

eHealth Use and Disease Control During COVID-19 among
Diabetes Patients in China and the Philippines

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Global Health Program
in the Graduate School of Duke Kunshan University

2023

ABSTRACT

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Abstract

Background: According to the WHO 2020 NCD report, the COVID-19 pandemic disrupted diabetes care in 49% of countries. eHealth emerged as a solution to disease management challenges during the unprecedented outbreak. Due to the rapidly expanding nature of eHealth use during the pandemic, this study aimed to determine 1) the sociodemographic factors associated with eHealth during COVID-19 and 2) whether eHealth was associated with diabetes management and clinical outcomes. Methods: Using quantitative data from cross-sectional surveys from Kunshan and Taicang, China (n=309) and Manila, Philippines (n=150) (data sets uncombined), we performed Chi-squared and Fisher's exact tests and univariate logistic regressions to determine the relationship of eHealth use and sociodemographic characteristics. We then performed logistic and linear regression to determine the association of eHealth use with diabetes disease outcomes. Results: In China, younger age (p=0.02), higher education level (p=0.001), married marital status (p=0.03), suburban residence type (p=0.001), and higher household monthly income during COVID-19 (p=0.004) were associated with using eHealth. In the Philippines, younger age (p=0.009) and higher education level (p=0.01) were associated with eHealth use. eHealth use was associated with undergoing FBS testing in the last three months (OR = 2.19, 95% CI = 1.00, 4.78), undergoing HbA1c testing in the last three months (OR = 3.64, 95% CI = 1.01, 13.15), and reporting disease control per their last HbA1c test (OR = 9.98, 95% CI = 3.41, 29.18) in the Philippines, adjusting for various demographic characteristics. Conclusions: Our data indicated eHealth use could positively affect diabetes clinical and management outcomes for people with diabetes in China and the Philippines. We posit more research is needed for the impacts of eHealth on clinical outcomes as well as the methods for eHealth implementation and integration in LMIC.

Dedication

I dedicate this master's thesis to my grandparents, may they all rest in peace.

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1. Introduction

Patients living with non-communicable diseases (NCDs) like type 2 diabetes mellitus (DM) faced many challenges during the COVID-19 pandemic: decreased access to primary care and availability of lab tests,¹⁻² decreased glycemic control due to lockdown lifestyle changes,³ and financial hardship affecting disease management.⁴ Individuals living with diabetes were more likely to contract COVID-19 and had worse clinical outcomes if they did get coronavirus.⁵⁻⁶ In previous research, diabetes was considered a tracer condition for health systems and NCD care,⁷ and understanding the impacts on diabetes management during COVID-19 was a priority. In September 2020, the WHO declared, “Around half of countries reported complete or partial disruptions to diabetes and diabetic complication management services (49%), with lower-middle-income countries being somewhat more likely to report disruptions to these services than countries in all other income groups”.⁸

1.1 *Setting*

The COVID-19 pandemic disproportionately affected NCD care availability in low- and middle-income countries (LMIC).⁸ The prevalence of diabetes in China, an upper-middle-income country,⁹ was 8.12% for adults over 20 years old in 2019.¹⁰ China implemented strict city lockdowns across the nation, and a 2020 survey in China discovered 16.2% of participants with diabetes experienced difficulty accessing medication and treatment.¹¹ The prevalence of diabetes in the Philippines, a lower-middle-income country (on its way to upper-middle-income),⁹ was 5.56% in 2019.¹⁰ The Philippines also employed lockdowns to slow the spread of coronavirus, and researchers identified barriers to diabetes care during this time like gaps in follow-up and monitoring and issues with pharmacological management.¹² In both of these countries, increased attention and support was needed to address the challenges to diabetes care.¹¹⁻¹²

1.2 eHealth

One solution for bridging the gaps in care during COVID-19 was electronic-health (eHealth) and telehealth.¹³ eHealth and telehealth include telemedicine (all remote communications between patients and physicians), mobile health (m-health), electronic medical records (EMR), AI tools, and other electronic apps, devices, or software used for health.¹⁴⁻¹⁵ eHealth has become a useful tool for improving access and availability of health services during the COVID-19 pandemic.^{1,14-16} A randomized control trial in the United States showed that comprehensive eHealth care can improve a diabetic patient's health outcomes compared with a standard telemonitoring and care coordination, and supported eHealth implementation during the pandemic.¹⁷

