


The Impact of COVID-19 Lockdown on Diabetes Complication and Diabetes Management in People With Diabetes in Indonesia

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Abstract

Aims: As the country with the seventh largest number of People with Diabetes (PWD) in the world, the Coronavirus disease 2019 (COVID-19) pandemic, and the Large Social Scale Restriction (LSSR) policy taken by the Indonesian government to reduce the number of COVID-19 transmissions is estimated to interfere diabetes management and will increase the incidence of diabetes complications. This study aims to determine the difficulties of diabetes management and its impact on diabetes morbidity during the COVID-19 pandemic in Indonesia. **Methods:** This study is a cross-sectional study using a national scale web survey. This research was conducted in Indonesia enrolling 1124 PWD aged 18 years or older. Diabetes complications are defined as self-assessed incidence of hypoglycemia, or Diabetic Foot Ulcer (DFU), or hospital admission experienced by PWD in Indonesia during the COVID-19 pandemic. The correlation between diabetes management difficulties and diabetes-related complications was measured using a modified cox regression test. **Results:** Diabetes management difficulties were experienced by 69.8% of PWD in Indonesia. The difficulties include attending diabetes consultation 30.1%, access to diabetes medication 12.4%, checking blood glucose levels 9.5%, controlling diet 23.8%, and performing regular exercise 36.5%. Diabetes-related complications occurred in 24.6% of subjects. Those who had diabetes management difficulties during the COVID-19 pandemic are prone to have diabetes complications by 1.4 times greater (PR: 1.41, 95% CI: 1.09-1.83) than those who did not. **Conclusion:** The COVID-19 pandemic and LSSR have impact on diabetes management and diabetes-related complications as assessed by PWD in Indonesia.

Keywords

diabetes, COVID-19, Indonesia, impact evaluation, health outcomes

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Introduction

Indonesia has the seventh-largest number of people living with diabetes (PWD) worldwide.¹ It is estimated that 10.7 million people in Indonesia had diabetes.¹ Before the COVID-19 pandemic, diabetes management in Indonesia has already posed a big challenge. Diabetes care is still focused on secondary and tertiary levels, while primary care services are still sub-optimal with a lack of expertise, diagnostic equipment, and drug availability.²

This condition is exacerbated by inequality in the management of diabetes with people in remote areas having impoverished access.² In 2010, the Indonesia Ministry of health made a program, namely PROLANIS (*Program Layanan Penyakit Kronis* or chronic disease care program),

which focused on the diabetes self-management in primary care.² It was provided for all patients under the national health insurance scheme as an effort to improve the devastating condition. However, the utilization was sub-optimal.

With the continuation of the struggle to develop a responsive healthcare system in diabetes care, in 2020 the COVID-19 pandemic occurs. A total of 1736670 people were infected with SARS CoV-2 (May 18, 2021), and

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2.76% of the cases died (47976 people).³ Those made Indonesia the worst-hit country by COVID-19 in Southeast Asia.⁴ This conditions also affected PWD terribly. Those living with diabetes are at increased risk of becoming severely ill after contracting the virus. A study by deputy of health in Jakarta found about 11.1% of COVID-19 patients hospitalized had diabetes, and 26.9% of the cases were dead.⁵ The risk of mortality of PWD was increased by 1.26 times compared to general populations.⁵

To deal with this pandemic, the Indonesian government has imposed a lockdown (the Large Social Scale Restriction (LSSR) policy) on affected cities and provinces. Along with that, the Indonesian Society of Endocrinology (ISE/PERKENI) has issued recommendations for PWD to stay at home.⁶ They recommend maintaining physical distancing and optimize remote communication, including telehealth.⁶

However, this policy is estimated to interfere diabetes management and will increase the incidence of diabetes complications.⁷ While attention was more focused on COVID-19 infection, the attention needed by PWD was overlooked.⁷ The LSSR might have rendered patients physically less active or unable to exercise, health status monitoring is disrupted, diabetes club activity and education sessions become challenging, and maintaining the recommended dietary becomes more difficult. Also, the fear of contagion decreases the likelihood of PWD seeking medical care and in other setting, oral anti-diabetic drugs and insulin were more ardors to obtain during pandemics.^{7,8} While many countries anticipate the challenges through telehealth consultation, not all parts of Indonesia is ready to remote consultation⁹ The impact of this policy may bring about a more severe impact than the COVID 19 disease per se.

