The Effectiveness of Collaborative Telemedicine among Diabetic Patients in Koronadal City, South Cotabato

Balquin,JC., Escuadro,IMA[1]., Jacinto,VCE[1]., Faller,EM*[1,2,3]., Gania,M*[1,2,3].

[1]Pharmacy Department, St. Alexius College, General Santos Drive, Koronadal City, South Cotabato, Philippines

[2]Faculty of Health and Social Sciences, Bournemouth University, United Kingdom

[3]Pharmacy Department, San Pedro College, Davao City, Philippines

*Corresponding Author: Dr Erwin M. Faller Email Address: erwinfaller1007@gmail.com

ABSTRACT

Background: The effectiveness of collaborative telemedicine among diabetic patients helped improve the quality of treatment and created trust among patients while at home. This was to provide a more convenient, efficient, and safest way to monitor health status to their medical doctors.

Objectives: The study aims to identify sociodemographic profile of diabetic patients in Koronadal City, determine the diabetic factor among Type 2 diabetic patients, and determine the significant difference between the treatment and control group who undergone interventions within three (3) months.

Methodology: Comparison Group-type Quasi-experimental design was used in the study. Purposive non-random sampling technique was utilized in selecting the respondents. The study participants were the 20 selected residents, following the inclusion and exclusion criteria of the study. Inclusion criteria included participants who are a resident of Koronadal City, possess any kind of media technologies, aged 40-70 years old either male or female, had type 2 diabetes, were living in the rural area of Koronadal City, were not smoking and drinking alcoholic beverages, had the ability to use smartphones, tablets, and laptops. Patients who might not have the ability to use modern technology but had someone at home who could assist them, were willing to volunteer and accepted informed consent, and active in any social media platform for the rapid delivery of information. Exclusion criteria included those who are not residents of Koronadal, patients with Type 1 diabetes, patients below 40 and above 70 years old, disabilities

such as hearing and vision impairments, had physical, mental, and emotional problems, were allergic to insulin and any medications, and those that were not willing to participate. Scheduled telemedicine consultations and laboratory tests were conducted for data gathering. The eight (4) Rural Barangays were chosen in the Municipality of Koronadal, which are the following: Caloocan, Namnama, San Roque, and Magsaysay

Results: The findings of the study demonstrated that women aged 60 and older seemed more susceptible than men to having Type 2 diabetes. Results in the Diabetic profiles of patients clearly stated that most patients are still diabetic which obtained 8.19±1.85% but their HbA1c levels reduced after three (3) months of intervention compared to the control group (9.27±3.84). The data also represented that the treatment group after the 3 months of intervention obtained a low level of Systolic BP with (128±7.89) and a high level of Diastolic BP (88±6.33). On a similar note, treatment and control groups post-test showed almost similar comorbidities with some showing problems related to respiratory disease and liver disorders. The presence of additional chronic conditions has a significant impact on the treatment and management of Type 2 diabetes (T2DM). Overall results of the medication adherence among patients clearly indicated that the post-test through telemedicine has significantly increased the level of medication adherence among patients. This only suggests that telemedicine was an effective tool to ensure that patients are compliant with various medications required in relation to their current health status.

Conclusion: In conclusion, diabetic factors in both groups have no significant difference except in the medication adherence of the treatment group. Data shows a slightly reduction in HbA1c levels compared to the control group due to the prescribed medication of the physician with the help of the pharmacist in constantly monitoring them. The collaboration of Healthcare professionals in implementing telemedicine was an effective tool for patient's adherence to medications in order to effectively manage diabetes. Additionally, diabetic regulation is difficult if the patient has many complications and living in a sedentary lifestyle. Thus, the participation of the pharmacist plays a vital role in improving the medication adherence and diabetic knowledge of the patient.

Keywords: *Collaborative Telemedicine, Type 2 Diabetes, Telemedicine Effectiveness*

INTRODUCTION

Lack of medical resources in preventing diabetes opened the opportunity for medical experts to have an alternative way of treating diabetes management of patients worldwide. Telemedicine was widely used in clinical settings wherein the involvement of physicians, patients, and other healthcare professionals could give an impact on the management of diseases virtually. The convergence of healthcare and information technologies and the use of telehealth systems by older adults had been particularly relevant in tandem with smaller numbers of healthcare practitioners (Chang *et al*., 2017). The introduction of Telemedicine as the new way for health consultations might bring opportunities for diabetic patients to a convenient and safest way to monitor their health status to their medical doctors not only in Koronadal City but also in several parts of the Philippines and developing countries. Telemedicine was intended to improve the quality of treatment and to create trust among patients in the telehealth care system. Most of the countries lack a structured organizational framework for the provision of telemedicine services, which was the greatest challenge to the creation of telemedicine services (Bali, 2018). This system would allow patients with diabetes to access medical consultation in the midst of pandemics and allow clinical providers to assess their patients in response to the health protocols. However, in some parts of the Philippines, the adaptation of telemedicine innovation did not have an appropriate implementation, planning, and policies (Monaghesh & Hajizadeh, 2020). The purpose of this study was to provide patients with medical care and to help them monitor their health conditions while at home. This would give a great impact not only on the vulnerable community but also on those patients who took time and effort to visit the hospital for checkups and consultations. Moreover, the implementation of telemedicine would contribute to the development of the healthcare system.

Literature Review

Telemedicine

Telemedicine is a medical system that advanced telecommunications data and information systems to deliver services and exchange patient information worldwide. The advancement of telemedicine has altered decision-making and physician-patient relationships by treating their illnesses and supplying them with appropriate treatment (Kamsu-Foguem *et al.,* 2015). Telemedicine was utilized over long distances to facilitate consultations between a doctor and a physician at the state hospital and to provide medical advice to an airfield medical center. New options for health care facilities and delivery have become available because of the growth, affordability, and use over the past decades. This service were a big step forward in expanding access to healthcare for all patients, especially those living in neighborhoods where there is a shortage of local health care providers (Smith, 2018).

