stored package food (item 32) with "never", "sometimes", or "always" answer. The participants were also asked about their frequency of eating and snacking (item 33, 34), also type of frequent food consumed (item 35) during COVID-19 outbreaks.
b) Physical activity includes exercise behaviour (item 36) with "never", "sometimes", and "always" answer. If the answer was “never”, the participants skipped to the next part of questionnaire no. 40 about medication compliance. If the answer was “sometimes” or “always”, they were asked about their type of exercise (item 37), frequency (item 38) and duration (item 39) which collected as continuous data.
c) Medication compliance (item 40, 41) with 3 answers which consists of "never", "sometimes", and "always" answer. If the answer is “sometimes”, they were asked about how many times they forgot to take medicine in the past 12 months or during COVID-19 outbreaks.
d) Self-blood sugar monitoring include question about practice on blood sugar testing at home (item 42) with “no” or “yes” answer. If the answer is “yes”, they were asked about the frequency of their blood sugar checking at home.

Family support during COVID-19 (8 questions) inspired and adopted from Diabetes Social Support Questionnaire-Family Version (Greca & Bearman, 2002).

The study used several items for each key area mentioned in the original questionnaire: remind and cook healthy meals (items 43, 47), exercise (items 44), remind to take medicine on time (item 46), and remind to check HbA1c level (items 49), and emotional support (item 50). This study also included family support related to telemedicine use (item 45) and in-person visit (item 48) to consult a doctor which is not included in the original version. The answer classified into 3 responses “never”, “sometimes” and “always”.

<u>HbA1c level</u> (3 questions) included the target range (item 51), latest time check (item 52), and latest HbA1c level (item 53). The data collected as continuous data, but could not presented using mean (SD), n (%), and median because some participants did not give exact number of their HbA1c level (e.g., <7% or ≥7%). For analysis purpose, the data was transformed into 2 categories. Target range categorized into “no target” and “have target”. Latest time checked categorized into “2020” and “2021”. HbA1c level categorized using minimum target of glycemic target by ADA and PERKENI (<7%).

B. Validity and Reliability

A self-constructed questionnaire has been validated based on the Item-Objective Congruence (IOC) score 0.8 by four experts who were two (2) medical doctors from Indonesia, one (1) medical doctor from Thailand, and one (1) Public Health from Thailand. After the revision, the questionnaire was reviewed by all experts for confirmation. The validated questionnaire then translated into Bahasa Indonesia language using backward translation. Prior to actual data collection, a pilot test conducted in 30 samples (10% of total sample sizes) in different region from study area but with similar characteristics. By using SPSS version 22, reliability tested by Cronbach’s Alpha 0.7 or Kudar-Richardson formula 20.

Table 3.1 Validity and Reliability Result

Variables	Expert 1	Expert 2	Expert 3	Expert 4	IOC Score	Cronbach's Alpha
Diabetes conditions	1	1	0.8	1	0.9	0.7
Consultation factors	1	1	1	1	1	0.7
Self-care						0.7
Diet	1	0.8	1	1	0.9	
Physical activity	1	1	0.8	1	0.9	
Medication compliance	1	1	1	1	1	
Blood glucose	1	1	0.5	1	0.8	
Family support	0.8	0.8	0.9	1	0.8	0.9
HbA1c level	1	1	0.7	1	0.9	0.7

3.5 Data Collection

The study conducted during March 2021. Data collected by researcher who stayed in Bangkok, Thailand and some research assistants who were a medical doctor (1), nurse (1) and Bachelor of Public Health (1) in Indonesia. The researcher collaborated with healthcare professionals from primary, secondary, and tertiary hospitals in Jakarta, Indonesia to enroll the participants. After getting a list of potentital participants, the researcher contacted them directly via WhatsApp. They were given a Google Form link that consists of screening questions (Table 3.2), informed consent, and a structured questionnaire.

Table 3.2 Screening survey for data collection

No	Questions	Answer
1	How old are you in the completed year?	………
2	Where do you live in the past 6 months?	□ Jakarta □ Bogor □ Depok □ Tangerang □ Bekasi □ Others
3	What type of diabetes do you have?	□ Type 1 diabetes □ Type 2 diabetes

		□ I do not know
4	In what year you were diagnosed with diabetes?	……
5	Do you check HbA1c level during COVID-19?	□ Yes □ No
6	Do you currently have COVID-19?	□ Yes □ No
7	Are you currently hospitalized for any cause?	□ Yes □ No
8	Have you ever diagnosed with cognitive or psychiatric problem?	□ Yes □ No

The data collected by researchers include general characteristics, diabetes conditions, consultation factors, self-care during COVID-19, family support during COVID-19, and HbA1c level. Total questionnaire were 53 items. The researcher did not do any measurement to the respondent. HbA1c level informed by the respondent from their latest lab result and fill it into the questionnaire. All the data taken were linked by unique identifier codes and patient anonymity was protected.

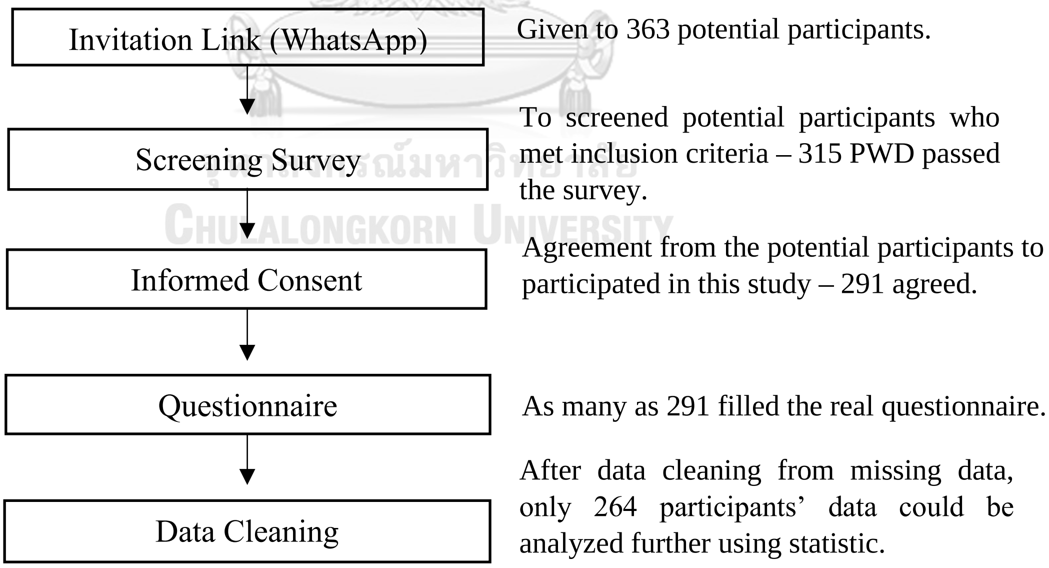


Figure 3.3 Steps of Data Collection

The study used non-probability sampling method. First was using purposive sampling to select district that has highest prevalence of diabetes in Indonesia.

Second step was using inclusion and exclusion criteria in sampling frame, diabetes outpatients who passed inclusion criteria will be included as subject. Third step was using convenience sampling to choose T2DM outpatients who agreed to participate.

3.6 Data Entry and Analysis

Principle researcher checked all data and coded it before entering to the computer. Data entry was done by double entry process and data cleaning performed before the analysis using SPSS software version 22 (licensed by Chulalongkorn University) for Windows.

a. **Descriptive statistic** consists of two types: (1) categorical data e.g., frequency (n) and percentage (%), and (2) continuous data e.g., mean, standard deviation (SD), and median.
b. **Normality test** used Kolmogorov-Smirnov and Shapiro-Wilk for general characteristics (e.g., age, income level, and living arrangement), diabetes conditions (e.g., years of diagnosis, duration of medication), consultation factors (e.g., frequency and duration), self-care (e.g., frequency of eating, frequency and duration of physical activity), and HbA1c level to identify data normality. Result of mean used if the data normally distributed, and median used if the data not normally distributed. The mean or median used as a cut off point for data categorization (chi square and regression).
c. **Chi-square test** (Cl 95%) to find the association between categorical data of independent (e.g., general characteristics, diabetes conditions, consultation factors, self-care, and family support) and dependent variables (e.g., HbA1c level). Characteristics with p-value <0.05 considered as significant result with association of the dependent variable.
d. **Binary logistic regression** to identify factors contributing to glycemic control among T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks. Result of this analysis indicate which factors become risk factors (Odds Ratio >1) or protective factors (Odds Ratio <1). This further analysis is done to provide a chance of characteristics with no significance association in bivariate analysis, with possibility to have significance result in

multivariate analysis (Bendel & Afifi, 1977; Mickey & Greenland). Therefore, all the characteristics who had p-value <0.250 in Chi-square test were included in the model (Bursac et al., 2008) and moved to below equation (Harrell, 2001):

$$\mathbf{Y = \boldsymbol{a} + \boldsymbol{b_1X_1} + \boldsymbol{b_2X_2} + \boldsymbol{b_3X_3} + \boldsymbol{b_4X_4} + \ldots + \boldsymbol{b_nX_n} + \boldsymbol{e}}$$

Y = dependent variables

X = independent variabels

a = constant; equals the value of Y when the value of X=0

b = coefficient of X; how much Y changes for each one-unit change in X

e = residual, or error term; the error of predicting the value of Y, given the value of X (in is not displayed in most regression equations)

In this study, “Y” refers to the value of glycemic control which divided into poor glycemic control (HbA1c≥7%) and good glycemic control (HbA1c>7%). “X” referes to the value of independent variables who had p-value <0.250 in the Chi-square test. As many as 16 factors (from 41) in the independent variables were included in the binary logistic model e.g., gender, education level, income level, smoking status, BMI, medication compliance, telemedicine experience, consultation, follow a meal plan, follow a diet restriction, medication compliance, frequent food consumed, reguler exercise, frequency of exercise, family support in telemedicine, and family support in reminding to check HbA1c.

3.7 Ethical Consideration

Ethical approval was obtained from the Ethical Review Board, Faculty of Medicine and Health, University of Muhammadiyah Jakarta, Indonesia No.052/PE/KE/FKK-UMJ/II/2021.

CHAPTER IV
RESULT

The objective of the study was to determine telemedicine use, associated factors with HbA1c level and factors contributing to glycemic control among diabetes patients. After excluding missing data, total subject of this study was 264 T2DM outpatients located in Jakarta, Indonesia. The results are consisting of descriptive, bivariate (chi-square), and multivariate (binary logistic regression) analysis.

4.1 Univariate Analysis

A. General Characteristics

Table 4.1 shows the general characteristics of participants. Mean (SD) of participants' age were 47.4 (7.2) years with median 50 years. Approximately most of the participants were female (53.4%) and graduated from senior high school (46.2%). Before COVID-19 outbreaks, as many as 68.6% were employed and had average (SD) income 545 (903) USD. While during COVID-19, as many as 62.5% were employed and had average (SD) income 500 (781) USD. Many participants were married (89.4%), never smoked (81.8%), and were being overweight (45.1%). No one participants in this study consumed alcohol. In average, the participants were living with 4 (2) people at home during the COVID-19 outbreaks.

Table 4.1 General characteristics of participants (n=264)

Characteristics	N	%
Age (years)		
Mean ± SD	47.4 ± 7.2	
Median	50	
Gender		
Male	123	46.6
Female	141	53.4
Education level		
Elementary school	8	3.0
Junior high school	8	3.0
Senior high school	122	46.2
Bachelor's degree	90	34.1
Master's degree	36	13.7

Characteristics	n	%
Employment status before COVID-19		
Unemployed	83	31.4
Employed	181	68.6
Income before COVID-19 (USD)		
Mean ± SD	545 ± 903	
Median	275	
Employment status during COVID-19		
Unemployed	99	37.5
Employed	165	62.5
Income during COVID-19 (USD)		
Mean ± SD	500 ± 781	
Median	206	
Marital status		
Married	236	89.4
Single	12	4.5
Divorce	10	3.8
Widow	6	2.3
Smoking status		
Never	216	81.8
Ex-smoker	11	4.2
Active smoker	37	14.0
Alcohol use		
No	264	100.0
Body mass index (BMI)		
Underweight (<18.5 kg/m^2)	4	1.5
Normal (18.5–24.9 kg/m^2)	93	35.2
Overweight (25–29.9 kg/m^2)	119	45.1
Obese (>30 kg/m^2)	48	18.2
Living arrangement		
Mean ± SD	4 ± 2	
Median	5	

Currency rate on 1st April 2021: 1 USD = IDR 14,528

B. Diabetes Conditions

Table 4.2 shows diabetes conditions of participants. The Mean (SD) of diabetes duration among participants were 6.5 (4.1) years with median 5 years. Medication type mostly used during COVID-19 outbreaks were oral medicine as monotherapy (69.4%). Many of them have been prescribed with certain medicine for more than 5.6 (3.6) years in average (SD) with median 5 years. As many as 70.8% participants had no complication and 87.1% had no comorbidity.

Table 4.2 Diabetes conditions of participants (n=264)

Characteristics	**n**	**%**
Diabetes duration (years)		
Mean ± SD	6.5 ± 4.1	
Median	5	
Medication		
Oral medicine	183	69.4
Insulin therapy	26	9.8
Oral medicine & insulin therapy	55	20.8
1st prescribed (years)		
Mean ± SD	5.6 ± 3.6	
Median	5	
Complication		
No complication	187	70.8
1 complication	43	16.3
2 complications	17	6.5
3 complications	13	4.9
5 complications	3	1.1
6 complications	1	0.4
Comorbidity		
No comorbidity	230	87.1
1 comorbidity	11	4.2
2 comorbidities	17	6.4
3 comorbidities	4	1.5
4 comorbidities	2	0.8

C. Consultation Factors

Table 4.3 shows consultation factors of participants during COVID-19 outbreaks. Many of the participants had no experience in using telemedicine before the pandemic (81.1%). During the pandemic, most of the participants were consulting with a doctor through in-person visit only (56.1%).

Table 4.3 Consultation factors of participants (n=264)

Characteristics	**n**	**%**
Telemedicine experience		
Never	214	81.1
Ever	50	18.9
Consult during COVID-19		
No visit/telemedicine	64	24.2
Telemedicine	52	19.7
In-person visit only	148	56.1

Table 4.4 shows telemedicine used among participants who consult with a doctor using health apps and other platform during COVID-19 outbreaks. Many of them consulted with a doctor via non-health apps (53.8%), communicated via text (61.6%) and some of them used video call (34.6%). Only few participants used phone call when consulting a doctor (3.8%). Many of them were consulted for less than 6 times (73.1%) and more than 15 minutes (50%) during COVID-19 outbreaks.

Table 4.4 Telemedicine used among participants (n=52)

Characteristics	n	%
Telemedicine type		
Health apps	24	46.2
Non-health apps (WhatsApp)	28	53.8
Communication type		
Text	32	61.6
Phone call	2	3.8
Video call	18	34.6
Frequency of consultation		
<6 times	38	73.1
≥6 times	14	26.9
Duration of consultation		
<10 minutes	16	30.8
10-15 minutes	10	19.2
≥15 minutes	26	50.0

Table 4.5 shows frequency and duration in-person visit only among participants who consulted with a doctor in a healthcare facility during COVID-19 outbreaks. Many of them consulted with a doctor through in-person visit only more than 6 times in a year (56.8%) around 10-15 minutes (66.2%) per consultation.

Table 4.5 In-person visit among participants (n=148)

Characteristics	n	%
Frequency of consultation		
<6 times	64	43.2
≥6 times	84	56.8
Duration of consultation		
<10 minutes	9	6.1
10-15 minutes	98	66.2
≥15 minutes	41	27.7

D. Self-Care During COVID-19

Table 4.6 shows self-care as diabetes management during COVID-19 outbreaks. More than fifty percent of participants had meal plan (51.1%) but only few of them always complied with the plan (28.1%). As many as 44.7% participants had diet restriction but only few of them complied with it (39.0%). During COVID-19 outbreaks, more than half participants cooked at home (54.9%) and consumed fried foods frequently (83%), had snacks between meals (81.8%), and stored package food (48.9%). In average (SD), all the participants eat 3 (1) times a day. Only 11.4% participants did not exercise and the rest of them exercise in average (SD) 3 (2) times a week and 26.7 (24.9) minutes a day. Most of them exercised by walking/jogging during the pandemic (50.8%). Almost all the participants reported to adhere with medication although some of them forgot to take medicine (9.5%). Nearly 42.4% of them did self-monitoring blood glucose (SMBG) at home.