1.3 Study Aims and Objectives

Due to the rapidly expanding nature of eHealth use during the COVID-19 pandemic, it is important to determine the factors associated with eHealth utilization in various settings. Previous studies explored the importance and impacts of eHealth use for diabetes care management using clinical trials in high- to middle- income countries in North and South America and Europe with mixed results.¹⁷⁻¹⁹ Additional research was conducted in a single-center in China, but this data only surveyed a very specific population.¹⁵ For the current research, we used recently gathered samples of diabetes patients from two middle-income countries in Asia, China and the Philippines, in order to:

1. Assess the factors associated with eHealth use in the two different countries during COVID-19; and
2. Explore the association between eHealth use and disease outcomes among patients with type 2 diabetes mellitus (DM). We determined the level of disease management based on three indicators: whether they underwent formal diabetes lab tests in the last 3 months; the

participant's most recent fasting blood sugar (FBS) score and glycated hemoglobin (HbA1c) score; and whether their disease was "controlled" per the last lab test.

2. Methods

This study used quantitative data collected for a joint project between research teams at Duke Kunshan University (Kunshan, China) and University of the Philippines (Manila, Philippines) titled “Impacts of COVID-19 on Diabetes and eHealth in the Philippines and China (ICoDe-PC).”⁴ The Chinese data were collected in Kunshan and Taicang, China from July to August 2020. The Filipino data were collected in Manila, Philippines from October 2021 to January 2022. Although, we determined that these data sets were not statistically compatible, and therefore did not combine the data sets, we chose to present the results in parallel to describe eHealth utilization in two different countries with similar samples.

2.1 *Participants*

In China, participants with hypertension or diabetes diagnoses were randomly recruited from electronic medical records in 3 cities for a larger study in 2019, but only a subset with diabetes diagnoses from two cities were given the ICoDe survey in 2020. Participants were included if they had the following criteria: (1) age ≥ 45 years; (2) diagnosis of type 2 diabetes from a registered health facility; (3) were a part of the 2019 study; (4) provided informed consent. Participants were excluded if they had the following criteria: (1) terminal illnesses; (2) current pregnancy; (3) inability to communicate with researchers verbally; (4) already had a family member enrolled in the study. The sample size of the Chinese study population was determined by the number of participants from the larger study who had diabetes diagnoses.

In the Philippines, participants who had diabetes were recruited from a larger epidemiological study in Manila and a large hospital, Philippine General Hospital with randomization and convenience sampling techniques, respectively. Participants were included if they had the following criteria: (1) age ≥ 18 years; (2) previously diagnosed with type 2 diabetes prior to January 2019 (at least 1 year before the first report of COVID-19 in the Philippines); (3)

were part of a previous epidemiological study in Manila or were receiving consultation at the Philippine General Hospital for diabetes. Participants were excluded if they had any of the following criteria: (1) were attending a diabetes specialty clinic for diabetes care; (2) unable to give informed consent. The Filipino research team assessed that the study would require a sample size of 124 for estimating the expected proportion with 5% absolute precision and 95% confidence.

2.2 Instruments

Research team members administered cross-sectional survey questionnaires to patients with diabetes in-person and over the phone in both countries. The survey questions were presented in the respective languages for the participants, and answers were later translated to English by the research teams. The surveys from China and the Philippines were not the same survey, but many of the questions were similar, and our team believed the measures reported were similar enough to compare the data subjectively for this study.

The questionnaires were primarily used to assess the types of issues brought on by the COVID-19 pandemic among patients with diabetes. Both countries' questionnaire covered demographic information, COVID-19 pandemic information, diabetes clinical characteristics, history of diabetes treatment and management, and eHealth utilization during the pandemic (See Appendix A (China) and Appendix B (Philippines)). Answers were self-reported, and participants were allowed to respond with "unknown" or abstain from answering. The surveys asked about times before the pandemic or "pre-pandemic", which was defined as any time before January 2020. All questions in the context of "during COVID" or "during the pandemic" described the period after January 2020 up to the time of the survey.

For the China data, demographics were collected from the large 2019 study and transferred to the 2020 data set using the participant's study ID. For the present study, the researchers obtained

the de-identified data sets after Duke Kunshan University Institutional Review Board (IRB) approval. The original codebooks for each data set were available for the researchers in English.