Telemedicine Applications

The use of telemedicine has long-term cost-effectiveness for patients who can use it, and it also helps to minimize the regular visit to the hospital and clinics to meet for contact and consultation with their medical specialist and other health workers (Batsis *et al*., 2019). Aside from that, it enables patients with complicated disorders and extreme comorbidities to be fully treated by a

specialist. Participation such as telemedicine programs allows patients while continuing to attend their local medical center, to receive treatment from a remote specialist. Traveling to the local hospital instead of the centralized hospital of the managing specialist saves patients significant distance, time, and money. Preliminary surgical findings show that there is a compromise in the procedure and operational efficiency. Strong survey evidence suggests that the absence of conventional "in-person" visits does not compromise patients' satisfaction. As the COVID-19 crisis rapidly increase, patients and HCPs were forced to use temporary telecommunication resources in several countries. Given the shortage of resources for telemedicine in places around the world, where diabetes is prevalent, technological availability is widely applicable (Ayatollahi *et al.,* 2018). Due to its capability to gather and monitor, telemedicine is a strikingly promising technique (Bertoncello *et al*., 2018).

Telemedicine Guidelines

Nowadays physicians and other healthcare providers need to help patients in the self-management of their conditions. In the post-pandemic scenario, teleconsultations would possibly be part of the new normal. The AMA Telemedicine Playbook (2020) emphasizes that a visit to Telemedicine is only effective if the patients will utilize it. In a financially limited environment and spending restrictions, telemedicine plays an important role in addressing the problems raised by socioeconomic developments in health care services throughout the 21st century. People are involved in their healthcare and this is transformed into a more virtual phase through telemedicine. This transition will only take place if knowledge, preparation, and technical transformation into people's routine healthcare are given. Training is better in the future when digital native people become the health care system's main patients.

Diabetes Mellitus

Diabetes Mellitus (DM) is a disorder usually found in adult patients in which their body is unable to produce enough insulin hormones that prevent the body from utilizing the energy. This usually happens in people over 40 years of age, and this can be treated with a healthy exercise diet and proper application of oral glucose-lowering and insulin hormone injections, and the food they consume. Among chronic diseases, diabetes is particularly vulnerable to remote telemedicine monitoring. Most patients accepted or strongly agreed that the use of telemedicine was beneficial during the pandemic to maintain effective glucose regulation (97%) and that they would use the clinic again (86%) in the future. Furthermore, ensuring uninterrupted access to health care providers (HCPs) is crucial and becomes more vital during times of pandemics and disasters. In addition, several studies have linked diabetes to a higher risk of COVID19 mortality, causing more psychological burden to people with diabetes who, at a period when this was desperately needed, are left without access to their HCPs (Röhling *et al*., 2019).

Telemedicine and Diabetes

In Type 2 Diabetes mellitus (T2DM), successful metabolic control is essential to improving the quality of life, and hence the use of telemedicine shows that it is efficient in controlling glucose levels. Studies also have shown that telemedicine has been linked to conventional care for patients. it is also shown that most telemedicine techniques can be useful either as an aide or as a

substitute in normal care (Bertoncello *et al*., 2018). during the interviews, where patients not only emphasized the importance of getting access to the doctor quickly and comfortably but also to a doctor who takes time and listens to them. This suggests that telehealth is still used as an alternative health service to the daily treatment of patients and that it is necessary for them to also have access to and connect with their doctor for professional support and continuity of care. Overall, the evidence from this research shows that telehealth can enhance the quality of life of patients, enabling them to live comfortably at home. The use of telehealth for the normal treatment of people with type 2 diabetes is also accepted (P. Lee *et al.,* 2018).

METHODS

Research design

A comparison group type of quasi-experimental design utilizing the purposive technique. The researchers chose existing groups with the same condition, but the experimental group only experienced the treatment such as intervention through the use of smartphones.The research design helped acquired a better understanding through telemedicine experience and accurate laboratory results.

Sampling technique

Purposive non-random sampling was utilized in selecting the respondents through the researcher's judgment in choosing the treatment group and control group that participated in the study. The respondents were chosen purposively to produce productive answers

Participants of the Study

The participants of the study comprised 20 diabetic patients in Koronadal City. They were selected according to their purpose and availability. Participants that were only included in this study were patients aged 40-70 years old either male or female, had type 2 diabetes, were living in the rural area of Koronadal City, were not smoking and drinking alcoholic beverages, had the ability to use smartphones, tablets, and laptops. Patients who might not have the ability to use modern technology but had someone at home who could assist them, were willing to volunteer and accepted informed consent, and active in any social media platform for the rapid delivery of information. Exclusion criteria made by the researchers were the following; Patients with Type 1 diabetes, patients below 40 and above 70 years old, disabilities such as hearing and vision impairments, had physical, mental, and emotional problems, were allergic to insulin and any medications, and those that were not willing to participate.

Locale of the study

The study was conducted in the Province of South Cotabato particularly the municipality of Koronadal, which has 27 barangays classified into two rural and urban areas with a GPS code of 6°29'47.0"N 124°50'35.1"E. The researchers only selected the respondents from the (4) four rural barangays because of the researchers' advantage on the accessibility to the respondent's data to

be gathered. The names of the 4 Barangays of the Municipality of Koronadal are the following: Caloocan, Namnama, San Roque, and Magsaysay.

Research Instrument

The researchers utilized a validated guide questionnaire for the scheduled telemedicine consultations with the use of smartphones to record the conversation of the physician and pharmacist through text and videoconference with the respondents.

Data Analysis

Standard guidelines for the implementation of telemedicine were applied in accordance with (DOH-UPM) JMC No. 2020-0001 entitled "Telemedicine Practice Guidelines", (DOHNPC) JMC No. 2020-0001 entitled "Guidelines on the Use of Telemedicine in COVID-19 Response" and Philippine Medical Association Telemedicine guidance for Filipino Physician and Patients. The goal of the physician and pharmacist was to reduce the HbA1c level of the patients, to monitor their blood pressure and body mass index (BMI), to ensure that the patients follow all the given instructions, adhere to the medication prescribed, and improve diabetes management.

Pre-test

Participants eligible for the study were reviewed and underwent informed consent. Once consented, subjects were assigned into two groups: - Treatment Group, Type 2 Diabetic patients received standard medical care with the implementation of telemedicine - Control Group, Type 2 Diabetic patients: Current standard of care (no additional telemedicine application but followed standard consultation procedure). There were two (2) teleconsultations only. The duration of the teleconsultation had started on the 1st week of March from 5 pm onwards with three (3) to four (4) patients only.