Table 4.6 Self care management during COVID-19 of participants (n=264)

Characteristics	n	%
Meal plan		
No	129	48.9
Yes	135	51.1
Meal plan compliance (n=135)		
Never	4	3.0
Sometimes	93	68.9
Always	38	28.1
Diet restriction		
No	146	55.3
Yes	118	44.7
Restriction compliance (n=118)		
Never	2	1.7
Sometimes	70	59.3
Always	46	39.0
Cooking at home		
Never	20	7.6
Sometimes	99	37.5
Always	145	54.9
Frequent food consumed		
Fried	220	83.0
Others	44	17.0

Characteristics	n	%
Frequency of eating (times per day)		
Mean ± SD	3 ± 1	
Median	3	
Snacking		
No	48	18.2
Yes	216	81.8
Stored package food		
No	135	51.1
Yes	129	48.9
Exercise		
Never	30	11.4
Sometimes	203	76.9
Always	31	11.7
Type of exercise (n=234)		
Walking/jogging	134	57.3
Running	24	10.3
Cycling	54	23.1
Aerobic exercise	22	9.4
Frequency exercise (times per week)		
Mean ± SD	3 ± 2	
Median	2	
Duration exercise (minutes)		
Mean ± SD	26.7 ± 24.9	
Median	30	
Medication compliance		
Sometimes forget	25	9.5
Never forget	239	90.5
Self-monitoring blood glucose (SMBG)		
No	152	57.6
Yes	112	42.4

E. Family Support During COVID-19

Table 4.7 shows family supports received by the participants during COVID-19 outbreaks regarding their diabetes condition. Most of their family always gave support in terms of reminding them to eat healthy meals (61.7%) and adhere with medication (59.8%). Some of their family cooked healthy foods (44.7%), were reminding them to check HbA1c level every 3 months (37.1%) and being listened about their diabetes concern (61.7%). Sometimes their family gave support by accompanying them to consult a doctor through in-person visit (37.5%). Many of their family did not recommend them to use telemedicine during COVID-19 outbreaks (59.1%).

Table 4.7 Family support during COVID-19 of participants (n=264)

Characteristics	n	%
FS in meal plan		
Never	18	6.8
Sometimes	83	31.5
Always	163	61.7
FS in recommending telemedicine		
Never	156	59.1
Sometimes	58	22.0
Always	50	18.9
FS in medication compliance		
Never	36	13.6
Sometimes	70	26.6
Always	158	59.8
FS in cooking healthy meals		
Never	42	15.9
Sometimes	104	39.4
Always	118	44.7
FS in accompanying in-person visit		
Never	75	28.4
Sometimes	99	37.5
Always	90	34.1
FS in reminding HbA1c check		
Never	96	36.4
Sometimes	70	26.5
Always	98	37.1
FS in listening to diabetes concern		
Never	33	12.5
Sometimes	68	25.8
Always	163	61.7

FS, Family Support

F. HbA1c Level

Table 4.8 shows HbA1c latest check and result of participants during COVID-19 outbreaks. Most of participants did not have target for their HbA1c in the next 3 months (70.5%). During the pandemic, the latest time of their checking HbA1c level was mostly in 2021 (January-March 2021) with approximately 51.8%. Of 264 participants, 159 (60.2%) had HbA1c ≥7% (poor glycemic control) and 105 (39.8%) had HbA1c <7% (good glycemic control).

Table 4.8 HbA1c level of participants (n=264)

Characteristics	n	%
HbA1c target		
No target	186	70.5
Have target	78	29.5
HbA1c check		
2020 (April–December 2020)	130	49.2
2021 (January–March 2021)	134	51.8
HbA1c level (%)		
<7%	105	39.8
≥7%	159	60.2

4.2 Bivariate Analysis

A. General characteristics and HbA1c level

Table 4.9 shows the bivariate analysis between general characteristics of participants and HbA1c level during COVID-19 outbreaks. Median of age (50) was used as cut-off point because the data were not normally distributed. For analysis purpose, education level was classified into two categories: below senior high school and bachelor's degree or higher. Income level was compared before and during COVID-19 to see whether there was a change experienced by them. For BMI, it was classified into 2 categories based on WHO standard for analysis purpose: normal or lower (<24.9 kg/m^2) and overweight or higher (≥25 kg/m^2). As of living arrangement, median (5) was used as cut-off point since the data were not normally distributed.

Among of all general characteristics, gender (p<0.001), income change due to COVID-19 outbreaks (p=0.043), smoking status (p=0.038), and BMI (p<0.001) had significant association towards HbA1c level during COVID-19 outbreaks. Age, education level, employment change during COVID-19, marital status, and living arrangement had no association with HbA1c level (p>0.05).

Table 4.9 Bivariate analysis between general characteristic and HbA1c level (n=264)

Characteristics	Good Glycemic Control (HbA1c<7) (n=105)		Poor Glycemic Control (HbA1c≥7) (n=159)		Total		P-value
	n	%	n	%	n	%	
Age							
<50 years	54	41.9	75	58.1	129	100.0	0.498
≥50 years	51	37.8	84	62.2	135	100.0	
Gender							
Male	63	51.2	60	48.8	123	100.0	**<0.001***
Female	42	29.8	99	70.2	141	100.0	
Education level							
Below SHS	48	34.8	90	65.2	138	100.0	0.083
Bachelor or higher	57	45.2	69	54.8	126	100.0	
Employment change							
No changed	95	38.6	151	61.4	246	100.0	0.156
Changed	10	55.6	8	44.4	18	100.0	
Income change							
No changed	90	42.9	120	57.1	210	100.0	**0.043***
Decreased	15	27.8	39	72.2	54	100.0	
Marital status							
Married	95	40.6	139	59.4	234	100.0	0.444
Others	10	33.3	20	66.7	30	100.0	
Smoking status							
Not smoker	96	42.3	131	57.7	227	100	**0.038***
Active smoker	9	24.3	28	75.7	37	100	
Body mass index (BMI)							
Normal/lower	57	58.8	40	41.2	97	100.0	**<0.001***
Overweight/higher	48	28.7	119	71.3	167	100.0	
Living arrangement							
<5 people	49	37.4	82	62.6	131	100.0	0.435
≥5 people	56	42.1	77	57.9	133	100.0	

***Chi-square test, p-value 0.05**; SHS, Senior High School

B. Diabetes condition and HbA1c level

Table 4.10 shows the bivariate analysis between diabetes conditions and HbA1c level during COVID-19 outbreaks. Median was used as cut-off point because the data of diabetes duration (5 years) and length of medication (5 years) were not normally distributed. Type of medication was classified into 2 categories for analysis purpose: oral medicine and others (insulin therapy only or combination). Among of all characteristics, only type of medication (p=0.001) which had significant association towards HbA1c level during COVID-19 outbreaks. Diabetes duration, length of medication, complication, and comorbidity of participants had no association with HbA1c level (p>0.005).

Table 4.10 Bivariate analysis between diabetes condition and HbA1c (n=264)

Characteristics	Good Glycemic Control (HbA1c<7) (n=105)		Poor Glycemic Control (HbA1c≥7) (n=159)		Total		P-value
	n	**%**	**n**	**%**	**n**	**%**	
Diabetes duration							
<5 years	43	41.0	62	59.0	105	100.0	0.750
≥5 years	62	23.5	97	76.5	159	100.0	
Type of medication							
Oral medicine	85	46.4	98	53.6	183	100.0	**0.001***
Others	20	24.7	61	75.3	81	100.0	
Medication used							
<5 years	43	41.7	60	58.3	103	100.0	0.600
≥5 years	62	38.5	99	61.5	161	100.0	
Complication							
No	79	42.2	108	57.8	187	100.0	0.201
Yes	26	33.8	51	66.2	77	100.0	
Comorbidity							
No	91	39.6	139	60.4	230	100.0	0.858
Yes	14	41.2	20	58.8	34	100.0	

Chi-square test, p-value 0.05

C. Consultation factors and HbA1c level

Table 4.11 shows the bivariate analysis between consultation factors and HbA1c level during COVID-19 outbreaks. Telemedicine experienced before the pandemic (p=0.009) and consulted with a doctor during the pandemic (p<0.001) had significant association towards HbA1c level during COVID-19 outbreaks. Most of the participants who did not do any visit or telemedicine to consult a doctor (93.8%) had poor glycemic control (HbA1c ≥7%) during the pandemic.

Table 4.11 Bivariate analysis between consultation factors and HbA1c (n=264)

Characteristics	**Good Glycemic Control (HbA1c<7) (n=105)**		**Poor Glycemic Control (HbA1c≥7) (n=159)**		**Total**		**P-value**
	n	**%**	**n**	**%**	**n**	**%**	
Telemedicine experience							
Never	77	36.0	137	64.0	214	100.0	**0.009***
Ever	28	56.0	22	44.0	50	100.0	
Consult during COVID-19							
No visit/telemedicine	4	6.3	60	93.8	64	100.0	**<0.001***
Telemedicine	28	53.8	24	46.2	52	100.0	
In-person visit only	73	49.3	75	50.7	148	100.0	

Chi-square test, p-value 0.05

D. Self-care during COVID-19 and HbA1c level

Table 4.12 shows the bivariate analysis between self-care and HbA1c level during COVID-19 outbreaks. For continuous data, some of characteristics were classified using median as cut-off point because the data were not normally distributed. It includes frequency of eating (3 times/day) and exercise frequency (2 times/week). The duration of exercise used standard of exercise per day from WHO (30 minutes). Among of all characteristics, following a meal plan (p=0.001), exercise (p<0.001), frequency of exercise (p=0.002), and frequent consumed foods (p=0.011) had significant association towards HbA1c level during COVID-19 outbreaks. Following a diet restriction, cooking at home, frequency of eating, snacking habit, stored package food, medication compliance, and self-monitoring blood glucose (SMBG) at home had no association with HbA1c level (p>0.005).

Table 4.12 Bivariate analysis between self-care and HbA1c (n=264)

Characteristics	**Good Glycemic Control (HbA1c<7)**		**Poor Glycemic Control (HbA1c≥7)**		**Total**		**P-value**
	n	**%**	**n**	**%**	**n**	**%**	
Following a meal plan							
No	51	38.3	82	61.7	133	100.0	**0.004***
Sometimes	30	32.3	63	67.7	93	100.0	
Always	24	63.2	14	36.8	38	100.0	

Characteristics	Good Glycemic Control (HbA1c<7)		Poor Glycemic Control (HbA1c≥7)		Total		P-value
	n	%	n	%	n	%	
Following a diet restriction							
No	55	50.0	93	84.5	148	100.0	
Sometimes	26	27.4	44	46.3	70	100.0	0.167
Always	24	52.2	22	47.8	46	100.0	
Cook at home							
No	10	50.0	10	50.0	20	100.0	0.331
Yes	95	38.9	149	61.1	244	100.0	
Frequent food consumed							
Fried	80	36.4	140	63.6	220	100.0	**0.011***
Others	25	56.8	19	43.2	44	100.0	
Frequency of eating							
<3 times a day	29	35.8	52	64.2	81	100.0	0.381
≥3 times a day	76	41.5	107	58.5	183	100.0	
Snacking habit							
No	20	41.7	28	58.3	48	100.0	0.767
Yes	85	39.3	131	60.7	216	100.0	
Stored package food							
No	55	40.7	80	59.3	135	100.0	0.742
Yes	50	38.8	79	61.2	129	100.0	
Regular exercise							
No	76	32.6	157	67.4	233	100	**<0.001***
Yes	29	93.5	2	6.5	31	100	
Frequency of exercise							
<2 times per week	18	24.3	56	75.7	74	100.0	**0.002***
≥2 times per week	87	45.8	103	54.2	190	100.0	
Exercise duration							
<30 minutes	32	40.0	48	60.0	80	100.0	0.960
≥30 minutes	73	39.7	111	60.3	184	100.0	
Medication compliance							
Sometimes forget	13	52.0	12	48.0	25	100.0	
Never forget	92	38.5	147	61.5	239	100.0	0.189
SMBG							
No	62	40.8	90	59.2	152	100.0	0.694
Yes	43	38.4	69	61.6	112	100.0	

Chi-square test, p-value 0.05

E. Family support and HbA1c level

Table 4.13 shows the bivariate analysis between family support received by the participants and HbA1c level during COVID-19 outbreaks. Among of all types of family support, only participant's family support in using telemedicine to consult a doctor (p=0.017) and were reminding them to check HbA1c level every 3 months (p=0.027) which had significant association towards HbA1c level during COVID-19 outbreaks. Family support in reminding participants to eat healthy meals, exercised with them, medication compliance, cooked healthy meals, were with them when doing in-person visit for follow up, and being listened to their concern about diabetes had no association with HbA1c level (p>0.005).

Table 4.13 Bivariate analysis between family support and HbA1c (n=264)

Characteristics	**Good Glycemic Control (HbA1c<7) (n=105)**		**Poor Glycemic Control (HbA1c≥7) (n=159)**		**Total**		**P-value**
	n	**%**	**n**	**%**	**n**	**%**	
FS in meal plan							
Never	8	44.4	10	55.6	18	100.0	
Sometimes	35	42.2	48	57.8	83	100.0	0.753
Always	62	38.0	101	62.0	163	100.0	
FS in exercise together							
Never	30	38.5	48	61.5	78	100.0	
Sometimes	43	39.4	66	60.6	109	100.0	0.922
Always	32	41.6	45	58.4	77	100.0	
FS in recommending telemedicine							
Never	51	32.7	105	67.3	156	100	
Sometimes	28	48.3	30	51.7	58	100	**0.017***
Always	26	52.0	24	48.0	50	100	
FS medication compliance							
Never	16	44.4	20	55.6	36	100.0	
Sometimes	27	38.6	43	61.4	70	100.0	0.823
Always	62	39.2	96	60.8	158	100.0	
FS cooking healthy meals							
Never	14	33.3	28	66.7	42	100.0	
Sometimes	45	43.3	59	56.7	104	100.0	0.525
Always	46	39.0	72	61.0	118	100.0	
FS in accompanying in-person visit							
Never	29	38.7	46	61.3	75	100.0	
Sometimes	40	40.4	59	59.6	99	100.0	0.972
Always	36	40.0	54	60.0	90	100.0	
FS reminding to check HbA1c							
Never	37	38.5	59	61.5	96	100.0	
Sometimes	20	28.6	50	71.4	70	100.0	**0.027***
Always	48	49.0	50	51.0	98	100.0	

Characteristics	Good Glycemic Control (HbA1c<7) (n=105)		Poor Glycemic Control (HbA1c≥7) (n=159)		Total		P-value
	n	%	n	%	n	%	
FS listening to diabetes concern							
Never	15	45.5	18	54.5	33	100.0	
Sometimes	30	44.1	38	55.9	68	100.0	0.454
Always	60	36.8	103	63.2	163	100.0	

Chi-square test, p-value 0.05; FS, Family Support

4.3 Multivariate Analysis

Table 4.14 shows the factors contributing to glycemic control among T2DM outpatients during the pandemic. The risk of poor glycemic control (HbA1c≥7%) were 5.740-times higher among participants who had BMI categorized as overweight or obese (OR: 5.740 [95% Cl 2.554-12.899]; p<0.001) than in those who had normal or underweight BMI, 5.740-times higher among those who were prescribed with insulin or in combination with oral medication (OR: 3.083 [95% Cl 1.238-7.677]; p=0.016) than in those who took oral medication only, and 5.204 times higher in those who consumed fried foods frequently (OR: 5.204 [95% Cl 1.631-16.606]; P=0.005) compared with other types of cooking/food consumed. Meanwhile, the risk of having poor glycemic control is lower in T2DM outpatients who had higher education level (OR:0.198 [95% Cl 0.078-0.503]; p=0.001), had experience in using telemedicine before the COVID-19 pandemic (OR: 0.372 [95% Cl 0.139-0.995]; p=0.049), consulted with a doctor during COVID-19 outbreaks either using telemedicine (OR:0.193 [95% Cl 0.044-0.846]; p=0.029) or in-person visit only (OR:0.065 [95% Cl 0.016-0.260]; p<0.001), followed a diet restriction (OR:0.333 [95% Cl 0.133-0.833); p<0.019) and regular exercise (OR:0.036 [95% Cl 0.007-0.195); p<0.001).