No publication is currently available regarding the effect of lockdown in PWD in Indonesia. This study assesses the broader impact of the COVID-19 pandemic beyond the effects of the disease itself. This research may provide a basis for decision-making by the government to optimize diabetes management, especially during the COVID-19 pandemic in Indonesia. This study aimed to determine diabetes management difficulties faced by PWD during the COVID-19 pandemic in Indonesia and its impacts on diabetes morbidity. Also, this study aimed to assesses the solutions taken by PWD in response to diabetes management difficulties during the COVID-19 pandemic.

Methods

This study is a cross-sectional study based on an open online survey. The survey was conducted for 2 weeks during the period of 21 July 2020 to 4 August 2020. Flyers containing invitations to become research respondent were given to the professional organization (ISE, Indonesian Medical Association, Indonesia Society of Internal Medicine, Indonesia Diabetes Association, and Indonesia

Diabetes Educators Association) simultaneously during the period of 21 July 2020 to 4 August 2020, which can be disseminated to PWD as an invitation to access the web-survey. Initial contact with potential subjects was made entirely from the internet. PWD was also directly invited to the study through social media platforms, including WhatsApp, Instagram, Facebook, and diabetes social media group. We included all adults age more than 18 years, who are diagnosed with diabetes and lived in Indonesia during period of March to July 2020 and were not being hospitalized when filling out the questionnaire.

The survey was developed by a team of researchers in Fatmawati General Hospital at the Diabetes Integrated Services Center, including 2 endocrinologists, 2 internists, and an epidemiologist. This survey includes 4 parts (26 multiple choice questions in Bahasa Indonesia); section (1): demographic data consists of 13 questions, section (2): clinical data/history of diabetes mellitus, consisting of 4 questions, section (3): diabetes management before the COVID-19 pandemic, consists of 2 questions, section (4): diabetes complications during the pandemic, consists of 2 questions, section (5): diabetes management difficulties during a pandemic consists of 8 questions.

The questionnaire has been tested to determine its validity and reliability by using an electronic questionnaire (KR20 coefficient 0.70 (test-retest reliability: $r=0.87$, $P=.003$). The survey was conducted via Google form—no randomization of questions for each subject in the questionnaire applied. Pretesting and technical functionality of the web survey were performed before the questionnaire was distributed to respondents. The survey initiation clearly stated the right of the individuals to participate or not to participate in the survey. All the subjects enrolling must have to fill the informed consent form.

Data including sex, age, occupation, income, health insurance, transportation, residence, and distance to the health facility were obtained. Working condition were classified into work from home and work from the office. The distance to the health facility is a subjective measure of distance from home to the control place according to the subject. This study also measured diabetes profile which included duration of diagnosis, diabetes treatment, diabetes control facility, and numbers of medical consultation during the pandemic.

Difficulties during the pandemic period were defined as any kind of difficulties that were subjectively endured/experienced by the PWD (difficulties in attending health consultation, or checking blood glucose levels, or obtaining diabetes drugs, or maintaining diet control, or performing exercise). It was asked through yes or no questions covering the 4 questions; “during COVID-19 pandemic in Indonesia (March 2020 to present), did you have any difficulties regarding in-persons appointment with your doctor/checking blood glucose levels/regulating your diet/exercising?” Complications were defined as any experiences of hypoglycemia or Diabetes