Intervention

During the teleconsultation, the full cooperation of the patient was required to prevent prolonged teleconsultation sessions. The consultation was only limited to ten (10) to fifteen (15) minutes and three (3) to four (4) patients to be catered per day. After the first online consultation of the experimental group, the patient availed medicines from the City health. Periodic monitoring was conducted by the pharmacist. The Pharmacist contacted the patients to monitor and record their conditions, to make sure the patients followed instructions, and adhered to the medication prescribed by the Physician. The pharmacist monitored the patients every week. Periodic monitoring started after the 1st intervention and lasted before the 2nd intervention.

Post-test

Before the 2nd collaborative telemedicine intervention, the patient again underwent a laboratory test that served as their post-test. The physician and pharmacist analyzed and evaluated the results of the patients' laboratory test to see their progress in managing their diabetes. The pharmacist reviewed the previous data of patients. The Pharmacist also presented the information

she obtained from periodic monitoring. Moreover, clinical output and productivity of the patients after three (3) months were presented. The Control Group, on the other hand, underwent laboratory tests for their pre-test and the same process after three (3) months for their post-test. They also availed free consultation from the Barangay Health center and availed themselves of free medications in the City Health from the prescriptions given by the physician.

Ethical Consideration

The research study was approved by the Pharmacy Ethics Committee (PREC) last January 30, 2020. The code of ethics number of the study is registered as SAC-PREC-01-FEB-001. Before conducting the interview, the questionnaires used in the study undergone a standardization process for validation and reliability test. For the data gathering, the researchers provided a letter of consent approved by the research adviser and the mayor of the Municipality where the study was conducted. Consent letters were also sent to the respective Barangay Captains of a specific Barangay before conducting the study. Respondents were fully informed and instructed of the purpose of the study, the procedures that would be used to collect the data. The respondents provided protocols and signed consent that includes the information on the respondent's right to withdraw at any time without reason and penalty, assurance that participant identity will be kept highly confidential, right to access to their data, and right to ask for more information from the researchers.

RESULTS AND DISCUSSION

Demographic Profile

Table 1
Demographic Characteristics of the Respondents

Group	Parameters	Segmentation	N	%
TREATMENT GROUP	Gender	Female	5	50.0
		Male	5	50.0
	Age Bracket	40 - 45 years old	0	0.0
		46 - 50 years old	2	20.0
		51 - 55 years old	2	20.0
		56 - 60 years old	1	10.0
		61 - 65 years old	5	50.0
		66 - 70 years old	0	0.0
	Years diagnosed	< 1 year	0	0.0
		1 - 3 years	2	20.0
		> 3 years	8	80.0
	Highest educational attainment	Elementary Graduate	1	10.0
		High School Graduate	4	40.0
		College graduate	5	50.0
	Marital status	Single	1	10.0
		Married	8	80.0
		Widowed	1	10.0

CONTROL GROUP	Gender	Female	7	70.0
		Male	3	30.0
	Age Bracket	40 - 45 years old	1	10.0
		46 - 50 years old	3	30.0
		51 - 55 years old	3	30.0
		56 - 60 years old	1	10.0
		61 - 65 years old	1	10.0
		66 - 70 years old	1	10.0
	Years diagnosed	<1 year	2	20.0
		1 -3 years	1	10.0
		>3 years	7	70.0
	Highest educational attainment	Elementary Graduate	1	10.0
		High School Graduate	4	40.0
		College graduate	5	50.0
	Marital status	Single	5	50.0
		Married	4	40.0
		Widowed	1	10.0

Results of the survey revealed that there is an equal number of males and females in the treatment group with more than three years of diagnosis, Meanwhile, for the control group, the majority of the respondents were female with 70% of them have been diagnosed for more than three (3) years. This data represented those women aged 60 and older seemed more susceptible than men to having type 2 diabetes. The risk of developing diabetes increases as diabetic person ages. The likelihood of developing various medical problems, such as high blood pressure and excessive cholesterol, increases with age making it more difficult to regulate diabetes. These findings also revealed a significant relationship between age, income level, educational level, and glycemic control with women ages above 60. Furthermore, lower education levels have been linked to increased rates of sedentary behavior, obesity, and alcohol use, all of which are known risk factors for the development or worsening of diabetes. Educational attainment of patients is helpful for them to may be able to comprehend their health requirements and follow instructions, advocate for themselves or their families, and communicate effectively with their health care providers. Hence, through education, patients can better understand their health condition and the therapy they are receiving that leads to increased treatment compliance and reduced difficulties. Married couples are more likely to adhere to medical advice. In addition, their romantic spouse is expected to be a leading source of support in times of crisis or difficulty. It is vital to have a healthy romantic connection since the chronic disease is typically managed with the help of a spouse. However, in the control group, results have shown that most patients are single which, according to Protheroe *et al*., (2017), glycemic control may be achieved and maintained in several ways, such as through increasing patient knowledge of diabetes and their behavior towards self-care management. A long and healthy life may be achieved if patients take care of themselves and manage their diabetes early (World Health Organization, 2016).

Laboratory Profile of Patients

Table 2.1
Pretest and Posttest Data of Patients Laboratory Profile

Test Parameters		HbA1c	Systolic BP	Diastolic BP	BMI
Pretest	Treatment Group	10.2±3.36	139±19.12	81±7.38	23.09±2.38
	Control Group	9.52±3.61	131±24.90	82±9.42	23.81±5.20
Posttest	Treatment Group	8.19±1.85	128±7.89	88±6.33	23.08±1.64
	Control Group	9.27±3.84	138±26.16	82±9.19	24.31±5.07