Table 4.14 Factors to glycemic control during COVID-19 outbreaks (n=264)

Variables	B	S.E.	p-value	OR	95% Cl	
					Lower	Upper
Gender						
Male[ref]						
Female	0.440	0.408	0.281	1.553	0.698	3.457

Variables	B	S.E.	p-value	OR	95% Cl	
					Lower	Upper
Education level						
Below SHS[ref]						
Bachelor or higher	-1.620	0.478	**0.001***	0.198	0.078	0.503
Income level						
No changed[ref]						
Decreased	0.949	0.491	0.053	2.583	0.987	6.762
Smoking status						
Not smoker[ref]						
Active smoker	0.922	0.636	0.147	2.513	0.723	8.740
BMI						
Normal/lower[ref]						
Overweight/higher	1.747	0.413	**<0.001***	5.740	2.554	12.899
Medication						
Oral medicine[ref]						
Others	1.126	0.466	**0.016***	3.083	1.238	7.677
Telemedicine experience						
No[ref]						
Yes	-0.989	0.502	**0.049***	0.372	0.139	0.995
Consultation						
No consultation[ref]						
Telemedicine	-1.644	0.753	**0.029***	0.193	0.044	0.846
In-person visit only	-2.736	0.709	**<0.001***	0.065	0.016	0.260
Follow a meal plan						
No[ref]						
Sometimes	0.507	0.464	0.275	1.660	0.669	4.118
Always	-0.566	0.562	0.314	0.568	0.189	1.710
Follow a diet restriction						
No[ref]						
Sometimes	-1.099	0.468	**0.019***	0.333	0.133	0.833
Always	-0.292	0.537	0.587	0.747	0.261	2.141
Medication compliance						
Sometimes forget[ref]						
Never forget	0.992	0.718	0.167	2.696	0.660	11.008
Frequent food consumed						
Others[ref]						
Fried	1.649	0.592	**0.005***	5.204	1.631	16.606

Variables	B	S.E.	p-value	OR	95% Cl	
					Lower	Upper
Regular Exercise						
No[ref]						
Yes	-3.33	0.864	**<0.001***	0.036	0.007	0.195
Freq of exercise						
<2 times per day[ref]						
≥2 times per day	-0.565	0.439	0.198	0.568	0.240	1.344
FS Telemedicine						
Never[ref]						
Sometimes	-0.715	0.485	0.141	0.489	0.189	1.267
Always	-0.423	0.573	0.461	0.655	0.213	2.016
FS HbA1c						
Never[ref]	0.365	0.517	0.480	1.440	0.523	3.967
Sometimes	0.237	0.463	0.609	1.267	0.512	3.137
Always						

**Binary Logistic Regression, p-value 0.05*
SHS, Senior High School; FS, Family Support

CHAPTER V
DISCUSSION

5.1 HbA1c Level During COVID-19 Outbreaks

Glycosylated haemoglobin (known as HbA1c) is a standard to monitor the long-term control of diabetes mellitus because it is little affected by day-to-day variations unlike the blood glucose level (Whitlock et al., 2000; WHO, 2011). The primary goal of diabetes care is to achieve near-normal glycaemia (7%) as recommended by World Health Organization and adapted by Indonesian Society of Endocrinology (PERKENI, 2015). HbA1c is formed via non-enzymatic glycosylation reactions at the α–amino group of βVal1 residues in the tetrameric haemoglobin (Hb). It can reflect the cumulative of glycemic history over the past 2–3 months and it is considered as reliable biomarker for diagnosis and prognosis of diabetes (Sherwani et al., 2016). Therefore, the HbA1c test should be checked every 3 months or monthly for T2DM patients with HbA1c level 10% or higher. Good glycemic control during COVID-19 outbreaks is important to have good immunity and to prevent diabetes-related complications (PERKENI, 2020).

This study shows that 60.2% of the participants had poor glycemic control (≥7%) during COVID-19 outbreaks in Jakarta, Indonesia. Even if compared to normal situation, the result is not much different as Cholil *et al* (2019) found that glycemic control among diabetes patients in Indonesia tends to be suboptimal. The study reported only one-third of T2DM patients achieved the ADA-recommended target for HbA1c (<7%) (Cholil et al., 2019). This study result is understandable because many of people with diabetes in Indonesia were experienced difficulties in managing their condition during the pandemic (Kshanti et al., 2020) and lifestyle changed due to the restrictions (Kishimoto et al., 2021; Ruiz-Roso et al., 2020; Sankar et al., 2020; Tiwari et al., 2021). The result was similar with previous studies in many countries e.g., India, China, and Korea which found an increase of HbA1c level among T2DM patients amid the lockdown (Khader et al., 2020; Khare & Jindal, 2020; Park et al., 2021; Xue et al., 2020). Even in a country without lockdown such as Japan, glycemic control among T2DM reported to increase during the pandemic (Tanji et al., 2021). Interestingly, the worsen glycemic control and diabetes-related complications during COVID-19 outbreaks have been predicted before (Ghosal et al., 2020). Hence, a high number of patients with poor glycemic control after 1-year implementation of Large-Scale Social Restrictions (PSBB) in this study was not surprising. Contrarily, an improvement in glycemic control was found in patients with T2DM in Greece and from a separate study in India (Anjana et al., 2020; Psoma et al., 2020; Rastogi et al., 2020). The improvement was caused by a decrease in work-related stress, adequate time for self-care, better compliance with medications, adherence to dietary recommendations through home-cooked food, and an increase in physical activity while at home. The study finding is also at variance with those reported in Italy which found an unchanged of HbA1c level during home confinement related to COVID-19 lockdown (Biancalana et al., 2021; Bonora et al., 2020; Falcetta et al., 2021). Several reasons may contribute to such heterogeneous results, including difference in population characteristics (Asia and non-Asia country), length of lockdown implementation, baseline glycemic control, and access to diabetes care during COVID-19 outbreaks.

5.2 General Characteristics

A. Age

Age is the length of time a person has lived (years). This study measured the age of participants in year of 2021 and targeted those who were 25-54 years old (younger diabetic patients as the 3rd highest prevalence). The reasons were to avoid age as confounding factors because older age may increase complexity and changes in body composition which can affect HbA1c level (Sinclair et al., 2019). Age was measured because it is associated with increased HbA1c level and should be taken into consideration for diabetes management (Dubowitz et al., 2014). National Socioeconomic Survey (SUSENAS, 2019) showed that the largest number of population in Jakarta was at the productive age with the highest in 20-29 years (9%), 30-34 years (10%), and 35-39 years (9%). In this study, most of the participants were ≥50 years (51.2%) with average 47.4 (7.2) years.

Based on the bivariate analysis, poor glycemic control during COVID-19 outbreaks was found mostly in participants who were age 50 years and older

(62.2%). Younger participants (<50 years) were more likely to achieve the glycemic target compared to the older one (≥50 years) in this study. The result is consistent with a study from Dubowitz et al. which found that aging is associated with increased HbA1c level. Although the mechanism of increasing age to raise HbA1c still unknown, but some studies believed it could involve processes such as glycation and red blood cell lifespan (Cohen et al., 2008; Kilpatrick et al., 1996). This may be the reason why elderly (≥65 years) have higher HbA1c target 7.5-8.5% (PERKENI, 2015). A study from United States has different finding, which found younger diabetes patients (<50 years) have poorer glycemic control (Benoit et al., 2005). Quah et al. have the similar finding with Benoit et al., although with the different age distribution. That study conducted in Singapore and identified younger adult patients with diabetes (<60 years) have poorer glycemic control because they may be less motivated to manage their condition, as they are busy with working and have less time to comply with medication, healthy lifestyle, and follow-up appointments (Quah et al., 2013). However, this study found no significant association between age and HbA1c level (p>0.05). It may because the age limit of study participant which only focused on younger diabetic patients (24-54 years).

B. Gender

Gender refers to the characteristics of women, men, girls and boys that are socially constructed. The determination of gender in this study was based on the way of the participants represent themselves through talking, dressing, and behaving which divided into female, male, and prefer not to answer. Although male population is higher (50.4%) in Jakarta, there is no slight difference compared to female population (49.6%) (SUSENAS, 2019). In this study, number of female participants (53.4%) were higher than male (46.6%). This is similar to the results of the Basic Health Survey (MoH, 2018) which showed the prevalence of diabetes in women was higher (1.8%) compared to men (1.2%).

Based on the bivariate analysis, poor glycemic control during COVID-19 outbreaks was found mostly in female (70.2%) compared to male (48.8%) participants. Moreover, this study found significant association between gender and

HbA1c level ($p<00.1$). This finding is consistent with some previous studies which found better glycemic control in men. The possible causes of poor glycemic control in women include differences in metabolic process, regulation of glucose homeostasis, treatment response and psychological factors (Nielson, 2004; Shalev et al., 2005; Wexler et al., 2005). The supporting reason is in the pandemic situation, women experiencing more psychological stress compared to men which can affect their well-being (Yan et al., 2021). Higher psychological stress in females may be partially due to their work being more heavily impacted and the care burden while staying at home. Further, the emotional distress can contribute to difficulties in diabetes self-management, poor glycemic control, and worsening diabetes condition over time.

C. Education Level

Education level is the highest level of formal education that has been completed by the participants. This was classified into 6 categories, including elementary school, junior high school, senior high school, bachelor’s degree, master’s degree, and doctoral degree. Based on National Socioeconomic Survey (SUSENAS, 2019), most of the Jakarta population was graduated from senior high school (44.9%). The characteristic of participants in this study was similar because many of them were graduated from senior high school (46.2%). Level of education become an important factor to be measured because this may affect participant’s knowledge, attitude, and practice in managing their diabetes condition (Al-Rasheedi, 2014).

This study found that glycemic control among participant who had latest education level in senior high school or lower tend to be suboptimal (65.2%). Although no significant association found ($p>0.05$), having a higher education level could be a protective factor of poor glycemic control (OR:0.198 [95% Cl 0.078-0.503]; $p=0.001$). This may because education level reflects the ability of participants in accessing diabetes-related knowledge and quality of care, also influence their ability to comply with diabetes treatment plan (Brown et al., 2004; Kirkman et al., 2015). However, no association found between education level towards HbA1c level in this study is consistent with some studies (Kamuhabwa &

Charles, 2014; Kirk et al., 2011; Mellergard et al., 2020). It presumes that participants with lower educational might have more trust in the physicians' advice, while the higher educational level tend to have better knowledge and awareness of diabetes complication (Chaudhary, 2010). Therefore, regardless of their education, T2DM patients could achieve good glycemic control during the pandemic and beyond if they comply with medication, healthy lifestyle, and do routine follow up with a doctor.

D. Employment Status

This study targeted T2DM patients in productive age (24-54 years) which among of them (30-34 years) identified as the highest number of working population in Jakarta with approximately 729,843 people (BPS, 2019). Employment status measured before and during COVID-19 outbreaks because in this unexpected situation many people might have lost their job. Therefore, for analysis purpose, this factor was classified into “no changed” means the participants were originally employed/unemployed and “changed” of employment status. The result showed that many of participants were employed before (68.6%) and during (62.5%) COVID-19 outbreaks.

Based on the bivariate analysis, poor glycemic control during COVID-19 outbreaks was found mostly in participants who did not lost their job (61.4%) which means they were still working during the pandemic. The reason may be due to the work status uncertainty and work shifting to teleworking (partial or fully) which could affect their psychological stress. The similar finding was also reported in Japan (Kishimoto et al., 2021). Employed diabetes patients were more likely to shift to teleworking since they should stay at home for longer periods during the pandemic. Although employment status change during the pandemic had no significant association towards HbA1c level ($p>0.005$), there is possibility that this factor may impact the participant’s financial situation and affect their diabetes management e.g., not able to adhere to a diabetes-friendly diet and access to grocery stores or food supply (Sy & Munshi, 2020).

E. Income

Level of income among participants in this study was measured before and during COVID-19 outbreaks. For analysis purpose, this factor was classified into "no changed" and "decreased" categories. The mean of participants' income was 545 USD before the pandemic, and it was decreased to 500 USD during the pandemic because some of them had lost their job. Based on the bivariate analysis, poor glycemic control was found mostly in participants with decreased income during the pandemic (72.2%) compared to those who had the unchanged income (57.1%). Interestingly, we found significant association between income level change which experienced by the participants due to the COVID-19 outbreaks (p=0.043). This result indicates that level of income changed could limit their ability to afford medication, recommended diet, blood glucose monitoring supplies, and transportation to healthcare facilities or access to telemedicine care. However, its study did not measure whether the participant got COVID-19 aid funds from the government which provided to workers whose wages are below 344 USD per month. If they received the money, this would help them survive in the current situation which can be used for managing their diabetes.

F. Marital Status

Marital status is a participant's state of being single, married, separated, divorced, or widowed. As many as 49% of Jakarta population was married, the rest were single (47%), widowed (3%), and divorced (1%). Same as this study, most of the participants were married (89.4%). Others were single (4.5%), divorce (3.8%), and widow (2.3%). Marital status was measured by considering family as a major source of support for T2DM patients during this challenging time e.g., physical (blood glucose control) and psychological (illness adaption). Support from one's spouse become the most important support during illness episode, but the disruption of self-care may occur when the marital relationship disrupted (Trief et al., 2001). Further, the study suggest that marital relationship may be more powerful than general family support in terms of impact on glycemic control.

Based on the bivariate analysis, poor glycemic control (HbA1c ≥7%) during COVID-19 outbreaks was found mostly in participants with marital status categorized as “others” (66.7%). It either the participants were single, divorced, or widowed during the pandemic. However, this study did not find any significant association (p=0.444) between marital status and HbA1c level although married participants tend to achieve better glycemic control compared to non-married one. This finding was different with a previous study which found marriage as a protective effect on glycemic control, and it helps T2DM patients to be more successful in the long-term treatment and follow-up period of diabetes (Avci, 2018). However, the finding is understandable because with almost of all participants were married (8.94%), this study did not measure the quality of their marriage which may impact their diabetes management during the pandemic. The assumption is supported by a study from Trief et al., which found that a negative marital relationship could affect people with diabetes’ adjustment and their ability to maintain the care regimen including good glycemic control. Further, there is a possibility that no association between marital status and glycemic control in this study is due to the spouse’s nescience of how to help them in managing their diabetes (Burns et al., 2013).

G. Smoking Status

Cigarette smoking have been known as a risk factor for T2DM. In diabetic patients, this unhealthy behaviour makes the disease hard to control. Smokers with diabetes tend to have higher risk for serious complication, include retinopathy, nephropathy, peripheral neuropathy, heart and kidney disease (CDC, 2010). Therefore, quit smoking is advised among T2DM patients to control the disease (PERKENI, 2015). Approximately 81.8% of the participants never smoked, 4.2% have been quit smoking before the pandemic (categorized as ex-smoker), and 14% were smoking during the pandemic.

Based on the bivariate analysis, poor glycemic control during COVID-19 outbreaks was found mostly among participants who were an active smoker (75.7%). It is consistent with a previous study which identified smoking behaviour as a risk factor of T2DM, worsening diabetic status, and increase the risk of diabetes-related complication (Hmood et al., 2020). A similar finding was reported in Australian population where current and past smokers had poorer glycemic control compared to never smoker (Szwarchbard et al., 2020). Smoking behaviour have been reported to affect glucose metabolism and cause hyperglycaemia in people with diabetes (Sari et al., 2018; Sherman, 2005). Furthermore, in people who were ex-smoker, there is potential to gain weight in the initial period of smoking cessation which may impact their glycemic control (Campagna et al., 2019; Lino et al., 2004).

H. Alcohol Use

There were no participants who consumed alcohol during COVID-19 outbreaks. Either they have known the negative effect of alcohol use for their disease or not, this healthy behaviour was expected to be done among diabetes patients to control their disease. Although alcohol intake is considered as a risk factor of T2DM, some studies found this can be protective factors which can lowered HbA1c level (Hong et al., 2016). However, stop drinking alcohol is one of the non-pharmacological treatments for diabetes patients, along with lose weight, increase physical activity, quit smoking, and reduce salt consumption (PERKENI, 2015). With none of the participant using alcohol during the COVID-19 outbreaks, there was no statistical analytical test to find association towards HbA1c level. Further, this healthy behaviour is expected to continue to be complied among T2DM patients (PERKENI, 2015) although the moderate consumption of alcohol still allowed.