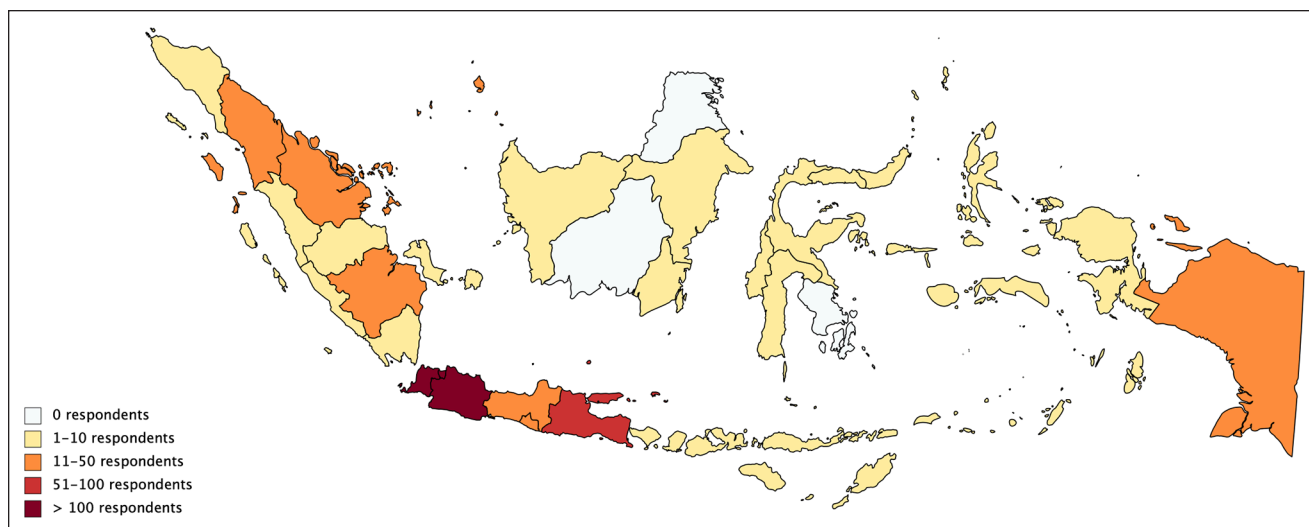


Figure 1. Respondent distribution map.

Foot Ulcers (DFU) or hospitalization during the COVID-19 pandemic in Indonesia. It was asked through questions “During the COVID-19 pandemic in Indonesia (March 2020 to present), have you ever experienced the following conditions? 0. did not experience these conditions, 1. Low blood glucose level, 2. Wounds on the feet, and 3. Hospitalized” Subjects were allowed to answer these questions subjectively. Subjects were allowed to answer more than one of these statements and we did not quantify nor follow up subject’s answer.

Descriptive analysis was performed in terms of frequency and percentage for categorical variable. The relationship between difficulties and the incidence of complications during the COVID-19 pandemic was measured by assessing the prevalence ratio (PR) and 95% confidence interval (CI) using a modified cox-regression test. A P -value of $<.05$ was considered statistically significant. Statistical analysis was performed using the STATA 15 Mac version program. This research has been approved by the research ethics committee of the Fatmawati Center General Hospital with an ethical clearance number: 11/KPP/VII/2020.

Results

Characteristics of Respondents

This study included 1124 PWD from 34 provinces in Indonesia (Figure 1). The characteristics of the subjects in this study can be seen in Table 1. The proportion of male includes 54.89% of the total respondents, almost 60% of the respondents are in productive age, less than a quarter of the respondents have an income below the National Minimum Wage (NMW), and almost 80% of the total respondents

receive treatment using National Health Insurance (NHI)/*Badan Penyelenggara Jaminan Sosial* (BPJS). In this study, the majority of patients were married and lived with their families. As many as 35% of patients felt that they live far away from the health facility where they regularly attended for diabetes treatment. Also, the majority of patients went to the facility using private vehicles.