2.3 Measures

2.3.1 Demographic Characteristics

Each questionnaire asked about demographic characteristics: sex, age, highest education attained, marital status, household size, and monthly household income (pre- COVID and during- COVID). For the China data, the age variable was calculated anew for the 2020 ICoDe survey based on the previous age (originally obtained in 2019) plus 1 year; age (years) was categorized into “ ≤ 55 ,” “55-65,” “66-75,” and “ ≥ 75 ” for both data sets. The education variable was categorized into “Primary School or Less,” “Middle/High School,” and “Vocational School or College.” Marital status was categorized into “Single” (including never married, widowed, divorced, or other) and “Married.” Household size (total people) was grouped into “1-2,” “3-5,” and “6+.” For China, an additional question about residence type was included; this was separated into “Suburban” and “Urban.”

All income measurements reported for this study were approximate. The Pre-COVID household monthly income level (based on the reported income in 2019 for Chinese participants or recalled by the Filipino participants at the time of the survey) and COVID household monthly income level were standardized into “Low Income,” “Middle Income,” and “High Income” due to the differing distribution of absolute incomes in the separate countries. For this study, “Low Income” participants had household monthly income of $\leq 5,000$ Chinese Yuan (CNY) ($\sim \$775$ USD) in China and $\leq 5,000$ Philippine Peso (PHP) ($\sim \$100$ USD) in the Philippines. “Middle Income” participants had household monthly incomes between 5,000-15,000 CNY ($\sim \$775$ - $\$2325$ USD) or between 5,000-20,000 PHP ($\sim \$100$ - $\$400$ USD). “High Income” participants had household monthly incomes 15,000+ CNY ($\sim \$2325$ + USD) or 20,000+ PHP ($\sim \$400$ + USD).

2.3.2 Diabetes Clinical and Management Outcomes

Participants were asked to self-report their disease status and various clinical characteristics. Participants reported the number of years since their diabetes diagnosis, whether they had hypertension, the types of DM medication they used, the time (in months) since their last fasting blood sugar (AKA fasting blood glucose, FBS) test and glycated hemoglobin (HbA1c) test, the exact values of their last FBS and HbA1c tests (if they remembered), or if they remembered if their diabetes was “Uncontrolled” or “Controlled” at their last FBS and HbA1c (separately). FBS and HbA1c tests are common formal blood tests for DM and should be obtained at regular intervals; physicians use these diagnostic tests to diagnose and monitor DM and set treatment goals based on the lab results and condition of the patient.²⁰

For the Chinese data, the diabetes duration variable was calculated anew for the 2020 ICoDe survey based on the previous reported duration (originally obtained in 2019) plus 1 year. The hypertension variable was categorized as “No” or “Yes”; if participants answered “No,” they may still have had other comorbidities. Diabetes medications were categorized as “Insulin Injection,” “Oral Hypoglycemic Agents (OHAs),” “Both,” or “Other Medication/Unspecified.” Participants were asked to report the months since their last FBS and HbA1c, and answers were grouped into “3+,” “0-3,” or “Unrecalled/Unanswered.” Participants were asked to self-report an exact value for their last FBS (mmol/L) or HbA1c (%) test, although many participants were unable to recall exact amounts. No matter if a participant recalled the exact amount of their last diabetes lab tests, they were asked to self-report if their diabetes was “Uncontrolled” or “Controlled” based on the results of their last test.

This study assumed that a FBS level of 7 mmol/L or higher indicated “Uncontrolled” diabetes, and an HbA1c 6.5% or higher indicated “Uncontrolled” diabetes per the medical guidelines for diabetes.²⁰ This cutoff was a very strict measurement and patients could have had a

higher target lab value for their diabetic care plan. For this study, participants were categorized as “Uncontrolled” based on their self-reported answers to the “Uncontrolled”/“Controlled” variable AND based on their actual lab value (giving priority to the lab value if reported). Although participants with unknown lab values or unrecalled diabetes control could have “Controlled” disease, we included these people in the “Uncontrolled” group to maintain a strict cutoff for DM control.

2.3.3 eHealth Utilization

The two surveys asked about internet access, the types of devices available, and eHealth use during COVID-19. Internet access was defined as “None” or “Home Internet or Mobile Data.” Devices were grouped in “None,” “Phone (shared or personal),” “Computer/Tablet (shared or personal),” or “Both;” the “Computer” and “Both” categories were only included in the Filipino survey. To be categorized as “Used eHealth” Chinese participants needed to answer “yes” to “Used eHealth since COVID-19?” OR “Used mobile health APP for DM/HTN control/management?” questions, and Filipino participants needed to respond “yes” to “Used eHealth in the last 6 months [i.e. during COVID-19].”