I. Body Mass Index (BMI)

BMI was measured by weight-to-height ratio, calculated by dividing one's weight in kilograms by the square of one's height in meters. It is used as an indicator of underweight, normal, overweight, and obese. Many participants of this study were categorized as overweight (45.1%) and only few of them were obese (18.2%). Based on the bivariate analysis, poor glycemic control during COVID-19 outbreaks was found mostly in participants who were overweight or obese (71.3%) and it was significantly associated ($p<0.001$). Using binary logistic regression, it showed that being overweight or obese are 5.740-times higher in having poor glycemic control compared to those who had normal or underweight BMI (OR: 5.740 [95% Cl 2.554-12.899]; p<0.001). The finding is similar with many studies in different countries. A study from Malaysia, India, Saudi Arabia, and Turkey identified being overweight and obese as the associated factor with poor glycemic control (Alzaheb & Altemani, 2018; Mahmood et al., 2016; Sisodia & Chouhan, 2019; Sonmez et al., 2019). So are Bae et al. study which utilized data from US physician electronic health records (Humedica®) from 2009-2011 (Bae et al., 2016). The study found the significant associations between being overweight or obese and having suboptimal glycemic control in patients with diabetes. The association between being overweight or obese and poor glycemic control could be explained by insulin resistance and secretion. The similar result indicates that even in different countries with varied population characteristics, being overweight or obese leads to poor glycemic control or higher HbA1c level.

J. Living Arrangement

Living arrangement defines as the number of people who live with the participants during COVID-19 outbreaks which related to family support in diabetes management. This factor was measured with assumption that people who live with others during the pandemic would have good adoption in protective behaviours e.g., comply with diabetes management (Cohn-Schwartz & Ayalon, 2021). Further, adults who live alone may have double burden in the crisis such as risk of loneliness and health problems (Weissman & Russell, 2016). It presumed that living alone report greater life dissatisfaction, less happiness, and less support compared to those who lived with a spouse/partner and other family members. In this study, most of the participants lived with more than 5 people during the pandemic (50.4%). This study found that higher HbA1c level experienced by participants who lived less than 5 people (62.6%), but we found no significant association (p=0.435) because no one participants in this study lived alone during the pandemic. Unfortunately, this study did not identify whether the participants live with their family or others.

5.2 Factors Associated to HbA1c Level

A. Diabetes Condition

The diabetes condition included diabetes duration, medication type, length of medication, comorbidity, and complication. Those factors were included as a potential predictor of poor glycemic control which may affect HbA1c level as identified in previous studies (Janghorbani & Amini, 2012; Kamuhabwa & Charles, 2014; Mamo et al., 2019). In this study, higher HbA1c level (≥7%) mostly found in participants who have been diagnosed with T2DM for more than 5 years (76.5%), prescribed with insulin therapy or combination (75.3%), have been prescribed with medication more than 5 years (62.8%), had complication (66.2%) and had no comorbidities (60.4%).

Diabetes duration in this study defined as a time length of participants have been diagnosed with T2DM by a doctor. This factor is known to be associated with poor glycemic control. However, this study found no significant association between the diabetes duration and HbA1c level (p=0.750). The reason might because this study focuses on younger diabetic patients aged 25-54 years. The cut-off point of diabetes duration (5 years) was also shorter than previous studies which found significant association between the length of diabetes duration (7 years or more) and glycemic control (Al-Akour et al., 2011; Juarez et al., 2012; Mamo et al., 2019; M. Verma et al., 2006). However, poor glycemic control was mostly found among participants who had T2DM for more than 5 years. It indicates that the longer diabetes duration, the harder it was to maintain glycemic control. Even if self-care skills improved with longer diabetes duration, resistance to medication and the need for higher doses or additional medications increase over time. Glycemic control correlates with longer diabetes duration also possibly due to the progressive impairment of insulin secretion with time because of the failure β-cells, increased insulin resistance to control blood sugar, and eventually in insulin secretion. Further, longer diabetes duration is predicted to be the risk factor for sustained poor glycemic control among diabetes patients (Juarez et al., 2012), also associated with elevated risks of cardiovascular disease and mortality (Li et al., 2020).

Medication type is prescribed medicine to manage diabetes e.g., oral medication, insulin injection, or combination. This factor was measured because drugs have been known to affect HbA1c level in different ways (Unnikrishnan et al., 2012). Among all type of medication, metformin is the most frequent used among T2DM patients (Y. W. Wang et al., 2017) which similar with this study finding. Further, this study found that participants who used oral medicine as monotherapy to treat their diabetes was mostly had good glycemic control (46.4%) compared to those with insulin therapy and/or combination (24.7%). This study also found a significant association between medication type and HbA1c level (p=0.001). This finding supported by previous evidence which found the effectiveness of metformin therapy in lowering HbA1c level as monotherapy (Hirst et al., 2012). Further with multivariate analysis, this study found that T2DM patients who prescribed with insulin or in combination with oral medication had 3.083-times higher risk of having poor glycemic control (OR: 3.083 [95% Cl 1.238-7.677]; p=0.016) compared to those who used oral medication or insulin.

In contrast with medication type, the length of medication used had no significant association towards HbA1c level (p=0.600) although participants who used certain medication more than 5 years tend to have higher HbA1c level (61.5%). Longer diabetes medication was expected to help the patients with diabetes in achieving near-normal glycemic (7%), but this study found otherwise, and the reason might be the excessive medication burden, decrease compliance with diet, exercise, or the medical regimen, and weight gain during COVID-19 outbreaks. Another possibility was medication change or dosage decrease due to the current situation which was not measured in this study.

It has been known that HbA1c level suggests to be less than 7% as the primary glycemic control target for diabetics (ADA, 2019; PERKENI, 2015). The increase of HbA1c level will increase the risk of diabetes-related complication e.g., retinopathy, neuropathy, nephropathy, and others (Khaw et al., 2004). In this study, complication defined as health problem (s) that develop rapidly or over time caused by diabetes include retinopathy, nephropathy, neuropathy, foot problems, heart attack, stroke, cancer, cardiovascular disease, and oral complications (IDF, 2017).

This study found only few participants who had diabetes-related complications (29.2%) and most of them only had one type of complication (16.3%). As higher HbA1c leads to the increase of complication risk, this study showed that HbA1c level more than 7% was mostly found in participants who have complication (66.2%) regardless of the number of complications they had. However, this study found no significant association between complication and HbA1c level (p=0.201). The result is understandable because the known relationship is higher HbA1c level to the risk of complication, not otherwise.

Unlike complication, comorbidity did not appear to limit achievement of good glycemic control (HbA1c <7%). In this study, comorbidity is defined as existing chronic disease experience by the participants before diagnosed with T2DM by a doctor. Only 12.9% participants had comorbidity with the most reported were hypertension and dyslipidaemia. Higher HbA1c (>7%) was mostly found in participants who had no comorbidity (60.4%), but this study found no association between the comorbidity and HbA1c level (p=0.858). The possible reason of this finding is well explained by Lang *et al*. It mentioned that patients with more comorbidities were less likely to have increased HbA1c because the coordination between the physicians and other specialists to find the most effective and appropriate care for diabetes management (Lang & Markovic, 2016). In the other hand, a previous study found that one or more comorbidities have higher risk of having poor glycemic control (Mamo et al., 2019). The reason is because the additional medication which could increase the pill burden to the patient.

B. Consultation Factors

It defined as determinant of consultation that may affect HbA1c level of participants including telemedicine experienced before the pandemic and consult with a doctor during the pandemic. All the factors were measured as a diabetes management during this challenging time, where most of T2DM patients cannot go to the hospital as often as before due to the risk of SARS-CoV-2 infection. As the diabetic patients identified as high risk group with poorer prognosis of the disease, T2DM patients were advised to stay at home and used telemedicine to consult a doctor. This study measured the telemedicine experience of participants to identify how many of them have used telemedicine before the pandemic. That experience may influence their decision to use telemedicine to consult a doctor during COVID-19 outbreaks.

Approximately 18.9% of the participants have used telemedicine before the pandemic. Poor glycemic control was mostly found in participants who did not do any visit/telemedicine during COVID-19 outbreaks used telemedicine (93.8%). This indicate that doctor consultation is important to help people with diabetes managing their condition to achieve glycemic target (HbA1c <7%). Interestingly, this study found significant association between telemedicine experience and glycemic control during the pandemic (p=0.009). This experience also become a protective factor of poor glycemic control among T2DM patients in this study (OR: 0.372 [95% Cl 0.139-0.995]; p=0.049). The possible reason might because that experience helped them to adapt easily in the difficult situation, even when their access to healthcare services is restricted. Further, despite the potential benefits of telemedicine in glycemic control (J. Y. Lee et al., 2020; Tourkmani et al., 2020), this study found only 19.7% participants took the initiative to use telemedicine to consult a doctor during the COVID-19 outbreaks. The number is not much different when compared to the participants who had used telemedicine before the pandemic (18.9%) although this study did not specify how many of participants continued or stopped using the telemedicine to consult a doctor. The possible reason is patients' unfamiliarity with telemedicine platform and how to use the apps (Muharram AP & Tahapary, 2019), or they may feel more comfortable doing in-person visits. Another reason might be related to barriers in using telemedicine, include technology illiteracy, unavailability or expense of the required technology/platform, lack of timing of online visits, reimbursement issue, and others (Aberer et al., 2021). Another study from Indonesia found that among participants who experienced difficulties in managing diabetes during the pandemic, approximately 50.5% of them attempted to chat with health providers via non-health application (e.g., WhatsApp), 9.4% of them call health providers for a consultation, and 21.6% of them consult with health professionals via health applications/internet. The high number of telemedicine used in that study was due to the large number of study participants (1,124 people with diabetes) and conducted in all regions in Indonesia which targeted T1DM and T2DM aged 18 years or older (Kshanti et al., 2020).

This finding is below the expectation that there will be a high increase in the use of teleconsultation during COVID-19 outbreaks as the Indonesian government has endorsed many health applications which provide telemedicine services (paid or free charge). This study still found many of participants consulted with a doctor through in-person visit only (56.1%) although PERKENI have urged diabetes patients to avoid clinic visits to reduce the risk of SARS-CoV-2 infection (PERKENI, 2020). This finding is understandable because virtual care is currently expensive and not easily affordable to everyone, and most of diabetes patients covered by National Health Insurance (Kshanti et al., 2020) which only with in-person visit they can claimed the insurance to get diabetes treatment. However, regardless of consultation type, follow-up appointment is advised for controlling diabetes during the COVID-19 pandemic either directly or remotely using telemedicine since it was statistically significant ($p<0.001$). Compared to in-person visit only, participants who used telemedicine to consult a doctor tend to achieve glycemic control target (53.8%). The findings were further analysed using binary logistic regression, it showed that the risk of having poor glycemic control is lower in T2DM outpatients who consulted with a doctor during COVID-19 outbreaks either using telemedicine (OR:0.193 [95% Cl 0.044-0.846]; $p=0.029$) or through in-person visit (OR:0.065 [95% Cl 0.016-0.260]; $p<0.001$).

From this finding, it indicates that there is possibility for telemedicine use in the future or beyond the pandemic to manage diabetes in a distance and help diabetic patients to achieve good glycemic control. Several studies conducted during COVID-19 outbreaks in India, Japan, Italy, and Saudi Arabia have identified significant positive impact of telemedicine care on glycemic control among people with diabetes (Anjana et al., 2020; Luzi et al., 2021; Onishi et al., 2021; Tourkmani et al., 2020). Even more, a study conducted in Singapore regarding telehealth strategy (e.g., telephone, video, and remote patient monitoring) for managing diabetes found virtual health applications as safe, effective, and efficient way to replace in-person visits. All the telemedicine benefits in improving glycemic control further strengthens previous finding in term of telemedicine use for diabetes management (J. Y. Lee et al., 2020; Shea et al., 2009).

C. Self-Care During COVID-19 Outbreaks

Good glycemic control is required for T2DM patients during COVID-19 outbreaks to prevent worsen prognosis and risk of any infection. Unfortunately, lockdown implementation amid the current pandemic has been proven to negatively affect diabetes management (Khare & Jindal, 2020; Onmez et al., 2020; Rastogi et al., 2020). Moreover, a study from Ghosal et al. has predicted that the longer duration of lockdown may worsen glycemic control and diabetes related-complication due to difficulties in managing the disease (Ghosal et al., 2020). A study conducted by Kshanti et al. also found that many diabetic patients (60.4%) in Indonesia experienced difficulties in managing their diabetes. It includes the difficulties in attending diabetes consultation (30.1%), access to diabetes medication (12.4%), checking blood sugar levels (9.5%), controlling diet (23.8%), and performing regular exercise (36.5%). Therefore, to prevent diabetes related complication and manage good glycemic control during the pandemic, T2DM patients are advised to proactively practicing self-care which include regular eating (at least 2-3 times a day), exercise 30 minutes daily, adhere with medication, and check blood glucose levels routinely (IDF, 2017; Sy & Munshi, 2020).

Meal plan is defined as healthy-eating plan to manage blood sugar levels. This study did not measure diet pattern changes before and during the pandemic which have been identified as a factor in contributing to poor glycemic control (Tiwari et al., 2021). However, many of participants (51.1%) in this study had meal plan to maintain their diet compliance with regular meals (at least 3 times per day) although not focusing on diabetic diet. It is understandable because in the current situation, ensuring good nutrition with regular meals are more important than diet optimization (Sy & Munshi, 2020). Further, this study found that participants who did not follow a meal plan (61.7%) tend to have poor glycemic control. This study found significant association between following a plan towards HbA1c level (p=0.04). Participants who followed a meal plan tend to achieve glycemic target (63.2%) compared to those who never (38.3%) and forget to comply with the plan (32.3%). The result indicates that what most important during the pandemic is to have good compliance towards meal plan to ensure the body gets healthy and nutritious food intake. The result was similar with a previous study in Saudi Arabia which recorded T2DM patients who adhere to meal plan tend to have good glycemic control (Badedi, 2016). The association was stronger in participants who adhere with meal plan and combined with taking medication prescribed, exercise regularly, and check blood glucose level.

Nearly half of the participants had diet restriction (e.g., sugar, bread, rice, soda, certain fruits, package foods) and many of them did not follow with it during the pandemic (56.1%). This study reported that 48.9% participants stored package food to ensure their food supply at home. It is expected that home confinement will contribute to the increase of food cravings, which translated to higher consumption of snacks or dairy. However, this was not supposedly recommended because package foods are typically high in calories and/or fats, with a potential increase in carbohydrate consumption, and may increase the risk of weight gain and worsen glycemic control (Wicaksana et al., 2020). Unfortunately, this study found no association between stored package food habit towards HbA1c level (p=0.742). It is because this study only asked whether they stored the package food or not and did not ask about their consumption. This study also did not find any association between following a diet restriction with HbA1c level (p>0.05), although its compliance became a protective factor of poor glycemic in this study (OR:0.333 [95% Cl 0.133-0.833]; p<0.019). Further, this study found higher HbA1c level (≥7%) in participants who did not have diet restriction (62.3%) and never complied with it (84.5%). The result is different with previous studies regarding diet restriction among T2DM patients. Some restrictions have reported to reduce HbA1c level effectively in overweight or obese patients with diabetes e.g. carbohydrate and calories restrictions (Kirkpatrick et al., 2020; Thomas & Shamma, 2018). Although some of people with diabetes had fruit intake restriction, Christensen et al.

recommend that the intake of fruit should no be restricted in T2DM patients (Christensen et al., 2013).

Due to the implementation of PSBB and to ensure their healthy eating plan, many of participants always cooked at home (54.9%). This finding is expected because due to the restriction, many people have more time to cook at home. This study did not find any significant association between the cooking habit towards HbA1c level (p=0.331). Further, poor glycemic control was mostly found among participants who cooked at home during the pandemic (61.1%). It was found out that many of them consumed fried foods frequently (83.0%) when staying at home during the pandemic. Using binary logistic regression, it showed that T2DM outpatients who consumed fried foods are 5.204-times higher to have poor glycemic control (OR: 5.204 [95% Cl 1.631-16.606]; P=0.005). The finding is understandable because when foods are fried, it absorbs a lot of fat and if it consumed often, this unhealthy cook could gain the T2DM patients' weight and leads to worsen glycemic control. However, during COVID-19 outbreaks, what most important is the regular meal consumption (Sy & Munshi, 2020) like it showed in this study. Participants who eat 3 times a day or more tend to achieve glycemic control target (41.5%) compared to those who eat less than 3 times a day (35.8%). It looks like there were no remarkable change in the frequency of eating which also reported by a study in Japan during the pandemic (Kishimoto et al., 2021). In terms of snacking habit, higher HbA1c (≥7%) were mostly found among participants who consumed snack (60.7%) during COVID-19 outbreaks. Unfortunately, this study did not specify what kind of snack the participants eat while staying at home. There is possibility if higher HbA1c among those who eat snack because the package food they stored at home. Further, this study did not find any association between frequency of eating (p=0.381) and snacking habit (p=0.767) during the pandemic.