The diabetes profile of the subjects can be seen in Table 2. The majority of respondents had been diagnosed with diabetes for more than 3 years and visited a hospital for diabetes treatment. As many as 74.02% of respondents received oral anti-diabetic drug therapy and as many as 40.3% of patients received insulin therapy. In this study, 77.85% of the total number of respondents usually had, at least, 1 consultation in 3 months before the COVID-19 pandemic.

Impact of COVID-19 Lockdown on Diabetes Complication and Diabetes Management

In this study, 24.56% of the total respondents admitted that they had diabetes complications during pandemic (hypoglycemia 12.90%, DFU 7.38%, and hospital admission 6.76%) (Table 2). About 70% of PWD experienced difficulties during the COVID-19 pandemic, which include attending diabetes consultation (30.07%), access to diabetes medication (12.37%), checking blood glucose levels (9.52%), controlling diet (23.75%) and performing regular exercise (36.48%; Table 2). Multivariate analysis results show an increased incidence of diabetes complications by 1.41 times during the COVID 19 pandemic (95% CI: 1.09-1.83; Table 3). Other factors that play a role on increasing number of incidences were found in PWD under 60 years of age (PR: 1.44, 95% CI: 1.12-1.85) and those receiving insulin therapy (PR: 2.23, 95% CI: 1.75-2.85).

Table 1. Demographic Characteristics of the Subject.

Variable	Frequency (n)	Presentation (%)
Sex		
Male	507	54.89
Female	617	45.11
Age		
18-40 years	144	12.81
>40-60 years	514	45.73
>60 years	466	41.46
Occupation		
Does not work	604	53.74
Work from home	259	49.81
Work from office	261	50.19
Income		
<Rp. 2,000,000 ^a	238	21.17
Rp. 2,000,000-Rp. 5,000,000 ^a	464	41.28
Rp. 5,000,000-Rp. 10,000,000 ^a	208	18.51
>Rp. 10,000,000 ^a	214	19.04
Health insurance		
National Health Insurance	880	78.30
Other Insurance	78	6.94
Pay with own money	64	5.69
Marriage		
Married	978	87.01
Single	43	3.83
Ever been married	103	9.16
Transportation to health facility		
Private vehicle	861	76.60
By foot	16	1.42
Online transportation	106	9.43
Public transportation	141	12.54
Residence		
Live with family	936	83.27
Live alone	183	16.28
Live in a boarding house/institution	5	0.44
Distance to health facility		
Close	731	65.04
Far	393	34.96

^aRp. Rupiah (IDR).

Action Taken by People With Diabetes

The study shows that, the majority of PWD did not take any action in maintaining/resolving their diabetes health-related problems during the COVID pandemic in Indonesia. These include as many as 50.59% of respondents who had difficulty in attending diabetes consultation, 60.75% who had difficulty in checking blood glucose levels, and 30.94% who had difficulty in obtaining anti-diabetes drugs or insulin. (Table 4).

Discussion

From PWD's point of view in Indonesia, the COVID-19 pandemic and LSSR have impact on diabetes management and

diabetes self-assessed related complications. Nearly 70% of PWD in Indonesia experienced difficulties in managing diabetes during the COVID-19 pandemic, which include performing regular exercise (36.48%), attending diabetes consultation (30.07%), controlling diet (23.75%), access to diabetes medication (12.37%), and checking blood glucose levels (9.52%). At least 1 in 4 PWD experienced diabetes self-assessed related complications, including DFU (7.4%), hypoglycemia (12.9%), and hospitalization (6.8%). Moreover, subjects who experienced difficulties during the COVID-19 pandemic had an increased risk of developing diabetes complications by 1.4 times more often than those who did not.

Several studies assess the impact of lockdown on metabolic control in patients with diabetes. A study involving 85

Table 2. Diabetes Profile, Self-Assessed Diabetes Management Difficulties, and Self-Assessed Diabetes Complication Experienced by PWD.