Results of the survey indicated that the treatment group (those that received intervention through telemedicine) at the pre test level showed a high level of HbA1C and systolic BP compared to their results in post test. It was clearly stated that most patients still have diabetes, which obtained 8.19±1.85% but their HbA1c levels reduced after three (3) months of intervention compared to the control group (9.27±3.84). Poorly regulated diabetes could be a factor in poor access to services, poor health awareness, and poor return to providers with existing glucose levels for follow-up and contact (Franc, 2019). Access to a medical specialist is becoming difficult due to the rising number of patients with diabetes, particularly in the countryside. 30% of patients with diabetes do not meet the target glucose values, which is a crucial drawback in contemporary diabetology, resulting in a lower quality of life (Dlugazesk *et al*., 2016; Ashrafzadeh & Hamdy, 2019). This explains that regulating diabetes is difficult if the patient has many complications. Although patients in both groups are classified as diabetic, Telemedicine has a greater impact in lowering the HbA1c of the patients compared to standard consultation. The data represented that the treatment group after the three (3) months of intervention obtained a low level of Systolic BP with (128±7.89) and a high level of Diastolic BP (88±6.33). This also explained that most of the patients are pre-hypertensive and some are Stage I hypertensive. Hypertension, as one of the leading causes of diabetes, has shared common risk factors. According to the American Diabetes Association (ADA), if high blood pressure and type 2 diabetes are combined, the chances of suffering a heart attack or stroke are greatly increased. Being overweight and diabetic raises the risk of acquiring additional diabetes-related illnesses. To prevent these complications, normal blood pressure is vital as keeping a healthy range of blood sugar levels.

Results of the patients in terms of their body mass index showed that treatment group in their post-test were classified as normal with 23.08±1.64, which explains that patients are knowledgeable enough in managing their condition following the instruction of the Physician and the weekly reminders of the Pharmacist in their medication and food intake while most of the patients in the control group were also classified as normal and some are overweight with 24.31±5.07. Obesity is becoming more prevalent in people with Type 2 Diabetes. As a result, women with a higher BMI acquire diabetes more quickly than men (Pinchevsky *et al.*, 2020). Thus, obesity prevention is a top concern to avoid diabetes and other chronic illnesses. The goal is that lowering the rise in obesity will also help to decrease the increase of diabetes cases. Nonetheless, this may also indicate that telemedicine may influence patients' behavior towards

medication adherence, leading to a substantial decrease in the laboratory data. Meanwhile, the clinical profile of patients based on the existing comorbidities was recorded for both treatment and control groups. The overall data is shown in Table 2.2.

Table 2.2
Pre test and Post test Data of Patients Clinical Profile

Test Parameters		Co-morbidities	N	%
Pretest	Treatment Group	Hypertension	9	90.0
		None	1	10.0
	Control Group	Hypertension	6	60.0
		Tuberculosis	1	10.0
		Fatty Liver	1	10.0
		None	2	20.0
Post test	Treatment Group	Hypertension	8	80.0
		None	2	20.0
	Control Group	Hypertension	6	60.0
		Chronic Disease	2	20.0
		None	2	20.0

Results in table 2.2 indicated that the treatment group before telemedicine intervention mainly was hypertensive. On a similar note, treatment and control groups post test showed almost identical comorbidities, with some showing problems related to respiratory disease and liver disorders. The presence of additional chronic conditions has a significant impact in treating and managing type 2 diabetes (T2DM). In addition to preventing comorbid conditions from occurring, lifestyle modifications can also be beneficial in treating diabetes-related comorbid conditions. Hence, there is greater feasibility that patients with diabetes with more comorbidities had poorer outcomes in managing their diseases. Meanwhile, the patients' medications were also recorded and results are shown in Table 2.3.

Table 2.3
Pretest and Post-test Data of Patients Medications

Medications used	PRE-TEST		POST-TEST	
	Treatment group	Control Group	Treatment group	Control Group
Sulfonylureas	5 (50%)	6 (60%)	6 (60%)	5 (50%)
Biguanides	6 (60%)	7 (70%)	9 (90%)	8 (80%)
Thiazolidinediones	0 (0%)	1 (10%)	1 (10%)	2 (20%)
Alpha-glucosidase inhibitors	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meglitinide	0 (0%)	0 (0%)	0 (0%)	0 (0%)
DPP-4 Inhibitors	6 (60%)	3 (30%)	5 (50%)	3 (30%)
SGLT2 Inhibitor	4 (40%)	2 (20%)	4 (40%)	1 (10%)
Bile Acid Sequestrant	0 (0%)	0 (0%)	0 (0%)	1 (10%)
Rapid-Acting Insulin	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Intermediate acting Insulin	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Long-Acting Insulin	0 (0%)	0 (0%)	0 (0%)	0 (0%)

| Ultra-Long Acting Insulin | 0 (0%) | 1 (10%) | 0 (0%) | 1 (10%) |

Among all the medications, the most used T2DM treatment was Biguanides as first line therapy in combination with Sulfonylureas particularly in overweight people which greatly impacts on the implementation of telemedicine as shown in Table 2.1 where the patient's HbA1c level reduces from 10.2±3.36 to 8.19±1.85. This also signifies that the efficacy of medicine has something to do with a class of medication. Most of the patients were prescribed with oral combination therapy to improve glycemic control and existing comorbidities. Moreover, the pharmacological care and motivations that the pharmacist has offered to the patients, greatly affect their results in lowering their HbA1c levels. Thus, the choice of pharmacological medicines should be guided by a patient-centered approach. In addition, the patient's medication adherence was also recorded and results are shown in Table 2.4.

Table 2.4

Pretest and Post-test Data of Patients Medication Adherence

Items	PRETEST		POSTTEST	
	Treatment group	Control Group	Treatment group	Control Group
In the past one month, I frequently failed to take my medication in accordance with the doctor's	1.50	2.20	1.50	1.50
In the past one month, I reduced my medication intake when I felt better.	1.80	2.10	1.50	1.90
In the past one month, I took my medication alternately.	1.80	1.60	1.60	2.10
I was often late on / missed the appointment date to get the supplies of my follow-up medication at the pharmacy counter.	2.10	2.30	1.70	1.70
I have excess supply of the prescribed medication at home.	2.50	3.00	2.00	3.510
I did not fully comply with the prescriptions because I felt it was	2.20	1.80	1.70	2.30
In the past one month, I frequently failed to remember to take my medication.	2.30	1.60	1.60	1.80
I regularly take less medication than prescribed for fear of the side effects to my body.	1.80	2.40	1.60	1.70
I will miss/not take my medication if no one reminds me to do so.	1.70	2.00	1.40	1.70
I am uncertain about my daily medication doses.	1.90	2.00	1.80	1.80
I am unable to manage my medication intake properly.	2.20	1.70	1.40	1.90
Without support or help from the loved ones, I lack motivation to take my medication as prescribed by the doctor.	1.40	1.40	1.80	1.60
Overall mean	**1.93±0.32**	**2.01±0.45**	**1.63±0.18**	**1.96±0.54**