With activity limitation outside home amid the pandemic, T2DM patients are still encouraged to do physical activity for at least 30 minutes daily (PERKENI, 2020; Sy & Munshi, 2020). Regular exercise can help T2DM patients in improving their glycemic control (Najafipur et al., 2020), enhance metabolic health (Balducci et al., 2009; Colberg et al., 2016), and immune defence (Duggal et al., 2019; Nieman

& Wentz, 2018). Interestingly, this study observed that PSBB implementation was not an obstacle for the participants to exercise regularly at home. The result is different with a previous study which found a reduction in physical activity during pandemic because the increase time of sitting (Ruiz-Roso et al., 2020). Many participants were reported exercise regularly at least 2 times per week (71.2%) and 30 minutes per exercise (69.7%). Only few of them (11.7%) did regular exercise during the pandemic. Higher HbA1c ($\geq$7%) were mostly found in participants who did not exercise regularly (67.4%). This study found significant association between regular exercise ($p<0.01$) and its frequency ($p=0.001$), but not for exercise duration ($p=0.960$). If further analysed using binary logistic regression, the result showed that exercise regularly at home is lowering the risk of having poor glycemic control (OR:0.036 [95% Cl 0.007-0.195); $p<0.001$). This finding indicates that what most matter is exercise regularly at home during COVID-19 outbreaks regardless of how long the exercise takes. Further, intensity and type of physical activity could be individualised based on patients' ability and fitness level.

In terms of medication compliance, poor glycemic control were mostly found in participants who always take their medication as scheduled (61.6%). Unfortunately, this study found no significant association between medication compliance and HbA1c level ($p=0.189$). The reason might because all the participants reported to adhere with their medication (90.5%), although some of them sometimes forgot to take it (9.5%). This was similar with a study in Saudi Arabia which reported no significance changed regarding medication compliance among T2DM patients during the pandemic (Alshareef et al., 2020). Another interesting finding of this study was participants who comply with medication had HbA1c level >7% (61.6%). The finding was in contrast with a previous study which shown that greater medication adherence associated with improved glycemic control and less hospitalization for newly diagnosed diabetes patients (L.-K. Lin et al., 2017). It was found that medication adherence in the early stage of diabetes was important to maximizing the effectiveness of pharmaceutical therapy (e.g., oral medicine and insulin injection). The different result might be due to the information bias regarding the medication compliance which not informed by the participants, or medication change which was not measured in this study.

Additionally, self-monitoring blood glucose (SMBG) level is also recommended during COVID-19 pandemic (PERKENI, 2020). Interestingly, this study found that poor glycemic control was mostly found among participants who did self-monitoring blood glucose during the pandemic (61.6%) although there was only slight difference compared to those who did not do (59.2%). Moreover, this study found SMBG had no effect on HbA1c level (p=0.694). It may because, unlike the HbA1c measurement, SMBG is episodic and only measures glucose at one-point time which should be set correctly to enable proper interpretation of the result (Dailey, 2007). This is contrary with previous study which found the efficacy of SMBG for glycemic control in diabetic T2DM patients undergoing insulin and non-insulin therapy (Hou et al., 2014; I.-C. Huang et al., 2012). SMBG strategy will only play its proper role only when its effectively combined with diabetes self-management education (Hou et al., 2014). However, the finding was understandable because the value of home blood-sugar monitoring among T2DM patients still unclear. A 1-year randomized-trial study in US found that self-monitored blood glucose did not improve glycemic control, especially in non-insulin dependent type 2 diabetes, due to its cost and uncertainty with frequency of testing. Further, the study suggests that SMBG at home might be a good idea for T2DM patients who take insulin therapy, plan to gain or lose weight, add or stop taking one of their medications, change their diabetes medications, and develop an infection (Young et al., 2017).

D. Family Support During COVID-19 Outbreaks

In the current situation, many families might moved their loved ones from nursing homes to live together, so well-equipped family is an important skill to address the TD2M patients' healthcare needs (Sy & Munshi, 2020). Previous study found that stronger family support relates to T2DM patients better psychological adjustment and enhanced their self-care practice which leads to better glycemic control (Beanlands et al., 2005; DiMatteo, 2004; Shao et al., 2017; Stopford et al., 2013; Trief et al., 2001). Lack of family support could be identified as barrier to diabetes self-management during COVID-19 outbreaks. Family support in this study defined as the support provided by family member to T2DM patients. The expression may be vary depending to culture and/or situation, for example in the COVID-19 outbreaks which can lead to a feeling of isolated, lonely, or depressed. This study focused on family support in reminding to eat healthy meals, giving recommendation to use telemedicine, reminding to take medicine as prescribed and scheduled, cooking healthy meals, accompanying them when visiting a doctor in healthcare facility (in-person visit), reminding to check HbA1c every 3 months, and listening to their diabetes concern.

Interestingly, this study only found family support in recommending telemedicine to consult a doctor (p=0.017) and reminding to check HbA1c level every 3 months (p=0.027) which had significant association with HbA1c level. It is understandable because T2DM patients did not know about the existence of telemedicine and how to use it. Therefore, family support can help them to identify and use telemedicine to consult a doctor during COVID-19 outbreaks. In terms of family support in routine HbA1c level, reminder from family can help T2DM patients to adhere with treatment plan and monitor their diabetes-related condition. Its clearly that HbA1c need to check at least every 3 months to make sure blood sugar still in near-normal glycemic target (7%). Other types of family support were needed to help the T2DM patients achieved the glycemic target during the pandemic although in this study had no significance association (p>0.05). However, good glycemic control were mostly found among participants who always received support in doing regular exercise (41.6%), accompanied when doing in-person visit (40%), get recommendation to use telemedicine (52%), and were reminded to check HbA1c every 3 months (49%). Reminder to take medication as scheduled was not affect HbA1c level among participants because almost all of them complied with medication plan during COVID-19 outbreaks. The reason why family support in listening to the participants' diabetes-related concern was not affect the glycemic control might because this study did not identify how their family respond to their concern in details. This study only asked whether their family listened to them without blaming with no further explanation e.g., did their family show visible irritation or refuse to share the burden living with diabetes after listening to them. No significant association in most of family support type might because the study participants were young adults who were able to manage their diabetes condition independently.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study assessed telemedicine use and associated factors related to HbA1c level in 264 T2DM outpatients in Jakarta, Indonesia during COVID-19 outbreaks. People with diabetes type 2 who were 25-54 years, diagnosed T2DM by doctor before 2020, check HbA1c during COVID-19 (April 2020–March 2021), live in Jakarta for at least 6 months without migration or move to another city, and have no COVID-19 included in this study. The objective was to determine HbA1c level, to find association between general characteristics, diabetes condition, consultation factors, self-care, and family support toward HbA1c level and to identify factors contributing to glycemic control among T2DM outpatients during COVID-19 outbreaks.

This study found that during the COVID-19 outbreaks, most of the T2DM outpatients had HbA1c level ≥7% . Many of the participants were female (53.4%) and graduated from senior high school (46.2%). As many as 68.6% were employed and had average (SD) income 545 (903) USD before the pandemic. While during the pandemic, approximately 62.5% were employed and the average (SD) income was decreased to 500 (781) USD. Most of the participants were married (89.4%), never smoked (81.8%) and were being overweight (45.1%). No one participants in this study used alcohol. In average, the participants lived with 4 (2) people during the pandemic. The mean (SD) of diabetes duration among all participants were 6.5 (4.1) years with median 5 years. Most of the participants prescribed with oral medicine as monotherapy (69.4%). Many of them have been prescribed with certain medication for more than 5.6 (3.6) years in average (SD) with median 5 years. As many as 70.8% participants had no complication and 87.1% had no comorbidity reported. Many of the participants had no experience in using telemedicine before the pandemic (81.1%). However, most of the participants were consulting with a doctor through in-person visit only (56.1%). Approximately 19.7% of participants utilized telemedicine platform (WhatsApp and health application) to stay connected with a doctor during the pandemic. Many of them preferred to consult a doctor via text (61.6%) and some of them used video call (34.6%). Only few participants used phone call when consulting a doctor (3.8%). Many of them consulted with a doctor for less than 6 times (73.1%) and more than 15 minutes (50%). For in-person visit only, many of the participants consult for more than 6 times in a year (56.8%) around 10-15 minutes (66.2%) per consultation.

Regarding self-care management during COVID-19 outbreaks, more than fifty percent of the participants had meal plan (51.1%) although half of them never complied with the plan (50.4%). As many as 44.7% participants had diet restriction but only few of them complied with it (39.0%). More than half participants cooking at home (54.9%), had snacks between meals (81.8%), and stored package food (48.9%) during the pandemic. In average (SD), all the participants eat 3 (1) times a day. Although only 11.7% participants exercised regularly during the pandemic, most of the participants exercised as many as 3 (2) times a week and 26.7 (24.9) minutes a day. Almost all participants reported to adhere with medication although some of them forgot to take medicine as scheduled (9.5%). Nearly 42.4% of the participants did self-monitoring blood glucose (SMBG) at home during the pandemic. Further, it was reported that most of participants' family always gave support in terms of reminding them to eat healthy meals (61.7%) and adhere with medication (59.8%). Some of their family cooked healthy foods (44.7%), remind to check HbA1c level every 3 months (37.1%), and listening to their concern about diabetes (61.7%). Sometimes their family gave support by accompanying them to consult a doctor through in-person visit (37.5%). Unfortunately, many of their family never recommended them to use telemedicine during COVID-19 outbreaks (59.1%).

Out of 264 participants, as many as 60.2% had poor glycemic control during COVID-19 outbreaks. The glycemic control was measured by the HbA1c level and considered as poor if ≥7%. This study found that poor glycemic control was mostly found in participants who were 50 years or older (62.2%), female (70.2%), had education level senior high school or below (65.2%), no changed in employment status (61.4%), decreased income (72.2%), not in marriage relationship (66.7%), active smoker (75.7%), being overweight or higher (71.3%), and lived with less than 5 people during the pandemic (62.6%). Poor glycemic control also mostly found in participants who were diagnosed with T2DM for 5 years or more (76.5%), prescribed with insulin or combination therapy (75.3%), used medication for more than 5 years (61.5%), had complication (66.2%) and had no comorbidity (60.4%). Participants who never used telemedicine before the pandemic (64%) and did not consult with a doctor during the COVID-19 outbreaks (93.8%) tend to have HbA1c level higher than standard (7%). Considering the self-care management, participants who had no meal plan (60.5%), seldom to complied with meal plan (67.7%), had no diet restriction (62.3%), did not comply with diet restriction (84.5%), cooked at home (61.1%), consumed fried food frequently (63.3%), eat less than 3 times a day (64.2%), eat snack between meals (60.7%), stored package foods (61.2%), did not exercise regularly (67.4%) or less than 2 times per week (75.7%), adhere with medication (61.5%), and did self-blood glucose monitoring at home (61.6%) were reported to have poor glycemic control. Further, poor glycemic control was found in participants who had family support in preparing healthy meals (62%), did not get support to do regular exercise (61.5%) and telemedicine for consulting a doctor (67.3%), seldom to get reminder to take medication as scheduled (61.4%), never provided with healthy home-cooked foods (66.7%), were not being accompanied when doing in-person visits (61.3%), sometimes did not get reminder to check HbA1c check (71.4%) and being listened about their diabetes concern (63.2%).

Using bivariate analysis with chi-square test (CI 95%), this study found several factors associated with HbA1c level. It includes general characteristics which consists of gender (p<0.001), income level change (p=0.043), smoking status (p=0.038), and BMI (p<0.001). Regarding the diabetes condition, the type of medication used (p=0.001) affects the HbA1c level. Telemedicine experience (p=0.009) and consultation with a doctor (p<0.001) had significantly associated with HbA1c level during the pandemic. Among all types of self-care in diabetes management, HbA1c level was associated with following a meal plan (p=0.004), regular exercise (p<0.001), frequency of exercise (p=0.002) and frequent consumed foods (p=0.011). In additions, family support in recommending telemedicine to consult with a doctor (p=0.005) and remind to check HbA1c every 3 months (p=0.027) had a significant association with HbA1c level during the pandemic.

Factors contributing to glycemic control was further analysed using binary logistic regression (Cl 95%). The results showed that being overweight or obese (OR: 5.740

[95% Cl 2.554-12.899]; p<0.001), prescribed with insulin or in combination with oral medication (OR: 3.083 [95% Cl 1.238-7.677]; p=0.016) and consumed fried foods frequently (OR: 5.204 [95% Cl 1.631-16.606]; P=0.005) are become the risk factors of having poor glycemic control (HbA1c ≥7%). However, the risk is lower in T2DM outpatients who had higher education lever (OR:0.198 [95% Cl 0.078-0.503]; p=0.001), had experience in using telemedicine before the pandemic (OR: 0.372 [95% Cl 0.139-0.995]; p=0.049), consulted with a doctor during COVID-19 outbreaks either using telemedicine (OR:0.193 [95% Cl 0.044-0.846]; p=0.029) or in-person visit (OR:0.065 [95% Cl 0.016-0.260]; p<0.001), complied with diet restriction (OR:0.333 [95% Cl 0.133-0.833); p<0.019) and regular exercise (OR:0.036 [95% Cl 0.007-0.195); p<0.001).

6.2 Recommendation

A. People with Diabetes

Diabetes patients are advised to comply with healthy healthy lifestyle e.g comply with meal plan and diet restriction, stop smoking and do regular exercise (at least 2 times per week) even during the pandemic situation. Recommended exercise is walking/jogging, running, cycling, and aerobic by still adhering to the protocol of COVID-19 prevention. In terms of diet, T2DM patients are advised to reduce or avoid fried foods to control their blood glucose level and change it to healthy cooking e.g., boiling and steamed. PWD are also needed to stay connected with healthcare professional either through in-person visit or using telemedicine platform (e.g., health apps or WhatsApp).

B. For Diabetes Community

There has been a guideline for diabetes management during COVID-19 outbreaks from PERKENI. It was expected to be complied with the diabetes patients to help them achieving good glycemic target (HbA1c 7%). Therefore, physicians can formulate compliance monitoring for diabetes patients, especially for those who have poor glycemic control. This may help in their decision-making on whether change needs to make regarding the antidiabetic medications used. Assessment of tobacco use, and counselling or treatments that aid smoking cessation, as recommended by guidelines, should be considered as an imperative for improving outcomes among people with diabetes who are an active smoker. Additionally, there is an urgent need for recommending exercise for diabetes patients through home-based exercise programs which may be useful, safe, and effective alternative during COVID-19 outbreaks. Further from these findings, physician endorsement and technical support is needed to help diabetes patients in adopting telemedicine for their diabetes management.

C. For Government

These findings could provide further guidance to policy makers in terms of diabetes management, especially during COVID-19 outbreaks and beyond. In the context of telemedicine, there is currently need for national comprehensive guidelines for diabetes and other chronic disease management in Indonesia. This will help to provide guidance and better promote telemedicine care for patients, healthcare professionals, and healthcare institutions to address barriers and issues related to patient's privacy and financial reimbursement. Even more, personalized telemedicine strategies can be implemented along with appropriated physician endorsement which will influence patients' decision to use telemedicine.

D. For Future Research

Further studies in other areas in Indonesia are required to establish the national compliance values regarding the impact of COVID-19 on glycemic control among patients with diabetes. Moreover, future research could assess the effectiveness of telemedicine use compared to in-person visit in diabetes care during and beyond the COVID-19 outbreaks.

6.3 Strength and Limitation

To the researcher's knowledge, this is the first study to assess the telemedicine use and factors associated with glycemic control which measured by HbA1c level among T2DM outpatients in Jakarta, Indonesia during the COVID-19 pandemic. However, this study had some limitations. First, data on general characteristics, diabetes condition, self-care, and HbA1c level were self-reported, and the estimates may have been subject to information and recall bias. Second, this study was not randomized, and all the participants were T2DM patients who did routine control within 1-year (e.g., doctor consultation, routine blood glucose check, or taking medication) which may lead to selection bias. Further, this study did not measure glycemic control before and after the COVID-19 pandemic, and therefore, it was not impossible to draw conclusions on the impact of PSBB on glycemic control.