Variable	Frequency (n)	Presentation (%)
Diabetes duration		
<3 years	253	22.51
≥3-5 years	257	22.86
≥5-10 years	233	20.73
≥10 years	381	33.90
Diabetes medication		
Do not know	21	1.87
No pharmacological treatment	56	4.98
OAD ^a	594	52.85
Insulin	215	19.13
OAD and insulin ^a	238	21.17
Health facility for diabetes treatment		
None	87	7.74
Hospital	763	67.88
Public health center	64	5.69
Private clinic	122	10.85
Private practice	86	7.65
Midwife/nurse	2	0.18
Number of regular consultations before the pandemic		
More than once in a month	30	2.67
Once in a month	657	58.45
Once in 2 months	69	6.14
Once in 3 months	119	10.59
Once in 6 months	93	8.27
Once in a year	71	6.32
Never	85	7.56
Diabetes management difficulties		
Attending diabetes consultation	338	30.07
Access to diabetes medication	139	12.37
Checking blood glucose levels	107	9.52
Controlling diet	267	23.75
Performing regular exercise	410	36.48
Diabetes complication		
Hypoglycemia	145	12.90
DFU	83	7.38
Hospital admission	76	6.76

^aOAD, oral anti diabetics.

patients with diabetes shows prolonged lockdown resulted in increased body weight and triglyceride levels in subjects with diabetes in Turkey.¹⁰ The lockdown also resulted in a significant increase of HbA1c by 0.51% from the baseline.¹⁰ Another study enrolling 114 subjects with controlled diabetes shows short-term metabolic worsening in approximately one-fourth of the subjects after 3 months of lockdown.¹¹ Another study conducted in Saudi Arabia in 2020, comparing diabetes ketoacidosis (DKA) incidence on 106 children with type 1 diabetes mellitus, found significantly increased DKA incidence compared to the previous year.¹²

However, the study by Falchetta et al¹³ in Italy found conflicting data. The lockdown did not exert a negative

effect on glycemic control in patients with T2DM. D'onofrio et al¹⁴ showed similar results. The COVID-19 lockdown in Rome did not significantly impact glycemic control in PWD. Most of the currently available studies evaluated the impact of COVID-19 lockdown on metabolic control, and only a few assessed the impact on diabetes complications. The majority of available studies were conducted in high-income and non-archipelago countries, which is geographic and economically dissimilar from Indonesia. Further research on the impact of the COVID-19 pandemic on metabolic control, quality of life, even more, direct and indirect cost of management of diabetes in PWD is still needed.

Table 3. Relationship Between Self-Assessed Difficulties During the COVID-19 Pandemic and Diabetes Complications in People With Diabetes in Indonesia.