Patients in the Treatment Group mainly were adherent to the medication per under the physician's instructions which obtained an overall mean of 1.63±0.18 in their post test results. With the constant reminders and guidance from the pharmacist, the patients could manage their

medication intake properly. In diabetes treatment, prescription adherence remained a significant factor. Furthermore, drug regimens are more likely to be followed by patients if they can see how the medication contributes to a positive and immediate outcome. This result is crucial not only for developing patient-centered intervention programs, but also for increasing their quality of life through long-term health promotion. Hence, pharmacists should spend more time providing pharmaceutical care and counseling to serve the patients better. Overall results of the medication adherence among patients clearly indicated that the post-test through telemedicine has significantly increased the level of medication adherence among patients. This only suggests that telemedicine was an effective tool to ensure that patients were compliant with various medications required in relation to their current health status.

Significant difference between the patients' diabetic profile before and after telemedicine intervention

Table 3
Testing the Significant Difference of Patients Diabetic
Profile Before and After Telemedicine Intervention

Test Variables		T value	P value	Remarks*
TREATMENT GROUP	HbA1C	1.02	0.1134	Not significant
	Systolic BP	1.68	0.1099	Not significant
	Diastolic BP	2.27	0.0352	Significant
	Body Mass Index	0.0109	0.9914	Not significant
	Comorbidities	0.392	0.531	Not significant
	Medication Use	8.09	0.088	Not significant
	Medication Adherence	2.76	0.011	Significant

*Calculation was performed at the 0.05 level of significance

Results of the statistical data analysis revealed that there is an existing significant difference in the patient's diabetic profile based on diastolic BP and medication adherence before and after telemedicine intervention during COVID-19 pandemic which means that they are lower the level of significance ($P \leq 0.05$). This signifies that respondent do not take their medication for granted. Following the prescribed medicines and instructions of the physician and constant reminders from the pharmacist in providing them pharmaceutical care has affected their medication adherence that was found to increase substantially. Thus, the advantages of telemedicine, such as the capacity to offer real-time data and condition monitoring, and the reduction in treatment sessions, were overwhelmingly positive among the participants in this study. On the other hand, most of the patient's diabetic profiles did not significantly change after the telemedicine intervention. It is clearly stated that telemedicine will not dramatically change the baseline of the laboratory results and diabetic factors if patients were used to standard consultation and if patients were not willing to improve their diabetic management. The results were greatly affected by their beliefs and decision-making. They do not have the same behavior towards adhering to the medications prescribed by their physician. To encourage the adoption and usage of telemedicine, collaboration between educators, healthcare practitioners, communications service providers, and patients is necessary.

Significant difference between patients undergoing telemedicine and patients not undergoing telemedicine

Table 4
Testing the Significant Difference of Patients who underwent Telemedicine and Standard Consultation

Test Variables	Treatment Group			Control Group		
	T value	P value	Remarks*	T value	P value	Remarks*
HbA1C	1.02	0.1134	Not significant	0.250	0.8823	Not significant
Systolic BP	1.68	0.1099	Not significant	0.578	0.5705	Not significant
Diastolic BP	2.27	0.0352	Significant	0.0961	0.9245	Not significant
Body Mass Index	0.0109	0.9914	Not significant	0.2177	0.8301	Not significant
Comorbidities	0.392	0.531	Not significant	2.67	0.446	Not significant
Medication Use	8.09	0.088	Not significant	4.69	0.584	Not significant
Medication Adherence	2.76	0.011	Significant	0.210	0.8353	Not significant

*Calculation was performed at the 0.05 level of significance

Results of the statistical analysis revealed that there is an existing significant difference in the patient's diabetic profile based on diastolic BP and medication adherence in the treatment group. Although the result of other diabetic factors was not significant, there is a slighter change from the baseline results of HbA1c as indicated in Table 2.1 and attained increase medication adherence. This means that telemedicine has greatly affected patients' results that are beneficial to their diabetic management. On the other hand, control group showed no existing significant difference in their pre and posttest results. Several factors should be considered in the results of the study. This explains that patients do not take their disease seriously. Some may have low income leading to a decreased purchase of medicines. For those living alone in rural areas that are 60 years old and above, going out freely to purchase medicine due to the protocol that has been implemented in their rural communities is a burden. Additionally, many people are skipping appointments because they do not want to leave their homes and expose themselves to the risk of having COVID-19. Overall results explained that most of the patient's diabetic profiles in both groups did not significantly change after three (3) months. The result also found that the use of telemedicine is productive, and these findings must be taken seriously, given diversity across cultures, interventions, settings, and the overall low quality of assessments included.

Conclusions

Most of the diabetic factors of both groups have no significant difference except in the medication adherence of the treatment group. Data shows a slightly reduction in HbA1c levels compared to the control group due to the prescribed medication of the physician with the help of

the pharmacist in constantly monitoring them. The collaboration of Healthcare professionals in implementing telemedicine was an effective tool for patient's adherence to medications in order to effectively manage diabetes. Diabetic regulation is difficult if the patient has many complications and living in a sedentary lifestyle. Thus, the participation of the pharmacist plays a vital role in improving the medication adherence and diabetic knowledge of the patient.