APPENDIX 1. Ethic Approval

KOMITE ETIK PENELITIAN KESEHATAN
HEALTH RESEARCH ETHICS COMMITTEE
FAKULTAS KEDOKTERAN DAN KESEHATAN UNIVERSITAS MUHAMMADIYAH JAKARTA
FACULTY OF MEDICINE AND HEALTH, UNIVERSITY OF MUHAMMADIYAH JAKARTA

KETERANGAN LAYAK ETIK
DESCRIPTION OF ETHICAL EXEMPTION
"ETHICAL EXEMPTION"

No.052/PE/KE/FKK-UMJ/II/2021

Protokol penelitian yang diusulkan oleh :
The research protocol proposed by

Peneliti utama
Principal In Investigator : Novi Sulistia Wati, S.K.M

Nama Institusi
Name of the Institution : College of Public Health Sciences, Chulalongkorn University

Dengan judul:
Title

"Penggunaan Telemedicine dan Faktor yang Berhubungan dengan Kadar HbA1c pada Pasien Diabetes Tipe 2 Selama Pandemi COVID-19 di Jakarta, Indonesia: Studi Cross-Sectional"

"Telemedicine Use and Associated Factors Related with HbA1c Level Among Type 2 Diabetes Outpatients During COVID-19 Outbreaks in Jakarta, Indonesia: A Cross-Sectional Study"

Dinyatakan layak etik sesuai 7 (tujuh) Standar WHO 2011, yaitu 1) Nilai Sosial, 2) Nilai Ilmiah, 3) Pemerataan Beban dan Manfaat, 4) Risiko, 5) Bujukan/Eksploitasi, 6) Kerahasiaan dan Privacy, dan 7) Persetujuan Setelah Penjelasan, yang merujuk pada Pedoman CIOMS 2016. Hal ini seperti yang ditunjukkan oleh terpenuhinya indikator setiap standar.

Declared to be ethically appropriate in accordance to 7 (seven) WHO 2011 Standards, 1) Social Values, 2) Scientific Values, 3) Equitable Assessment and Benefits, 4) Risks, 5) Persuasion/Exploitation, 6) Confidentiality and Privacy, and 7) Informed Concent, referring to the 2016 CIOMS Guidelines. This is as indicated by the fulfillment of the indicators of each standard.

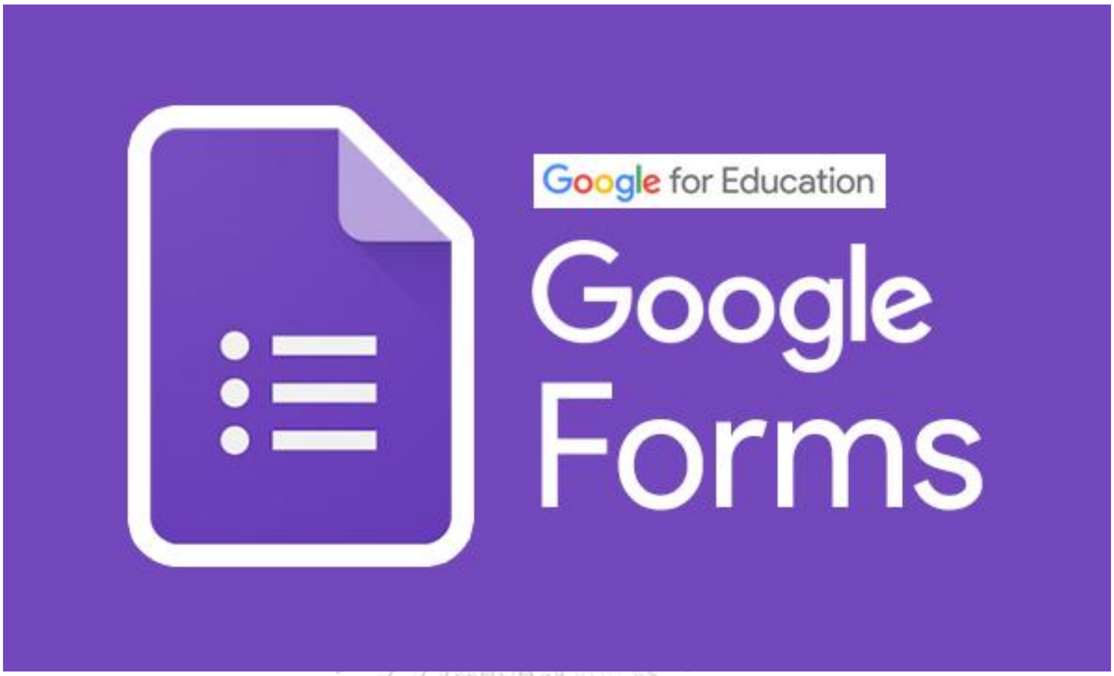
Pernyataan Laik Etik ini berlaku selama kurun waktu tanggal 25 Februari 2021 sampai dengan tanggal 25 Februari 2022.

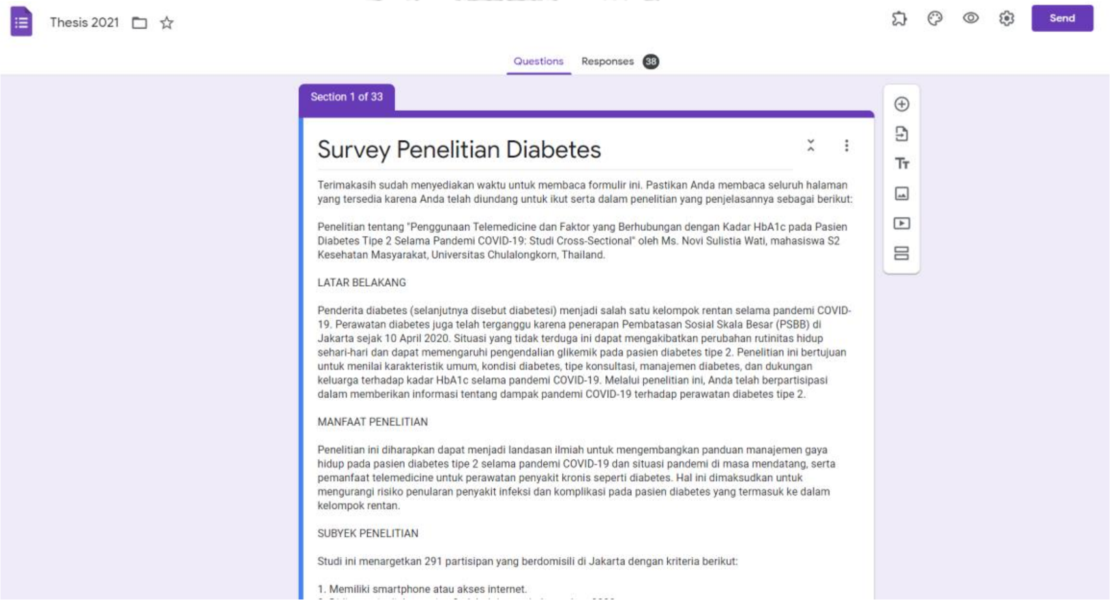
This declaration of ethics applies during the period February 25, 2021 until February 25, 2022.

February 25, 2021
Professor and Chairperson,

dr. Rahmini Shabariah, Sp.A

APPENDIX 2. Data Collection Tools




Thesis 2021

Send

Questions Responses 38

Section 1 of 33

Survey Penelitian Diabetes

Terimakasih sudah menyediakan waktu untuk membaca formulir ini. Pastikan Anda membaca seluruh halaman yang tersedia karena Anda telah diundang untuk ikut serta dalam penelitian yang penjelasannya sebagai berikut:

Penelitian tentang "Penggunaan Telemedicine dan Faktor yang Berhubungan dengan Kadar HbA1c pada Pasien Diabetes Tipe 2 Selama Pandemi COVID-19: Studi Cross-Sectional" oleh Ms. Novi Sulistia Wati, mahasiswa S2 Kesehatan Masyarakat, Universitas Chulalongkorn, Thailand.

LATAR BELAKANG

Penderita diabetes (selanjutnya disebut diabetesi) menjadi salah satu kelompok rentan selama pandemi COVID-19. Perawatan diabetes juga telah terganggu karena penerapan Pembatasan Sosial Skala Besar (PSBB) di Jakarta sejak 10 April 2020. Situasi yang tidak terduga ini dapat mengakibatkan perubahan rutinitas hidup sehari-hari dan dapat memengaruhi pengendalian glikemik pada pasien diabetes tipe 2. Penelitian ini bertujuan untuk menilai karakteristik umum, kondisi diabetes, tipe konsultasi, manajemen diabetes, dan dukungan keluarga terhadap kadar HbA1c selama pandemi COVID-19. Melalui penelitian ini, Anda telah berpartisipasi dalam memberikan informasi tentang dampak pandemi COVID-19 terhadap perawatan diabetes tipe 2.

MANFAAT PENELITIAN

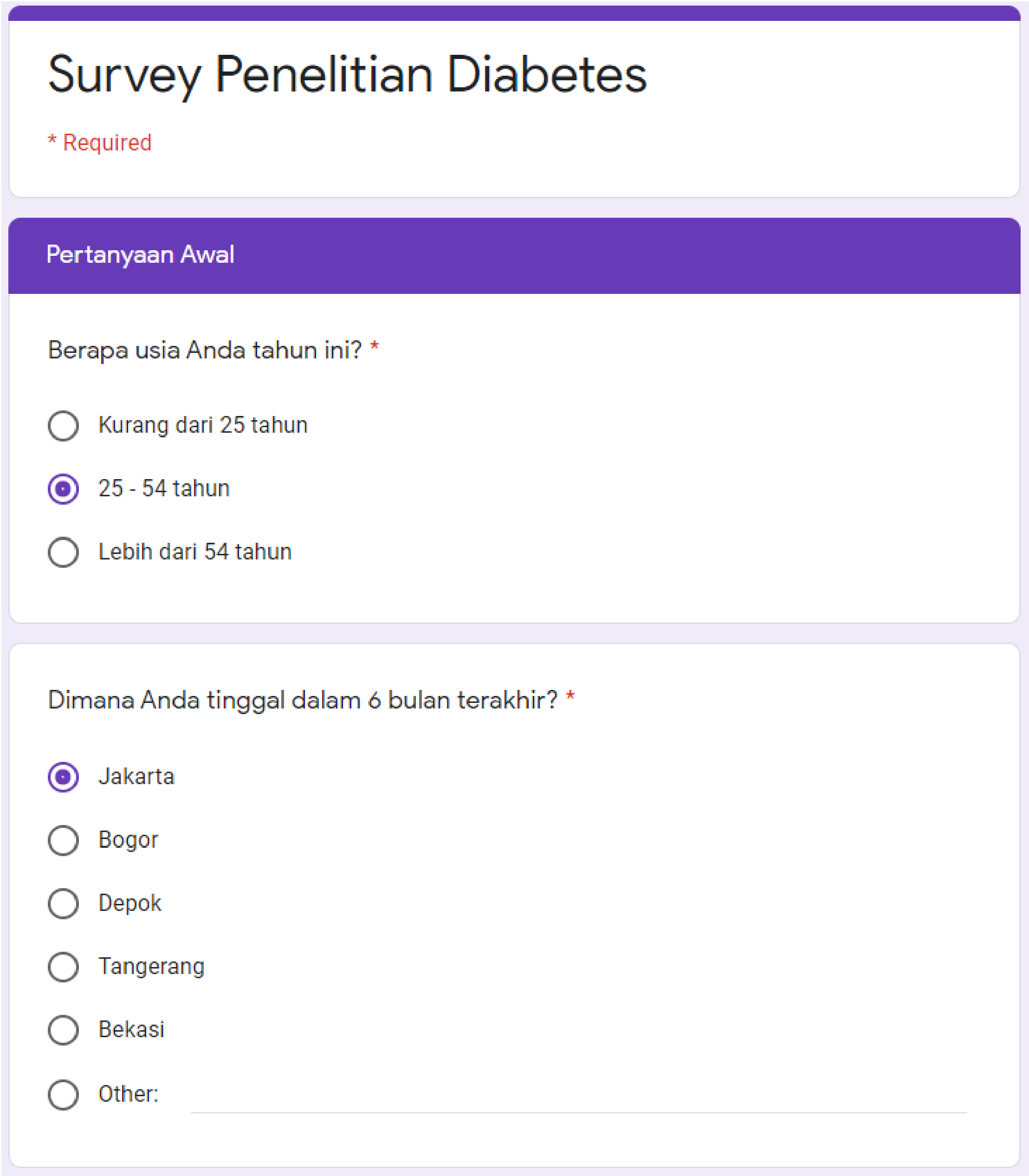
Penelitian ini diharapkan dapat menjadi landasan ilmiah untuk mengembangkan panduan manajemen gaya hidup pada pasien diabetes tipe 2 selama pandemi COVID-19 dan situasi pandemi di masa mendatang, serta pemanfaat telemedicine untuk perawatan penyakit kronis seperti diabetes. Hal ini dimaksudkan untuk mengurangi risiko penularan penyakit infeksi dan komplikasi pada pasien diabetes yang termasuk ke dalam kelompok rentan.

SUBYEK PENELITIAN

Studi ini menargetkan 291 partisipan yang berdomisili di Jakarta dengan kriteria berikut:

1. Memiliki smartphone atau akses internet.

APPENDIX 3. Screening Survey in Google Form



Survey Penelitian Diabetes

* Required

Pertanyaan Awal

Berapa usia Anda tahun ini? *

- ( ) Kurang dari 25 tahun
- (•) 25 - 54 tahun
- ( ) Lebih dari 54 tahun

Dimana Anda tinggal dalam 6 bulan terakhir? *

- (•) Jakarta
- ( ) Bogor
- ( ) Depok
- ( ) Tangerang
- ( ) Bekasi
- ( ) Other: ____

Tipe diabetes apa yang Anda miliki? *

- ( ) Diabetes tipe 1
- (•) Diabetes tipe 2
- ( ) Diabetes gestasional
- ( ) Tidak tahu

Kapan pertama kali Anda didiagnosis diabetes tipe 2? *

- (•) Sebelum tahun 2020
- ( ) Setelah tahun 2020

Apakah Anda melakukan pemeriksaan HbA1c selama COVID-19 (April 2020 - Maret 2021)? *

- ( ) Tidak
- (•) Ya

Apakah saat ini Anda didiagnosis COVID-19? *

- (•) Tidak
- ( ) Ya

Apakah saat ini Anda menjalani rawat inap di rumah sakit? *

- (•) Tidak
- ( ) Ya

Apakah Anda pernah memiliki gangguan kognitif atau kejiwaan? *

- (•) Tidak
- ( ) Ya

Back Next

APPENDIX 4. Information Sheet & Consent

Judul penelitian	:	Penggunaan Telemedicine dan Faktor yang Berhubungan dengan Kadar HbA1c pada Pasien Diabetes Tipe 2 Selama Pandemi COVID-19 di Jakarta, Indonesia: Studi Cross-Sectional
Jenis penelitian	:	Survei *cross-sectional*
Nama peneliti	:	Ms. Novi Sulistia Wati
Alamat kantor	:	College of Public Health Sciences, Chulalongkorn University, Institute building 3 (10th - 11th floor), Chulalongkorn Soi 62 Phyathai road, Bangkok 10330, Thailand.
Wilayah studi	:	Jakarta, Indonesia

Terimakasih sudah menyediakan waktu untuk membaca formulir ini. Formulir berisi informasi mengenai penelitian dan lembar persetujuan sebanyak tiga halaman. Pastikan Anda membaca seluruh halaman yang tersedia karena Anda telah diundang untuk ikut serta dalam penelitian yang penjelasannya sebagai berikut:

Penderita diabetes menjadi salah satu kelompok rentan selama pandemi COVID-19. Perawatan diabetes juga telah terganggu karena penerapan Pembatasan Sosial Skala Besar (PSBB) di Jakarta sejak 10 April 2020. Situasi yang tidak terduga ini dapat mengakibatkan perubahan rutinitas hidup sehari-hari dan dapat memengaruhi pengendalian glikemik pada pasien diabetes tipe 2. Penelitian ini bertujuan untuk menilai karakteristik umum, kondisi diabetes, tipe konsultasi, manajemen diabetes, dan dukungan keluarga terhadap kadar HbA1c selama pandemi COVID-19. Melalui penelitian ini, Anda telah berpartisipasi dalam memberikan informasi tentang dampak pandemi COVID-19 terhadap perawatan diabetes tipe 2.