Variable	Complications, n (%)		PR crude (95% CI)	PR adjusted (95% CI)
	Present, 276 (24.56)	Not present, 848 (75.44)		
Difficulties in diabetes management				
Present	194 (70.29)	485 (57.19)	1.55 (1.23-1.95) ^a	1.41 (1.09-1.83) ^a
Not present	82 (29.71)	363 (42.81)	1.00	1.00
Sex				
Male	124 (44.93)	383 (45.17)	0.99 (0.81-1.22)	
Female	152 (55.07)	465 (54.83)	1.00	
Age				
<60 years	186 (67.39)	472 (55.66)	1.46 (1.17-1.83) ^a	1.44 (1.12-1.85) ^a
≥60 years	90 (32.61)	376 (44.34)	1.00	1.00
Residence				
Outside Java Island	51 (18.48)	149 (17.57)	1.05 (0.79-1.40)	
Java Island	225 (81.52)	699 (82.43)	1.00	
Occupation				
Work from office	54 (41.86)	207 (52.94)	0.71 (0.53-0.97) ^a	
Work from home/unemployed/ retired	75 (58.14)	184 (47.06)	1.00	
Income				
Below NMW ^b	73 (26.45)	165 (19.46)	1.34 (1.07-1.68) ^a	
NMW/above NMW ^b	203 (73.55)	683 (80.54)	1.00	
Health insurance				
NHI ^c	38 (13.77)	104 (12.26)	1.10 (0.82-1.48)	
Other	238 (86.23)	744 (87.74)	1.00	
Residence				
Live alone	46 (16.67)	137 (16.16)	1.03 (0.78-1.35)	
Live with family/other	230 (83.33)	711 (83.84)	1.00	
Distance to health facility				
Far	109 (39.49)	284 (33.49)	1.21 (0.99-1.50)	
Close	167 (60.51)	564 (66.51)	1.00	
Diabetes duration				
≥5 years	163 (59.06)	451 (53.18)	1.20 (0.97-1.48)	
<5 years	113 (40.94)	397 (46.82)	1.00	
Diabetes medications				
Insulin	168 (60.87)	285 (33.61)	2.30 (1.87-2.84) [*]	2.24 (1.75-2.85) ^a
Others ^d	108 (39.13)	563 (66.39)	1.00	1.00
Health facility for diabetes treatment				
Hospital	188 (68.12)	575 (67.81)	1.01 (0.81-1.26)	
Others ^e	88 (31.88)	273 (32.19)	1.00	
Number of regular consultations before the pandemic				
≥Once in 3 months	59 (21.38)	190 (22.41)	0.96 (0.74-1.23)	
<Once in 3 months	217 (78.62)	658 (77.59)	1.00	

^aP-value <.05.^bNational Minimum Wage.^cNational Health Insurance.^dDo not know, no pharmacological treatment, and oral anti diabetes.^eNone, public health center, private clinic, private practice, and midwife/nurse.

In dealing with the difficulties afflicted by PWD during the COVID-19 pandemic in Indonesia, only less than half of the respondents took the initiative to utilize available online resources/information or to contact a doctor for consulting their health conditions. However, more than half of respondents answered that they did nothing and

just let their condition deteriorate. Moreover, more than a third of PWD discontinue their medication during the COVID-19 pandemic.

Before the COVID-19 pandemic, there has been inequality in the management of T2DM in Indonesia. A study by Mulyanto et al¹⁵ demonstrated low utilization of T2DM

Table 4. How People with Diabetes in Indonesia Cope With Difficulties of Diabetes Management During Pandemic.

Variables	Frequency (n)	Presentation (%)
Difficulties in attending diabetes consultation	338	30.7
Disregard the condition/indifference	171	50.59
Chat with health providers via non health applications	62	18.34
Call health providers for a consultation	32	9.47
Consultation with health providers via health applications/internet	73	21.60
Difficulties in checking blood glucose levels	107	9.52
Left alone (do not check blood glucose levels)	65	60.75
Buy a glucometer	35	32.71
Borrow glucometer from friends/relatives	7	6.54
Difficulties in obtaining diabetes medications	139	12.37
Left alone (do not take medicine)	43	30.94
Buy medicine at pharmacies/online/internet applications	78	56.12
Ask friends/family to buy medicine	11	7.91
Change medication without consultation	5	3.60
Consult a doctor/educator/nurse via application/internet to get a prescription	2	1.44

medication. The factors associated with this condition were geographical location and low socioeconomic status. As an effort to improve this condition, in 2010 Indonesia ministry of health made a program, namely PROLANIS (*Program Layanan Penyakit Kronis* or chronic disease care program).¹⁶ It was previously provided only for the civil servant. However, after 2014 in the commencement of universal health coverage, PROLANIS was provided for all patients under the national health insurance scheme. The benefit of becoming PROLANIS member was “Allowed to obtain a 1-month supply of medicines for T2DM, while non-members were only allowed to obtain the medicines for a maximum of 7 to 14 days, other than that PROLANIS member can receive monthly group education sessions and group exercise, and free monthly blood glucose check. These are usually delivered 1 day in each month, named ‘PROLANIS day’. Moreover, PROLANIS member can receive free HbA1c testing after 6 months with routine visits in 6 consecutive months.”^{16,17} However, in 2017, Asfiani and Ilyas¹⁸ assessed the adherence of PWD in attending PROLANIS program in 5 consecutive primary health care. They found the adherence of attending the PROLANIS was only 3.59 out of 6 times. Moreover, the utilization rate was less than 5%, with the number of participants in 2016 was only 260.361.¹⁸