Recommendations

The researchers recommend this study to patients to use telemedicine as a form of consultation for it is more applicable in this time of pandemic compared to a traditional standard consultation. The researchers recommend this study to the pharmacists to provide healthcare services to patients without having a face-to-face interaction. This will give recognition to the pharmacist in providing healthcare services that patients can ask them whenever they are confused about the instructions of the physician or have anxiety in taking the right medication. Thus, Educational programs in improving the diabetic management of T2DM are recommended.In terms of diabetic patients' medication adherence, the Department of Health (DOH) should also evaluate each local government health unit to determine what support they can offer to the challenges in the community brought by the COVID-19 pandemic. It becomes more realistic and helpful to the patients if the government particularly the Department of Health (DOH) would allocate funds for the augmentation of this program. Also, for Type 2 diabetic patients that are financially unstable who wants to continue Telemedicine to avail PhilHealth Insurance to help pay individual healthcare services and to ensure that all Filipinos are guaranteed equitable access to quality and affordable health care goods and services and protected against financial risk.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

REFERENCES
(2018) Retrieved from American Diabetes Association: https://diabetes.diabetesjournals.org/content/67/Supplement_1/2302-PUB
(2021). Retrieved from The John Hopkins Patient Guide to Diabetes: https://hopkinsdiabetesinfo.org/sglt2-

inhibitors/#:~:text=These%20medications%20typically%20lower%20HbA1c%20levels%20by%200.5,report%20mild%20weight%20loss%20after%20taking%20SGLT2%20inhibitors.

Al-Sofiani, M. E., Alyusuf, E. Y., Alharthi, S., Alguwaihes, A. M., Al-Khalifah, R., & Alfadda, A. (2020). Rapid Implementation of a Diabetes Telemedicine Clinic During the Coronavirus Disease 2019 Outbreak: Our Protocol, Experience, and Satisfaction Reports in Saudi Arabia. Journal of Diabetes Science and Technology. https://doi.org/10.1177/1932296820947094

American Medical Association; Telehealth Implementation Playbook; March2020. Accessed 20 Apr 20 *A review of telemedicine interventions in diabetes care (nd).* https://doi.org/10.1258/jtt.2012.

Asgari, P., & Nazari, E. (2019). Review of the Effectiveness of Information and Communication Technology (ICTs) in the Treatment of Type 1 and Type 2 Diabetes. *Frontiers in Health Informatics*,*8*(1),12. https://doi.org/10.30699/fhi.v8i1.182

Ashrafzadeh, S., & Hamdy, O. (2019). Patient-Driven Diabetes Care of the Future in the Technology Era. In *Cell Metabolism* (Vol. 29, Issue3,pp.564–575).CellPress. https://doi.org/10.1016/j.cmet.2018.09.005\

Ayatollahi, H., Mirani, N., Nazari, F., & Razavi, N. (2018). Iranian healthcare professionals' perspectives about factors influencing the use of telemedicine in diabetes management. *World Journal of Diabetes*, *9*(6), 92–98. https://doi.org/10.4239/wjd.v9.i6.92

Bali, S. (n.d.). *Barriers to Development of Telemedicine in Developing Countries*. www.intechopen.com

Batsis JA, DiMilia PR, Seo LM, et al. Effectiveness of Ambulatory Telemedicine Care in Older Adults: A Systematic Review. J Am Geriatr Soc. 2019;67(8):1737-1749. doi:10.1111/jgs.15959

Benson, G. A., Sidebottom, A., Hayes, J., Miedema, M. D., Boucher, J., Vacquier, M., Sillah, A., Gamam, S., & VanWormer, J. J. (2019). Impact of ENHANCED (diEtitiaNs Helping pAtieNts CarE for Diabetes) Telemedicine Randomized Controlled Trial on Diabetes Optimal Care Outcomes in Patients with Type 2 Diabetes. *Journal of the Academy of NutritionandDietetics*,*119*(4),585–598. https://doi.org/10.1016/j.jand.2018.11.013

Bertoncello, C., Colucci, M., Baldovin, T., Buja, A., & Baldo, V. (2018). How does it work? Factors involved in telemedicine home-interventions effectiveness: A review of reviews. In *PLoS ONE* (Vol. 13, Issue 11). Public Library of Science. https://doi.org/10.1371/journal.pone.0207332

Bouchonville, M. F., Paul, M. M., Billings, J., Kirk, J. B., & Arora, S. (2016). Taking Telemedicine to the Next Level in Diabetes Population Management: a Review of the Endo ECHO Model. In *Current Diabetes Reports* (Vol. 16, Issue 10). Current Medicine Group LLC 1. https://doi.org/10.1007/s11892-016-0784-9

Brody, T., Felker, G. M., & Teerlink, J. R. (n.d.). Intention-to-Treat Analysis Intent-to-Treat Analysis Versus Per Pro-tocol Analysis Clinical Trial Design in Heart Failure. In *Clinical Trials*.

Capoccia, K., Odegard, P. S., & Letassy, N. (2016). Medication Adherence With Diabetes Medication: A Systematic Review of the Literature. *The Diabetes Educator*, *42*(1), 34–71.https://doi.org/10.1177/0145721715619038

Chang, Chi-Ping PhD, RN; Lee, Ting-Ting PhD, RN; Mills, Mary Etta ScD, RN Experience of Home Telehealth Technology in Older Patients With Diabetes, CIN: Computers, Informatics, Nursing: October 2017 - Volume 35 - Issue 10 - p 530-537 doi: 10.1097/CIN.0000000000000341

Cheng, Y.-R. (2015). The outcomes and influencing factors of telecare managing patients with type 2 diabetes. *Chinese Nursing Research*, *2*(2–3), 80–83. https://doi.org/10.1016/j.cnre.2015.09.002

Clemensen, J., Rothmann, M. J., Smith, A. C., Caffery, L. J., & Danbjorg, D. B. (2017). Participatory design methods in telemedicine research. *Journal of Telemedicine and Telecare*, *23*(9), 780–785. https://doi.org/10.1177/1357633X16686747

Cleveland Clinic; Cleveland Clinic COVID-19 Response: Digital Health Playbook; April 13, 2020 (Accessed 20, April 2020 at: https://my.clevelandclinic.org)

Dandge, S., Jeemon, P., & Reddy, P. S. (2019). Technology enabled non-physician health workers extending telemedicine to rural homes to control hypertension and diabetes (TETRA): A pre-post demonstration project in Telangana,India.*PLoSONE*,*14*(2).https://doi.org/10.1371/journal.pone.0211551

Dimova, E. D., Mohan, A. R. M., Swanson, V., & Evans, J. M. M. (2017). Interventions for prevention of type 2 diabetes in relatives: A systematic review. In *Primary Care Diabetes* (Vol. 11, Issue 4, pp. 313–326). Elsevier Ltd. https://doi.org/10.1016/j.pcd.2017.04.003