2.4 Analysis

The two data sets were kept separate throughout the statistical analysis. The country’s respective questionnaires were created independently and were not intended to be statistically compared; due to the different sampling methods and different measurements in the data sets, we did not believe cross-country analysis was appropriate. Demographic, diabetes outcomes, and eHealth utilization measures were summarized into proportions (%), and we used means (standard deviation) to summarize continuously distributed data.

2.4.1 Demographics and eHealth Use

To answer study Aim 1, we performed bivariate analysis of proportions (Chi-squared tests and Fisher's exact test) to assess the association between demographic characteristics for those who used eHealth and those who did not use eHealth during COVID-19. We determined the strength of each univariate association using logistic regression with eHealth use as the outcome variable.

2.4.2 eHealth Use and Diabetes Outcomes

To address study Aim 2, we first performed Chi-squared and Fisher's exact tests to explore the association between eHealth users vs. non-users and diabetes clinical factors. Next, we used logistic regression analysis with outcome variables "FBS Test in the Last 3 Months," "DM Controlled per Last FBS," "HbA1c Test in the Last 3 Months," and "DM Controlled per Last HbA1c." Finally, we used linear regressions to test the association between the lab values of FBS/HbA1c tests and eHealth utilization.

We tested four models to determine the association between diabetes clinical factors and eHealth utilization. Models were identical for both countries, and adjustment variables were chosen for the models regardless of significant association with eHealth. Missing observations were not accounted for in the statistical analysis. Model 1 was the crude association of eHealth with the outcomes. Model 2 adjusted for participant sex and age. Model 3 adjusted for participant sex, age, and education. Model 4 adjusted for participant sex, age, education, pre-COVID income, and during-COVID income. We observed a change in income level distribution between the two income variables and decided to include both in the models. All statistical tests were conducted using 95% confidence intervals (CI). The statistical significance threshold was set at $\alpha \leq 0.05$. All statistical analyses were performed using Stata 17.²¹

3. Results

3.1 *Demographics, Clinical Characteristics, and eHealth Utilization Summary*

The ICoDe-PC researchers recruited 309 individuals in China and 150 people in the Philippines (Table 1). Most participants in China were female, 55-65 years old, married, completed only primary school, from a suburban area, lived with 3-5 people, and had middle-income level households (before and after COVID-19). Most participants from the Philippines were female, 55-65 years old, married, completed at least middle school, lived with 3-5 people, and had middle-income level households (before and after COVID-19).

Table 1. Participant demographic and socioeconomic characteristics from China and the Philippines (2020-2022).

Demographics	China n=309	Philippines n=150
Sex		
Male	47.6%	29.3%
Female	52.1%	70.7%
Age (Years)		
<55	10.7%	24.0%
55-65	45.0%	41.3%
66-75	39.2%	31.3%
≥76	4.9%	3.3%
Education		
Primary School or Less	55.7%	8.7%
Middle/High School	30.7%	50.0%
Vocational School or College	13.3%	41.3%
Marital Status		
Single	10.4%	41.3%
Married	89.6%	58.7%
Residence Type		
Suburban	57.6%	N/A
Urban	42.4%	N/A
Household Size (Total People)		
1-2	40.8%	20.0%
3-5	52.4%	48.0%
6+	6.8%	32.0%
Pre-COVID Household Monthly Income Level (2019)^a		
Low Income	31.4%	6.0%
Middle Income	40.5%	59.3%
High Income	12.3%	17.3%
Unknown	15.9%	17.3%

Demographics	China n=309	Philippines n=150
COVID Household Monthly Income Level (2020-2022) ^a		
Low Income	20.4%	17.3%
Middle Income	58.6%	50.7%
High Income	21.0%	13.3%
Unknown	0.0%	18.7%

Abbreviations: N/A, non-applicable

^a Income level is different for each country based on respective distribution of absolute incomes.