This condition has been worsened during the COVID-19 pandemic. The disruption of health service during pandemic is particularly problematic for PWD who needs regular care. Our study showed, the majority of PWD experienced difficulties in managing their disease which include attending diabetes consultation (30.07%), access to diabetes medication (12.37%), checking blood glucose levels (9.52%), controlling diet (23.75%), and performing regular exercise (36.48%). This current condition was not only found in Indonesia. A survey by WHO, including 37

countries, found about half of included countries had complete or partial disruptions to diabetes and diabetic complication management services (49%), with lower-middle-income countries being somewhat more likely to report disruptions.⁷ A study conducted in Jeddah enrolling 394 diabetic patients showed a significant reduction in therapy and healthy lifestyle habits in PWD during the pandemic.¹⁹ Another study conducted in India found major disruption in diabetes care activities during and after the lockdown phase in India.²⁰ As many as 89.47% participants experienced disruption in therapy including reducing clinical visit (87.28%), decrease in physical activity (69.07%), and increase in food intake (46.88%).²⁰ Moreover, only 29.80% participants were gone for virtual consultations and 87.81% reported that they didn’t have access to healthcare services.²⁰

At present, although the number of cases and deaths due to COVID-19 continues to increase, the death and cases of diabetes in Indonesia are still much higher than COVID-19.^{21,22} Putting aside comprehensive management of chronic diseases and mainly focusing on COVID-19 may potentially be harmful. For this reason, rapid and sustainable changes in the health sector to reduce the impact of COVID-19 pandemic on general health specifically in chronic disease is needed.²³

Virtual consultation that eliminates the need for physical meetings is a solution that has been implemented by many countries in the world, including Indonesia.²⁴ In Indonesia, ISE has provided recommendations to avoid direct consultation and suggested remote consultation for diabetic patients when applicable.⁶ The ISE specifically recommends PWD who are participants of the national health insurance program (JKN/BPJS) to use “Mobile JKN Health Facility” to get medical advice and treatment from their doctors. Moreover, for non-JKN participants, ISE recommends seeking information

about the telehealth services provided by their regular hospital.

However, our study found only less than half of the PWD in Indonesia used telemedicine during COVID-19 pandemic, while the remaining subjects remained idle, allowing their condition to deteriorate. In contrast, since the COVID-19 pandemic, doctors in People's Republic of China have shifted their services to telemedicine and the number of patients being served are more than 100 people per day per doctor, which exceeds the number that could be handled before the pandemic era.²³ The United States, Italy, and South Africa are also implementing the same approach, and even audio-only telemedicine service is provided as 1 solution although its effectiveness is still under study in the United States.²⁵

The concept of telemedicine is not new, even though the quality of virtual services will not be the same as direct meetings and physical examinations, changes due to the COVID-19 pandemic must be made because we still don't know when this pandemic will end.^{23,26} Several barriers are identified to create a wide range of coverage of telemedicine services in Indonesia. These including inequality in health services and infrastructure conditions, low internet usability, and relatively poor health literacy. As an archipelago country, health services in Indonesia are not evenly distributed. Based on the Ministry of Health data in 2020, out of 33 provinces in Indonesia, 3 provinces experience a shortage of doctors at the primary care level. All of them were outside Java (West Papua (63.27%), Papua (58.22%), and Maluku (51.66%); the total number of primary care experiencing doctor shortage/total number of primary care available). Meanwhile, 13 provinces in Indonesia had an excess of doctors, with the majority being in Java and Sumatra islands.²⁷