Dlugaszek, M., Gumprecht, J., Berdzik-Kalarus, S., Chodkowski, A., & Nabrdalik, K. (2016). Telemedicine in response to challenges of modern diabetology. In *Clinical Diabetology* (Vol. 5, Issue 1, pp. 22–25). Via Medica. https://doi.org/10.5603/DK.2016.0004

DOH (2017). DOH LEADS WORLD DIABETES OBSERVANCE IN THE PHILIPPINES. https://doh.gov.ph/node/11786

Food and Drug Administration - Philippines (2020); Guidelines in the Implementation of the use of electronic means of prescription for drugs for the benefit of individuals vulnerable to COVID-19 (FDA Circular: 2020-007)

Greenwood, D. A., Gee, P. M., Fatkin, K. J., & Peeples, M. (2017). A Systematic Review of Reviews Evaluating Technology-Enabled Diabetes Self-Management Education and Support. Journal of diabetes science andtechnology,11(5),1015–1027.https://doi.org/10.1177/1932296817713506

Grigsby, J., Kaehny, M. M., Sandberg, E. J., Schlenker, R. E., & Shaughnessy, P. W. (n.d.). *Effects and Effectiveness of Telemedicine*.

Hirani, S. P., Rixon, L., Cartwright, M., Beynon, M., & Newman, S. P. (2017). The Effect of Telehealth on Quality of Life and Psychological Outcomes Over a 12-Month Period in a Diabetes Cohort Within the Whole Systems Demonstrator Cluster Randomized Trial. *JMIR Diabetes*, *2*(2), e18. https://doi.org/10.2196/diabetes.7128

Izquierdo, R. E., Wang, D., Huang, D., Palmas, W., & Weinstock, R. S. (2015). Case Management with a Diabetes Team Using Home Telemedicine: Acceptance of Treatment Recommendations by Primary Care Providers in IDEATel. *Telemedicine and E-Health*, *21*(12), 980–986. https://doi.org/10.1089/tmj.2014.0236

Jun Yang Lee and Shaun Wen Huey Lee (2018). Telemedicine Cost–Effectiveness for Diabetes Management: A Systematic Review. *Diabetes Technology and Therapeutics Vol. 20 No, 7,* https://doi.org/10.1089/dia.2018.0098

Kamsu-Foguem, B., Tiako, P., Fotso, L., Foguem, C., Foguem Modeling, C., Tiako, P. F., & Fotso, L. P. (2015). *Clovis Modeling for effective collaboration in telemedicine*. *32*(4), 776–786. https://doi.org/10.1016/j.tele.2015.03.009ï

Kidholm, K., Clemensen, J., Caffery, L. J., & Smith, A. C. (2017). The Model for Assessment of Telemedicine (MAST): A scoping review of empirical studies. *Journal of telemedicine and telecare*, *23*(9), 803–813. https://doi.org/10.1177/1357633X17721815

Lee, P. A., Greenfield, G., & Pappas, Y. (2018a). The impact of telehealth remote patient monitoring on glycemic control in type 2 diabetes: A systematic review and meta-analysis of systematic reviews of randomised controlled trials. In *BMC Health Services Research* (Vol. 18, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12913-018-3274-8

Lee, S. W. H., Chan, C. K. Y., Chua, S. S., & Chaiyakunapruk, N. (2017a). Comparative effectiveness of telemedicine strategies on type 2 diabetes management: A systematic review and network meta-analysis. *Scientific Reports*, *7*(1). https://doi.org/10.1038/s41598-017-12987-z

Macabasag, Romeo Luis & Magtubo, Kristine Mae & Marcelo, Portia. (2016). Implementation of Telemedicine Services in Lower-Middle Income Countries: Lessons for the Philippines. Journal of the International Society for Telemedicine and eHealth. 4. 1-11.\

Manzella, D. (2020, September 27). verywellhealth. Comorbid Conditions and Diabetes.Retrieved from https://www.verywellhealth.com/comorbidity-disease-diabetes-1087365

Mathieson, K., Leafman, J. S., & Horton, M. B. (2017). Access to digital communication technology and perceptions of telemedicine for patient education among American Indian patients with diabetes. *Journal of Health Care for the Poor and Underserved*, *28*(4), 1522–1536. https://doi.org/10.1353/hpu.2017.0131

McDonnell, M. E. (2018). Telemedicine in Complex Diabetes Management. In *Current Diabetes Reports* (Vol. 18, Issue 7). Current Medicine Group LLC 1. https://doi.org/10.1007/s11892-018-1015-z

McLendon, S. F. (2017). Interactive video telehealth models to improve access to diabetes specialty care and education in the rural setting: A systematic review. In *Diabetes Spectrum* (Vol. 30, Issue 2, pp. 124–136). American Diabetes Association Inc. https://doi.org/10.2337/ds16-0004

Meade, L. T., Tart, R. C., & Buzby, H. L. (2017). *Evaluation of Diabetes Education and Pharmacist Interventions in a Rural, Primary Care Setting. Diabetes Spectrum, 31(1), 90–95.* doi:10.2337/ds16-006

Nyamu, R. De Coster and S. M. Taib, "An empirical study of collaborative innovation as a facilitator to telemedicine adoption in developing countries," 2015 International Conference on Information Society (i-Society), London, 2015, pp. 33-38. doi: 10.1109/i-Society.2015.7366853

K.laassen, B., van Beijnum, B. J. F., & Hermens, H. J. (2016, September 1). Usability in telemedicine systems—A literature survey. *International Journal of Medical Informatics*. Elsevier Ireland Ltd. https://doi.org/10.1016/j.ijmedinf.2016.06.004

Pathipati, A., Azad, T., & Jethwani, K. (2016). Telemedical Education: Training Digital Natives in Telemedicine. J Med Internet Res. doi:10.2196/jmir.5534

Peters, R. M., Lui, M., Patel, K., Tian, L., Javaherian, K., Sink, E., Xu, R., Xu, Z., Aung, W., Zhou, L., Huynh, J., Polites, G., Blanchard, M., Som, A., Ross, W., & Bernal-Mizrachi, C. (2017). Improving Glycemic Control With a Standardized Text-Message and Phone-Based Intervention: A Community Implementation. *JMIR Diabetes*, *2*(2), e15. https://doi.org/10.2196/diabetes.7910