Clinically, many participants had uncontrolled type 2 diabetes mellitus (Table 2). On average, the Chinese participants had a DM diagnosis for over 9 years, and the Filipino population had DM diagnosis for over 12 years. Most of the participants from the two countries had hypertension as well as DM and used oral hypoglycemic agents for treatment. 270 Chinese participants remembered their last FBS value, and 71 remembered their last HbA1c value. 58 Filipino participants reported their last FBS value, and 15 reported their last HbA1c value. The Chinese population had lower average FBS (7.78 mmol/L) and HbA1c (7.38%) test values than the Filipino participants (9.94 mmol/L and 7.74%, respectively). In China, most participants took an FBS test within 3 months of the survey (98.7%) but did not have an HbA1c test within 3 months (33.0%). About 44% of Chinese participants were categorized as “DM Controlled per Last FBS,” and approximately 11% had “DM Controlled per Last HbA1c.” In the Philippines, 62.0% of participants had FBS test within 3 months of the survey, but 55.3% of participants forgot when their last HbA1c test was. About 33% of Filipino participants were categorized as “DM Controlled per Last FBS,” and approximately 25% had “DM Controlled per Last HbA1c.” Many participants from both countries did not report or could not recall their last test values.

Table 2. Clinical diabetes characteristics for participants from China and the Philippines (2020-2022).

Diabetes Clinical Characteristics	China n=309	Philippines n=150
Duration of DM Diagnosis (Years)		
Mean (SD)	9.16 (6.63)	12.82 (8.05)
Hypertension		
No	29.8%	34.7%
Yes	70.2%	65.3%
DM Medication		
Insulin Injection	4.2%	7.3%
OHAs	77.3%	78.0%
Both	11.0%	14.7%
Other Med / Unspecified	7.4%	0.0%
Time Since Last FBS (Months)		
3+	1.3%	15.3%
0-3	98.7%	62.0%
Unrecalled/Unanswered	0.0%	22.7%
Value of Last FBS (If Remembered) (mmol/L) CH n=270, PH n=58		
Mean (SD)	7.78 (2.19)	9.94 (5.04)
DM Control per Last FBS^a		
Uncontrolled/Unknown	55.7%	67.3%
Controlled	44.3%	32.7%
Time Since Last HbA1c (Months)		
3+	67.0%	10.7%
0-3	33.0%	34.0%
Unrecalled/Unanswered	0.0%	55.3%
Value of Last HbA1c (If Remembered) (%) CH n=71, PH n=15		
Mean (SD)	7.38 (1.12)	7.74 (3.12)
DM Control per Last HbA1c^a		
Uncontrolled/Unknown	88.7%	75.3%
Controlled	11.3%	24.7%

Abbreviations: CH, China; DM, Type 2 Diabetes Mellitus; FBS, Fasting blood sugar test; HbA1c, glycated hemoglobin test; OHAs, Oral Hypoglycemic Agents; PH, The Philippines; SD, Standard deviation

^a DM control is determined by self-reported answers to a “DM controlled or uncontrolled per last test?” question AND based on their actual lab value

There were few participants who used eHealth during COVID-19 (Table 3). For eHealth, 40% of Chinese participants had mobile data or wireless internet access; conversely, 97% of the Filipino participants had internet access. Most of the participants from both countries had mobile or landline phones. In China, 11.3% of individuals used eHealth during COVID-19. In the Philippines, 34.0% of participants used eHealth during COVID-19.

Table 3. eHealth utilization measures for participants in China and the Philippines (2020-2022).

eHealth Utilization	China n=309	Philippines n=150
Internet Access		
None	59.2%	2.7%
Home Internet or Mobile Data	40.8%	97.3%
Gadgets		
None	8.7%	0.7%
Phone (Personal or Shared)	91.3%	70.7%
Computer/Tablet (Personal or Shared)	N/A	2.7%
Both	N/A	26.0%
Used eHealth/ Telemedicine Since COVID		
No	88.7%	66.0%
Yes	11.3%	34.0%

Abbreviations N/A, non-applicable

3.2 Sociodemographic Factors and eHealth Use

Using Chi-squared and Fisher exact tests, we observed eHealth use was significantly associated with various demographic characteristics (Table 4). In China, age ($p=0.02$), education level ($p=0.001$), marital status ($p=0.03$), residence type ($p=0.001$), and monthly household income during COVID-19 ($p=0.004$) were associated with using eHealth. In the Philippines, age ($p=0.009$) and education level ($p=0.01$) were associated with eHealth use.

Table 4. Selected characteristics of eHealth users vs. non-eHealth users in China and the Philippines (2020-2022).