Studi ini menargetkan 291 partisipan yang berdomisili di Jakarta, memiliki *smartphone* atau akses internet, didiagnosis diabetes tipe 2 oleh dokter sebelum tahun 2020, berusia 25-54 tahun, melakukan pemeriksaan HbA1c saat COVID-19, dan bukan pasien COVID-19. Peserta yang sedang hamil, memiliki riwayat masalah kognitif/kejiwaan, dan dirawat di rumah sakit karena sebab apa pun akan dikeluarkan dari penelitian. Peneliti akan menghubungi calon peserta (sekitar 20 – 30 per hari) melalui WhatsApp atau email dengan janji temu untuk memberikan *link* berisi informasi penelitian, lembar persetujuan, dan kuesioner *online* menggunakan Google Form. Pengumpulan data dilakukan oleh peneliti yang berada di Bangkok, Thailand dan satu orang asisten peneliti yang berada di Tangerang, Indonesia pada hari Senin hingga Minggu dari pukul 09.00 sampai 19.00. (GMT + 7) secara daring.

Peneliti tidak memberikan imbalan apapun kepada partisipan. Penelitian ini tidak memiliki prosedur risiko atau bahaya yang dapat menyebabkan efek buruk pada fisik, mental, sosial, ekonomi, dan keyakinan partisipan. Semua informasi yang berhubungan langsung dengan peserta akan dirahasiakan dan dihapus setelah penelitian selesai. Partisipan dalam penelitian ini bersifat sukarela dan berhak untuk menolak dan mengundurkan diri dari studi setiap saat, tidak perlu memberikan alasan apapun, dan tidak akan berdampak buruk bagi partisipan.

Penelitian dilakukan bukan untuk mengevaluasi atau mengkritik Anda, jadi mohon jangan merasa tertekan untuk memberikan tanggapan yang spesifik dan jawab semua pertanyaan dengan jujur. Jika Anda memiliki pertanyaan atau ingin mendapatkan informasi lebih lanjut tentang penelitian ini, peneliti selalu dapat dihubungi melalui WhatsApp +66840178528 atau email novisulis99@gmail.com

Setelah mendapat penjelasan mengenai maksud dan tujuan penelitian serta memahaminya secara utuh, maka saya menyatakan untuk secara sukarela berpartisipasi sebagai subjek penelitian. Demikian pernyataan ini dibuat dengan penuh perhatian tanpa adanya paksaan dari pihak manapun.

Saya telah membaca detail di lembar informasi peserta dan formulir persetujuan dan saya telah diberitahu dan dijelaskan tentang alasan/tujuan, prosedur penelitian, dan risiko serta manfaat proyek penelitian oleh peneliti. Saya memahami dengan jelas dengan kepuasan dan bersedia setuju untuk berpartisipasi dalam proyek penelitian ini dan memberikan persetujuan kepada peneliti dengan tanda tangan.

APPENDIX 5. Informed Consent

Lembar Persetujuan

Saya yang bertandatangan dibawah ini:

Nama :
Usia :
Jenis Kelamin :
Pekerjaan :
Alamat :

Dengan ini saya menyatakan bahwa saya *(SETUJU / TIDAK SETUJU) terlibat dalam penelitian yang berjudul: **Penggunaan Telemedicine dan Faktor yang Berhubungan dengan Kadar HbA1c pada Pasien Diabetes Tipe 2 Selama Pandemi COVID-19 di Jakarta, Indonesia: Studi Cross-Sectional**, dan telah mendapatkan penjelasan rinci mengenai:

1. Deskripsi penelitian
2. Perlakuan yang akan diterapkan pada subyek
3. Manfaat ikut sebagai subyek penelitian
4. Bahaya yang akan timbul
5. Prosedur Penelitian

Pernyataan ini saya buat dengan sebenar-benarnya dan tanpa ada paksaan dari pihak manapun.

Tanda Tangan Partisipan		**Tempat dan Tanggal**	

PENELITI:

<u>Saya telah menjelaskan penelitian kepada partisipan</u> yang bertandatangan di atas, dan saya yakin bahwa partisipan tersebut paham tentang tujuan, proses, dan efek yang mungkin terjadi jika dia ikut terlibat dalam penelitian ini.

Tanda Tangan Peneliti		**Tempat dan Tanggal**	

APPENDIX 6. Structured Questionnaire

Telemedicine Use and Associated Factors Related with HbA1c Level Among Type 2 Diabetes Outpatients During COVID-19 Outbreaks in Jakarta, Indonesia: A Cross-Sectional Study

These questions are asking about respondent condition in the past 12 months (April 2020–March 2021) during the implementation of Large-scale Social Restrictions (PSBB) as a response of COVID-19 outbreaks in Jakarta, Indonesia.

It consists of 6 variables with 53 items, include: general characteristics (items 1–11), diabetes condition (items 12–16), consultation factors (items 17–27), self-care during COVID-19 (items 28–42), family support during COVID-19 (items 43–50), and HbA1c level (items 51–53).

1. General Characteristics

Questions
1. How old are you in completed year? ……. years old
2. What is your gender? ☐ Female ☐ Male ☐ Prefer not to answer
3. What is your latest education level? ☐ Elementary school ☐ Junior high school ☐ Senior high school ☐ Bachelor's degree ☐ Master's degree ☐ Doctoral degree
4. What is your employment status? Before COVID-19 (March 2020): ☐ Unemployed ☐ Retired ☐ Employed, please specify your occupation:

During COVID-19 (April 2020–March 2021):

- ☐ Unemployed
- ☐ Retired
- ☐ Unpaid leave
- ☐ Paid leave
- ☐ Employed, please specify your occupation:

5. What is your average income per month?

Before COVID-19 (March 2020):

- ☐ No income
- ☐ I have income, please specify Rp ....

During COVID-19 (April 2020–March 2021):

- ☐ No income
- ☐ I have income, please specify Rp ....

6. What is your current marital status?

- ☐ Married
- ☐ Single
- ☐ Divorced
- ☐ Widowed
- ☐ Separate

7. Do you smoke?

- ☐ Never
- ☐ Ex-smoker, please specify in what year you quit smoking: ....
- ☐ Active smoker, please specify your frequency of daily smoking: .... cigarette per day

8. Do you drink alcohol?

- ☐ No
- ☐ Yes

If your answer is YES, please specify your frequency of drinking alcohol:

- ☐ Daily: .... times per day
- ☐ Weekly: .... times per week
- ☐ Monthly: .... times per month

9. What is your height? (at present) .... cm

10. What is your weight? (at present) .... kg

11. How many family members lived with you during COVID-19 outbreaks? .... people

2. Diabetes Condition

Questions
12. When is the first time you diagnosed with type 2 diabetes by doctor? Year ....
13. What medication did your doctor prescribe to manage your type 2 diabetes? ☐ Oral medication, please specify: .... ☐ Insulin therapy ☐ Combination ☐ No, I did not get any medication from doctor *(<u>skip to question no. 15</u>)*
14. When is the first-time doctor prescribed you medication for managing you type 2 diabetes? Year ....
15. Have you got any complication from your type 2 diabetes condition? ☐ No ☐ Yes *<u>If your answer is YES, please specify your type of complication (you can checklist more than one answer)</u>:* ☐ Retinopathy (eye problem) ☐ Nephropathy (kidney problem) ☐ Neuropathy (nerve problem) ☐ Foot problems ☐ Heart attack ☐ Stroke ☐ Cancer ☐ Cardiovascular disease ☐ Oral complications ☐ Others: ....
16. Did you have any other chronic diseases before the doctor diagnosed you with type 2 diabetes? ☐ No ☐ Yes *<u>If your answer is YES, please specify your type of comorbidity (you can checklist more than one answer)</u>:* ☐ Hyperlipidaemia (high cholesterol and/or high triglycerides) ☐ Hypertension ☐ Thyroid problems ☐ Chronic lung problems ☐ Chronic kidney disease ☐ Coronary artery disease ☐ Others: ....

3. Consultation Factors

Questions
17. Do you consult a doctor to manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)? ☐ No, *continue to question no. 28* ☐ Yes
18. Before COVID-19 outbreaks (March 2020), have you ever used telemedicine app to consult a doctor to manage your type 2 diabetes? ☐ No ☐ Yes
19. How do you consult a doctor to manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)? ☐ Telemedicine only, *continue to part C1, question no. 20, 21, 22, 23* ☐ In-person visit only, *continue to part C2, question no. 24, 25* ☐ Telemedicine and in-person visit, *continue to part C3, question no. 26, 27*
PART C1 ***Answer these questions if answer TELEMEDICINE ONLY in question no. 19***
20. What telemedicine platform you mostly used to consult a doctor to manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)? ☐ Sehatpedia ☐ Halodoc ☐ Alodokter ☐ KlikDokter ☐ GrabHealth ☐ SehatQ ☐ Teman Diabetes ☐ Aido Health ☐ WhatsApp ☐ Others ....
21. What communication type you mostly used to consult a doctor to manage your type 2 diabetes via telemedicine during COVID-19 outbreaks (April 2020–March 2021)? ☐ Text ☐ Phone call ☐ Video call
22. How many times **within 12 months** you consult a doctor to manage your type 2 diabetes using telemedicine?........ times
23. What is your average duration each time you consult a doctor to manage your type 2 diabetes using telemedicine during COVID-19 outbreaks (April 2020–March 2021)? ..... minutes
PART C2 ***Answer these questions if answer IN-PERSON VISIT ONLY in question no. 19***

24. How many times **within 12 months** you visit healthcare facility to consult a doctor to manage your type 2 diabetes? .... times
25. What is your average duration each time you consult a doctor to manage your type 2 diabetes in healthcare facility during COVID-19 outbreaks (April 2020–March 2021)? .... minutes
PART C3 ***Answer these questions if you answer BOTH in question no. 19***
26. What telemedicine platform you mostly used to consult a doctor to manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)? ☐ Sehatpedia ☐ Halodoc ☐ Alodokter ☐ KlikDokter ☐ GrabHealth ☐ SehatQ ☐ Teman Diabetes ☐ Aido Health ☐ WhatsApp ☐ Others ....
27. How many times **within 12 months** you consult a doctor to manage your type 2 diabetes? *Please answer point a and b* a. Telemedicine: .... times b. In-person visit: .... times
28. What is your average duration each time you consult a doctor to manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)? *Please answer point a and b* a. Telemedicine: .... minutes b. In-person visit: .... minutes

4. Self-Care During COVID-19

Questions **Diet**
29. Do you have a meal plan during COVID-19 outbreaks (April 2020–March 2021)? ☐ No ☐ Yes *If your answer is YES, do you able to follow the meal plan?* ☐ Never ☐ Sometimes ☐ Always

30. Have you been told to follow any diet restriction by doctor during COVID-19 outbreaks (April 2020–March 2021)?
   - ☐ No
   - ☐ Yes, please specify what are they: ....

   <u>If your answer is YES, do you able to follow the restrictions?</u>

   - ☐ Never
   - ☐ Sometimes
   - ☐ Always

31. Do you cook by yourself during COVID-19 outbreaks (April 2020–March 2021)?
   - ☐ Never
   - ☐ Sometimes
   - ☐ Always

32. How many times you eat per day during COVID-19 outbreaks (April 2020–March 2021)? …… times per day

33. Do you eat snack between meals during COVID-19 outbreaks (April 2020–March 2021)?
   - ☐ No
   - ☐ Yes, please specify your frequency of snacking: …… times per day

34. Do you stock up on packaged foods, sugary drinks, or soft drinks at home during COVID-19 outbreaks (April 2020–March 2021)?
   - ☐ Never
   - ☐ Sometimes
   - ☐ Always

35. How do you usually cook and/or consume your meals during COVID-19 outbreaks (April 2020–March 2021)? (you can choose more than one)
   - ☐ Grilled
   - ☐ Steamed
   - ☐ Fried
   - ☐ Baked
   - ☐ Boiled

Questions
Physical Activity

36. Do you exercise regularly (minimum 30 minutes per day) in the past 12 months?
   - ☐ Never, *continue to question no. 39*
   - ☐ Sometimes
   - ☐ Always

Skip these questions if your answer is NEVER and continue to no. 39

37. What type of exercise you mostly do during COVID-19 outbreaks (April 2020–March 2021)?
   - ☐ Cycling
   - ☐ Running
   - ☐ Yoga

☐ Pilates ☐ Dancing ☐ Walking or jogging ☐ Others: ....
38. How often do you exercise during COVID-19 outbreaks (April 2020–March 2021)? …… times/week
39. How long do you exercise in average during COVID-19 outbreaks (April 2020–March 2021)? …… minutes per exercise

Questions **Medication Compliance**
40. Do you follow diabetes medication as prescribed by doctor during COVID-19 outbreaks (April 2020–March 2021)? ☐ Never ☐ Sometimes ☐ Always
41. How many times within 12 months you forgot to take prescribed medicine? ☐ …… times per month ☐ I never forget to take my medication

Questions **Blood glucose monitoring**
42. Do you check your blood sugar level at home during COVID-19 outbreaks (April 2020–March 2021)? ☐ No ☐ Yes *<u>If your answer is YES, please specify your frequency checking blood sugar</u>*: ☐ Daily: .... times per day ☐ Weekly: .... times per week ☐ Monthly: .... times per month

5. Family Support During COVID-19

What did your family provide to help you manage your type 2 diabetes during COVID-19 outbreaks (April 2020–March 2021)?
43. Remind you to eat healthy meals ☐ Never ☐ Sometimes ☐ Always
44. Exercise with you ☐ Never

☐ Sometimes ☐ Always
45. Recommend and help you in using telemedicine to consult a doctor ☐ Never ☐ Sometimes ☐ Always
46. Remind you to take prescribed medicine on time ☐ Never ☐ Sometimes ☐ Always
47. Cook healthy meals for you ☐ Never ☐ Sometimes ☐ Always
48. Are with you when consulting a doctor in a healthcare facility ☐ Never ☐ Sometimes ☐ Always
49. Remind you to check HbA1c levels every 3 months ☐ Never ☐ Sometimes ☐ Always
50. Are available to listen your concerns or worries about your diabetes without blaming ☐ Never ☐ Sometimes ☐ Always

6. HbA1c Level

Questions
51. In the next 3 months, what is your target HbA1c levels? …… %
52. In what month is the latest time you check your HbA1c level during COVID-19 outbreaks (April 2020–March 2021)? ……
53. What is your latest HbA1c levels during COVID-19 outbreaks (April 2020–March 2021)? …… %

APPENDIX 7. IOC Result

Phase 1

Variables	IOC score	Expert 1	Expert 2	Expert 3	Expert 4	Average Score
General characteristics	0.8	1	0.8	1	1	0.9
Diabetes conditions	0.8	1	1	0.8	1	0.9
Consultation factors	0.8	1	1	1	1	1
Self-care						
Diet	0.8	1	0.8	1	1	0.9
Physical activity	0.8	1	1	0.8	1	0.9
Medication compliance	0.8	1	1	1	1	1
Blood glucose	0.8	0.5	1	-0.5	1	**0.5***
Family support	0.8	0.8	0.8	0.9	1	0.8
HbA1c	0.8	1	1	0.7	1	0.9

**Revised/Deleted*

Phase 2

Variables	IOC score	Expert 1	Expert 2	Expert 3	Expert 4	Average Score
General characteristics	0.8	1	0.8	1	1	0.9
Diabetes conditions	0.8	1	1	0.8	1	0.9
Consultation factors	0.8	1	1	1	1	1
Self-care						
Diet	0.8	1	0.8	1	1	0.9
Physical activity	0.8	1	1	0.8	1	0.9
Medication compliance	0.8	1	1	1	1	1
Blood glucose	0.8	1	1	0.5	1	0.8
Family support	0.8	0.8	0.8	0.9	1	0.8
HbA1c	0.8	1	1	0.7	1	0.9

APPENDIX 8. Reliability

1. Diabetes Condition

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.690	.718	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
years of diagnosed	3.63	3.551	.500	.	.629
type of medication	2.70	1.941	.701	.	.510
years of prescribed medicine	2.53	3.706	.223	.	.734
complication	3.70	3.597	.493	.	.633
comorbidity	3.70	3.597	.493	.	.633

Notes: There were no deleted/revised questions in this variable because the reliability score 0.700 (if rounded).