Looking at the infrastructure condition of information and technology, 98% of fibre optic backbone is available on Java Island, but it is not yet in eastern provinces in Indonesia, such as Maluku and Papua. Only 66.2% of households in Indonesia have access to the internet, and only 39.90% of individuals use the internet.²⁸ However, as an opportunity, 121 out of 100 residents are cellular telephone users, this means that 21 residents have more than 1 cellular contact.²⁸

Although many are unprepared in facing these changes, the collaboration between the government in providing infrastructure and health service providers including clinicians as the vanguard is necessary. The use of audio-only telemedicine may be applicable in Indonesia, especially in provinces with inadequate internet access. Further research is certainly needed to assess telemedicine's implementation and its effectiveness in health services during the COVID-19 pandemic in Indonesia. Furthermore, the sustainability of this new method of health care needs more further investigation.

However, beyond the readiness of the government and health service providers in developing telemedicine, it is also important to improve public health literacy. Inequality in the management of diabetes in Indonesia had existed before the COVID-19 pandemic. The gap in health literacy has become a scourge in the management of chronic diseases. A study conducted by Mulyanto et al¹⁵ demonstrated the underutilization of T2DM medication in low socioeconomic and rural groups. Pandemics bring about more challenges to pre-existing conditions. Therefore, improving the management of non-communicable diseases during a pandemic can also be achieved by improving health literacy and providing adequate access. It requires collaborative efforts, involving various stakeholders. A person with poor health literacy has a poor health status as well.²⁹ Therefore, good health literacy is needed by PWD to manage their health and make the right health decisions to achieve favorable disease outcomes.^{30,31} Utilizing technology to facilitate education on various aspects of diabetes management especially during the pandemic may offer solution to improve health literacy in the society.³²

This study has several limitations to be discussed. First, looking at Figure 1, most of our respondents came from Java Island (57.47% of respondents live in Jakarta and West Java). It is most likely that the results of this study over-represented by them. Second, the results of our study might not represent those who cannot use technology (i.e., geriatric patients, low-income subjects, subjects living in remote areas). Only 39.9% of people who live in Indonesia use the Internet, including 26.56% of all people living in rural areas and 50.92% in urban areas.

Third, our limitation in this study is not objectively assess what is meant by low blood glucose levels answered by respondent. The absence of an interviewer in an online survey resulted in the subject being unable to clarify the questions posed by us (eg, unfamiliar or ambiguous questions). Nevertheless, our pretesting data has not indicated such problems. However, we could not confirm the subject's condition (diabetes complication/management difficulties) objectively. The Questionnaire was answered subjectively by respondents. Hence, the condition of diabetes complications, which were not assessed objectively, could result in an overall lower/higher number than what occurred.

Last, our survey did not provide a view rate nor participation rate. We did not count unique visitors to the survey and therefore cannot measure the response rate. Therefore, it is necessary to be careful in generalizing the results of this study.

Conclusion

The results of this study may not be generalized to all diabetes patients in Indonesia since only 39.9% of people live

in Indonesia use internet and most of our respondents came from Java Island. However, this research can provide evidence and recommendations to various stakeholders including clinicians and PWD in the form of (1) The COVID-19 pandemic and LSSR have impact on diabetes management and diabetes-related complications as assessed by PWD in Indonesia, (2) the use of telemedicine in diabetes management needs to be strengthened and may offer a solution to overcome difficulties experienced by PWD during the COVID-19 pandemic, (3) cooperation between the government and health service providers in providing telemedicine services for PWD is necessary, (4) health organizations and government need to collaborate to formulate standards or guidelines for diabetes services during a pandemic, and (5) improving health literacy with technology-based health promotion may provide a solution to reduce the incidence of diabetes-related complications during a pandemic.

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Author Contributions

All authors contributed evenly in this study. IAK, ME, MIM, JN, and NM contributed to the design and implementation of the research, analysis, results, and the writing of the manuscript.

Declaration of Conflicting Interests

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