Pradeepa, R., Rajalakshmi, R., & Mohan, V. (2019). Use of Telemedicine Technologies in Diabetes Prevention and Control in Resource-Constrained Settings: Lessons Learned from Emerging Economies. *Diabetes Technology and Therapeutics*, *21*(S2), S2-9-S2-16. https://doi.org/10.1089/dia.2019.0038

Protheroe, J., Rowlands, G., Bartlam, B., & Levin-Zamir, D. (2017). *Health Literacy, Diabetes Prevention, and Self-Management. Journal of Diabetes Research, 2017, 1–3.* doi:10.1155/2017/1298315

Pourmand, A., Ghassemi, M., Sumon, K., Amini, S., Hood, C., & Sikka, N. (2020). Lack of Telemedicine Training in Academic Medicine: Are We Preparing the Next Generation? Telemedicine and e-Health. doi:doi.org/10.1089/tmj.2019.0287

O'Cathail, M., Sivanandan, M. A., Diver, C., Patel, P., & Christian, J. (2020). The Use of Patient-Facing Teleconsultations in the National Health Service: Scoping Review. JMIR medical informatics, 8(3), e15380. https://doi.org/10.2196/15380

Rasmussen, O. W., Lauszus, F. F., & Loekke, M. (n.d.). *Telemedicine compared with standard care in type 2 diabetes mellitus: A randomized trial in an outpatient clinic*. https://doi.org/10.1177/1357633X15608984?fbclid=IwAR3BEgWHHXMrYLdCX2kZNMikL5

Röhling, M., Redaélli, M., Simic, D., Lorrek, K., Samel, C., Schneider, P., Kempf, K., Stock, S., & Martin, S. (2019). Tedia-a telemedicine-based treatment model for inpatient and interprofessional diabetes care. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *12*, 2479–2487. https://doi.org/10.2147/DMSO.S229933

Sani, M., Makeen, A., Albasheer, O. B. A., Solan, Y. M. H., & Mahfouz, M. S. (2018). Effect of telemedicine messages integrated with peer group support on glycemic control in type 2 diabetics, Kingdom of Saudi Arabia. *International Journal of Diabetes in Developing Countries*, *38*(4), 495–501. https://doi.org/10.1007/s13410-018-0608-3

Saigí-Rubió, Francesc & Torrent-Sellens, Joan & Sáez, Cari & Kotzeva, Anna & Villalobos, Julio. (2016). Framework for the Implementation of a Telemedicine Service.

Sanchez-Rangel, E., Inzucchi, S.E. Metformin: clinical use in type 2 diabetes. *Diabetologia* 60, 1586–1593 (2017). https://doi.org/10.1007/s00125-017-4336-x

Scott, G., Ramos-Pérez, N., Ramos-Estremera, N. *et al.* Relating sociodemographic factors and glycemic control among inpatients with type 2 diabetes. *J Public Health (Berl.)* (2020). https://doi.org/10.1007/s10389-020-01303-1

Schmitz Mazur, L. (2019). *Telemedicine Collaborations and Partnerships: Key Considerations for Success*.

Sims, J. M. (2018). Communities of practice: Telemedicine and online medical communities. Technological Forecasting and Social Change, 126, 53–63. doi:10.1016/j.techfore.2016.08.030

Smith, Yolanda. (2018, August 23). Types of Telemedicine. News-Medical. Retrieved on November 20, 2020 from https://www.news-medical.net/health/Types-of-Telemedicine.aspx.

Sood, A., Watts, S. A., Johnson, J. K., Hirth, S., & Aron, D. C. (2018). Telemedicine consultation for patients with diabetes mellitus: a cluster randomised controlled trial. *Journal of Telemedicine and Telecare*, *24*(6), 385–391. https://doi.org/10.1177/1357633X17704346

Sun, C., Sun, L., Xi, S., Zhang, H., Wang, H., Feng, Y., Deng, Y., Wang, H., Xiao, X., Wang, G., Gao, Y., & Wang, G. (2019). Mobile phone–based telemedicine practice in older Chinese patients with type 2 diabetes mellitus: Randomized controlled trial. *Journal of Medical Internet Research*, *21*(1). https://doi.org/10.2196/10664

The Department of Health (DOH) & the University of the Philippines Manila (UPM). 2020. Telemedicine Practice Guidelines. https://app.adpc.net/publications/telemedicine-practice-guidelines

Wang, G., Zhang, Z., Feng, Y., Sun, L., Xiao, X., Wang, G., Gao, Y., Wang, H., Zhang, H., Deng, Y., & Sun, C. (2017). Telemedicine in the Management of Type 2 Diabetes Mellitus. *American Journal of the Medical Sciences*, *353*(1), 1–5. https://doi.org/10.1016/j.amjms.2016.10.008

Wang, T. T., Li, J. M., Zhu, C. R., Hong, Z., An, D. M., Yang, H. Y., Ren, J. C., Zou, X. M., Huang, C., Chi, X. S., Chen, J. N., Wang, W. Z., Xu, C. G., He, L., Li, W. M., & Zhou, D. (2016). Assessment of Utilization and Cost-Effectiveness of Telemedicine Program in Western Regions of China: A 12-Year Study of 249 Hospitals Across 112 Cities. *Telemedicine and E-Health*, *22*(11), 909–920. https://doi.org/10.1089/tmj.2015.0213

World Medical Association. (2018, October 22). World Medical Association. From WMA STATEMENT ON THE ETHICS OF TELEMEDICINE: https://www.wma.net/policies-post/wma-statement-on-the-ethics-of-telemedicine/

World Health Organization. Pan American Health Organization (2016) Framework from the Implementation of Telemedicine Service. https://iris.paho.org/bitstream/handle/10665.2/28414/9789275119037_eng.pdf

Wooldridge, J. S., & Ranby, K. W. (2018). *Influence of Relationship Partners on Self-Efficacy for Self-Management Behaviors Among Adults With Type 2 Diabetes. Diabetes Spectrum, ds170069.* doi:10.2337/ds17-006