2. Consultation Factors

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.714	.767	13

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
consultation with doctor	5.07	11.513	.994	.	.631
tele before covid	5.13	11.913	.804	.	.648
how to consult	4.43	9.082	.802	.	.600
mHealth name	5.57	13.978	.144	.	.719
comunication type	5.60	14.041	.180	.	.713
freq tele	5.53	13.775	.152	.	.720
dur tele	5.53	13.844	.137	.	.722
freq inper	4.77	11.289	.373	.	.701
dur inper	4.77	11.289	.373	.	.701
freq tele	5.70	14.493	.164	.	.714
dur tele	5.70	14.493	.164	.	.714
freq inper	5.70	14.493	.164	.	.714
dur inper	5.70	14.493	.164	.	.714

3. Self-Care During COVID-19

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.653	.629	17

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
meal plan	14.53	16.671	.671	.	.597
follow meal plan	14.27	14.616	.642	.	.569
diet restriction	14.60	17.352	.513	.	.615
follow restriction	14.23	15.495	.419	.	.610
cook	13.73	17.789	.251	.	.639
freq of eating	14.17	20.833	-.353	.	.687
freq of snacking	13.20	18.648	.230	.	.643
stock up food	14.43	21.702	-.411	.	.713
consume	14.13	14.740	.623	.	.573
exercise	13.97	17.413	.347	.	.627
type of exercise	14.17	18.351	.336	.	.635
freq of exercise	13.73	17.720	.210	.	.646
duration of exercise	13.57	15.633	.527	.	.594
medication adherence	13.37	18.723	.056	.	.668
forget medication	14.77	18.875	.183	.	.647
target blood sugar level	14.23	20.461	-.197	.	.700
check blood sugar	14.37	17.895	.366	.	.629

Notes: Question about target blood sugar level was deleted to get reliability score 0.700. This was also based on recommendation of expert in IOC score.

4. Family Support During COVID-19

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.901	.905	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
remind healthy meals	9.20	18.855	.675	.636	.891
exercise together	9.87	17.499	.640	.831	.893
recommend telemedicine	9.97	16.447	.841	.910	.873
reminde medication	9.53	16.533	.688	.839	.890
cook healthy meals	9.47	18.947	.598	.568	.896
accompany consult in-person	9.50	16.810	.884	.883	.871
remind to hba1c check	9.60	16.869	.684	.670	.890
listen well	9.40	18.524	.566	.771	.899

APPENDIX 9. Chi-Square Analysis

1. Age and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.459[a]	1	.498	.531	.291	
Continuity Correction[b]	.304	1	.581			
Likelihood Ratio	.459	1	.498	.531	.291	
Fisher's Exact Test				.531	.291	
Linear-by-Linear Association	.457[c]	1	.499	.531	.291	.080
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 51.31.

b. Computed only for a 2x2 table

c. The standardized statistic is .676.

2. Gender and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.597[a]	1	.000	.000	.000
Continuity Correction[b]	11.718	1	.001		
Likelihood Ratio	12.665	1	.000	.000	.000
Fisher's Exact Test				.000	.000
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 48.92.

b. Computed only for a 2x2 table

3. Education and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.006[a]	1	.083	.102	.054
Continuity Correction[b]	2.585	1	.108		
Likelihood Ratio	3.008	1	.083	.102	.054
Fisher's Exact Test				.102	.054
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 50.11.

b. Computed only for a 2x2 table

3. Employment change and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	2.009[a]	1	.156	.212	.122	
Continuity Correction[b]	1.364	1	.243			
Likelihood Ratio	1.959	1	.162	.212	.122	
Fisher's Exact Test				.212	.122	
Linear-by-Linear Association	2.001[c]	1	.157	.212	.122	.073
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.16.

b. Computed only for a 2x2 table

c. The standardized statistic is -1.415.

4. Income changes and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.078[a]	1	.043	.061	.030
Continuity Correction[b]	3.472	1	.062		
Likelihood Ratio	4.226	1	.040	.045	.030
Fisher's Exact Test				.061	.030
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 21.48.

b. Computed only for a 2x2 table

5. Marital status and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.586[a]	1	.444	.553	.288
Continuity Correction[b]	.322	1	.570		
Likelihood Ratio	.597	1	.440	.553	.288
Fisher's Exact Test				.553	.288
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.93.

b. Computed only for a 2x2 table

6. Smoking status and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	4.287[a]	1	.038	.046	.027	
Continuity Correction[b]	3.570	1	.059			
Likelihood Ratio	4.533	1	.033	.046	.027	
Fisher's Exact Test				.046	.027	
Linear-by-Linear Association	4.271[c]	1	.039	.046	.027	.017
N of Valid Cases	264					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.72.

b. Computed only for a 2x2 table

c. The standardized statistic is 2.067.

7. Body mass index (BMI) and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	23.085[a]	1	.000	.000	.000	
Continuity Correction[b]	21.849	1	.000			
Likelihood Ratio	23.039	1	.000	.000	.000	
Fisher's Exact Test				.000	.000	
Linear-by-Linear Association	22.998[c]	1	.000	.000	.000	.000
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 38.58.

b. Computed only for a 2x2 table

c. The standardized statistic is 4.796.

8. Living arrangement and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.609[a]	1	.435	.453	.256	
Continuity Correction[b]	.428	1	.513			
Likelihood Ratio	.609	1	.435	.453	.256	
Fisher's Exact Test				.453	.256	
Linear-by-Linear Association	.606[c]	1	.436	.453	.256	.074
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 52.10.

b. Computed only for a 2x2 table

c. The standardized statistic is -.779.

9. Diabetes duration and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.101[a]	1	.750	.798	.424	
Continuity Correction[b]	.036	1	.849			
Likelihood Ratio	.101	1	.750	.798	.424	
Fisher's Exact Test				.798	.424	
Linear-by-Linear Association	.101[c]	1	.751	.798	.424	.097
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 41.76.

b. Computed only for a 2x2 table

c. The standardized statistic is .318.

10. Medication type and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.095[a]	1	.001	.001	.001
Continuity Correction[b]	10.206	1	.001		
Likelihood Ratio	11.545	1	.001	.001	.001
Fisher's Exact Test				.001	.001
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.22.

b. Computed only for a 2x2 table

11. Length of medication type and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.275[a]	1	.600	.609	.346
Continuity Correction[b]	.156	1	.692		
Likelihood Ratio	.274	1	.600	.609	.346
Fisher's Exact Test				.609	.346
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 40.97.

b. Computed only for a 2x2 table

12. Complication and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.637[a]	1	.201	.216	.127
Continuity Correction[b]	1.302	1	.254		
Likelihood Ratio	1.658	1	.198	.216	.127
Fisher's Exact Test				.216	.127
N of Valid Cases	264				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.63.

b. Computed only for a 2x2 table

13. Comorbidity and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.032[a]	1	.858	1.000	.500
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.032	1	.858	1.000	.500
Fisher's Exact Test				.853	.500
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.52.

b. Computed only for a 2x2 table

14. Telemedicine experience before COVID-19 and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.781[a]	1	.009	.011	.008
Continuity Correction[b]	5.971	1	.015		
Likelihood Ratio	6.648	1	.010	.015	.008
Fisher's Exact Test				.011	.008
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 19.89.

b. Computed only for a 2x2 table

15. Consultation during COVID-19 and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	39.633[a]	1	.000	.000	.000
Continuity Correction[b]	37.807	1	.000		
Likelihood Ratio	47.694	1	.000	.000	.000
Fisher's Exact Test				.000	.000
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 25.45.

b. Computed only for a 2x2 table

16. Consultation type and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	39.961[a]	2	.000	.000
Likelihood Ratio	48.009	2	.000	.000
Fisher's Exact Test	46.733			.000
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.68.

17. Following a meal plan and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.480[a]	2	.001	.001		
Likelihood Ratio	14.740	2	.001	.001		
Fisher's Exact Test	12.835			.001		
Linear-by-Linear Association	13.378[b]	1	.000	.000	.000	.000
N of Valid Cases	135					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.60.

b. The standardized statistic is -3.658.

18. Following a diet restriction and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.602[a]	1	.438	.451	.258
Continuity Correction[b]	.422	1	.516		
Likelihood Ratio	.602	1	.438	.451	.258
Fisher's Exact Test				.451	.258
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 46.93.

b. Computed only for a 2x2 table

19. Diet restriction compliance and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	4.064[a]	2	.131	.128		
Likelihood Ratio	4.784	2	.091	.112		
Fisher's Exact Test	3.654			.128		
Linear-by-Linear Association	3.687[b]	1	.055	.072	.040	.023
N of Valid Cases	118					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .85.

b. The standardized statistic is -1.920.

20. Cooking at home and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.945[a]	1	.331	.350	.230
Continuity Correction[b]	.539	1	.463		
Likelihood Ratio	.927	1	.336	.350	.230
Fisher's Exact Test				.350	.230
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.95.

b. Computed only for a 2x2 table

21. Frequent consumed foods and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	6.404[a]	1	.011	.017	.010	
Continuity Correction[b]	5.579	1	.018			
Likelihood Ratio	6.270	1	.012	.017	.010	
Fisher's Exact Test				.017	.010	
Linear-by-Linear Association	6.380[c]	1	.012	.017	.010	.006
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 17.50.

b. Computed only for a 2x2 table

c. The standardized statistic is 2.526.

22. Frequency of eating and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.769[a]	1	.381	.415	.230	
Continuity Correction[b]	.548	1	.459			
Likelihood Ratio	.775	1	.379	.415	.230	
Fisher's Exact Test				.415	.230	
Linear-by-Linear Association	.766[c]	1	.381	.415	.230	.075
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.22.

b. Computed only for a 2x2 table

c. The standardized statistic is -.875.

23. Snacking habit and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.088[a]	1	.767	.871	.444
Continuity Correction[b]	.018	1	.894		
Likelihood Ratio	.088	1	.767	.871	.444
Fisher's Exact Test				.871	.444
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 19.09.

b. Computed only for a 2x2 table

24. Stored package food and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.108[a]	1	.742	.802	.420
Continuity Correction[b]	.041	1	.839		
Likelihood Ratio	.108	1	.742	.802	.420
Fisher's Exact Test				.802	.420
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 51.31.

b. Computed only for a 2x2 table

25. Reguler exercise during COVID-19 and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	42.411[a]	2	.000	.000		
Likelihood Ratio	45.783	2	.000	.000		
Fisher's Exact Test	44.345			.000		
Linear-by-Linear Association	23.594[b]	1	.000	.000	.000	.000
N of Valid Cases	264					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.93.

b. The standardized statistic is -4.857.

26. Frequency of exercise and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10.244[a]	1	.001	.002	.001	
Continuity Correction[b]	9.368	1	.002			
Likelihood Ratio	10.702	1	.001	.001	.001	
Fisher's Exact Test				.001	.001	
Linear-by-Linear Association	10.205[c]	1	.001	.002	.001	.001
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 29.43.

b. Computed only for a 2x2 table

c. The standardized statistic is -3.195.

27. Duration of exercise and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.002[a]	1	.960	1.000	.533	
Continuity Correction[b]	.000	1	1.000			
Likelihood Ratio	.002	1	.960	1.000	.533	
Fisher's Exact Test				1.000	.533	
Linear-by-Linear Association	.002[c]	1	.960	1.000	.533	.109
N of Valid Cases	264					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 31.82.

b. Computed only for a 2x2 table

c. The standardized statistic is .050.

28. Medication compliance and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.724[a]	1	.189	.203	.136
Continuity Correction[b]	1.206	1	.272		
Likelihood Ratio	1.687	1	.194	.203	.136
Fisher's Exact Test				.203	.136
N of Valid Cases	264				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.94.

b. Computed only for a 2x2 table

29. Blood glucose check and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.155[a]	1	.694	.705	.396
Continuity Correction[b]	.071	1	.790		
Likelihood Ratio	.155	1	.694	.705	.396
Fisher's Exact Test				.705	.396
N of Valid Cases	264				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 44.55.

b. Computed only for a 2x2 table

30. FS meal plan check and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.568[a]	2	.753	.755
Likelihood Ratio	.566	2	.754	.755
Fisher's Exact Test	.634			.755
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.16.

31. FS exercise check and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.163[a]	2	.922	.936
Likelihood Ratio	.163	2	.922	.936
Fisher's Exact Test	.178			.936
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 30.63.

32. FS telemedicine check and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	8.136[a]	2	.017	.017		
Likelihood Ratio	8.110	2	.017	.018		
Fisher's Exact Test	8.128			.017		
Linear-by-Linear Association	7.492[b]	1	.006	.007	.004	.002
N of Valid Cases	264					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 19.89.

b. The standardized statistic is -2.737.

33. FS medication compliance and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.389[a]	2	.823	.816
Likelihood Ratio	.385	2	.825	.816
Fisher's Exact Test	.423			.816
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.32.

34. FS cooking and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	1.289[a]	2	.525	.534
Likelihood Ratio	1.300	2	.522	.534
Fisher's Exact Test	1.264			.550
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.70.

35. FS in-person visit and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.057[a]	2	.972	.974
Likelihood Ratio	.057	2	.972	.974
Fisher's Exact Test	.070			.974
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 29.83.

36. FS remind to check HbA1c and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	7.195[a]	2	.027	.026
Likelihood Ratio	7.287	2	.026	.026
Fisher's Exact Test	7.176			.027
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.84.

37. FS listening to diabetes concern and HbA1c level

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	1.578[a]	2	.454	.451
Likelihood Ratio	1.572	2	.456	.459
Fisher's Exact Test	1.630			.435
N of Valid Cases	264			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.13.

APPENDIX 10. Binary Logistic Regression

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Gender(1)	.440	.408	1.162	1	.281	1.553	.698	3.457
	Edu_level(1)	-1.620	.476	11.577	1	.001	.198	.078	.503
	Income_changed(1)	.949	.491	3.735	1	.053	2.583	.987	6.762
	Smoking(1)	.922	.636	2.101	1	.147	2.513	.723	8.740
	BMI(1)	1.747	.413	17.893	1	.000	5.740	2.554	12.899
	Complication(1)	-1.000	.481	4.321	1	.038	.368	.143	.944
	Tele_exp(1)	-.989	.502	3.878	1	.049	.372	.139	.995
	Consult_duringCOV			15.642	2	.000			
	Consult_duringCOV(1)	-1.644	.753	4.760	1	.029	.193	.044	.846
	Consult_duringCOV(2)	-2.736	.709	14.873	1	.000	.065	.016	.260
	Meal_compliance			2.712	2	.258			
	Meal_compliance(1)	.507	.464	1.193	1	.275	1.660	.669	4.118
	Meal_compliance(2)	-.566	.562	1.013	1	.314	.568	.189	1.710
	Rest_compliance			5.525	2	.063			
	Rest_compliance(1)	-1.099	.468	5.522	1	.019	.333	.133	.833
	Rest_compliance(2)	-.292	.537	.295	1	.587	.747	.261	2.141
	Type_cooking(1)	1.649	.592	7.762	1	.005	5.204	1.631	16.606
	Exercise(1)	-3.330	.864	14.849	1	.000	.036	.007	.195
	Freq_exercise(1)	-.565	.439	1.657	1	.198	.568	.240	1.344
	Medication_ad(1)	.992	.718	1.909	1	.167	2.696	.660	11.008
	FS_tele			2.201	2	.333			
	FS_tele(1)	-.715	.485	2.167	1	.141	.489	.189	1.267
	FS_tele(2)	-.423	.573	.543	1	.461	.655	.213	2.016
	FS_HbA1c			.533	2	.766			
	FS_HbA1c(1)	.365	.517	.498	1	.480	1.440	.523	3.967
	FS_HbA1c(2)	.237	.463	.262	1	.609	1.267	.512	3.137
	Medication(1)	1.126	.466	5.850	1	.016	3.083	1.238	7.677
	Constant	.691	.997	.481	1	.488	1.996		

a. Variable(s) entered on step 1: Gender, Edu_level, Income_changed, Smoking, BMI, Complication, Tele_exp, Consult_duringCOV, Meal_compliance, Rest_compliance, Type_cooking, Exercise, Freq_exercise, Medication_ad, FS_tele, FS_HbA1c, Medication.

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VITA

NAME	Novi Sulistia Wati
DATE OF BIRTH	30 November 1995
PLACE OF BIRTH	Tangerang, Indonesia
INSTITUTIONS ATTENDED	1. College of Public Health Science, Chulalongkorn University, Thailand 2. Faculty of Public Health, Diponegoro University, Indonesia
HOME ADDRESS	Perum Bumi Asri Blok E 12 No.11 RT 009 RW 017, Kelurahan Kutabumi, Kecamatan Pasar Kemis, Kabupaten Tangerang, Banten 15560
PUBLICATION	The Role of Warga Peduli AIDS (WPA) on Discriminative Behavior among People Living with HIV/AIDS (Study at WPA Peterongan, South Semarang District, Semarang City)
AWARD RECEIVED	Degree with Honour and Best Graduate Student