Demographics	China		p-value	Philippines		p-value
	No eHealth use (n=274) (row %)	Used eHealth (n=35) (row %)		No eHealth use (n=99) (row %)	Used eHealth (n=51) (row %)	
Sex^b						
Male	86.4	13.6	0.2	66.0	34.0	1.0
Female	90.7	9.3		65.9	34.1	
Age (Years)^a						
<55	75.8	24.2	0.02*	44.4	55.6	0.009*
55-65	86.3	13.7		67.7	32.3	
66-75	93.4	6.6		78.7	21.3	
≥76	100.0	0.0		80.0	20.0	
Education^b						
Primary School or Less	94.8	5.2	0.001*	53.9	46.2	0.01*
Middle/High School	82.1	17.9		77.3	22.7	
Vocational School or College	78.1	22.0		54.8	45.2	

	China			Philippines		
	No eHealth use (n=274) (row %)	Used eHealth (n=35) (row %)	p-value	No eHealth use (n=99) (row %)	Used eHealth (n=51) (row %)	p-value
Demographics						
Marital Status ^{CHa, PHb}						
Single	100.0	0.0	0.03*	72.6	27.4	0.2
Married	87.4	12.6		61.4	38.6	
Residence Type ^b						
Suburban	83.7	16.3	0.001*	N/A	N/A	N/A
Urban	95.4	4.6				
Household Size (Total People) ^{CHa, PHb}						
1-2	88.9	11.1	0.7	66.7	33.3	0.9
3-5	87.7	12.4		63.9	36.1	
6+	95.2	4.8		68.8	31.3	
Pre-COVID Household Monthly Income Level ^c (2019) ^{CHb, PHa}						
Low Income	89.7	10.3	0.2	44.4	55.6	0.5
Middle Income	87.2	12.8		62.9	37.1	
High Income	79.0	21.1		57.7	42.3	
COVID Household Monthly Income Level ^c (2020-2021) ^a						
Low Income	98.4	1.6	0.004*	42.3	57.7	0.08
Middle Income	87.9	12.2		67.1	32.9	
High Income	81.5	18.5		55.0	45.0	

Abbreviations: CH, China; N/A, non-applicable; PH, The Philippines

* Statistical significance ($\alpha = 0.05$)

^a Performed Fisher's exact test

^b Performed Chi-squared test

^c Income level is different for each country based on respective distribution of absolute incomes.

The relationship between younger age and eHealth use is visually apparent in Figure 1. We observed fewer eHealth users in older age categories with no eHealth users of age 76+ in China. In Figure 2, we see more eHealth users had higher education levels. In the Philippines, we see a break in the pattern based on proportions due to the small group of people in the “Primary School or Less” category.

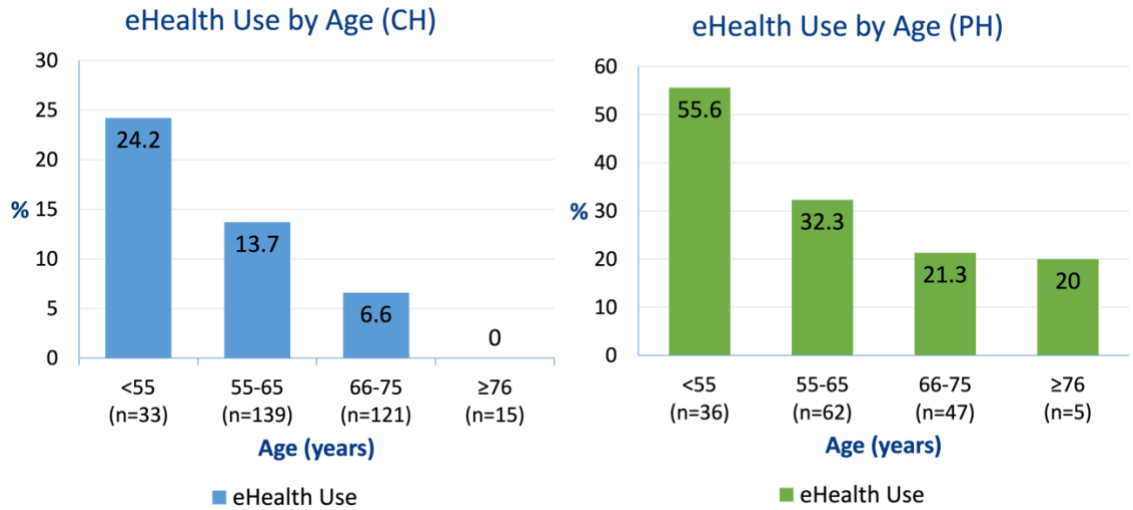


Figure 1. Proportion of eHealth users by age category in China and the Philippines.

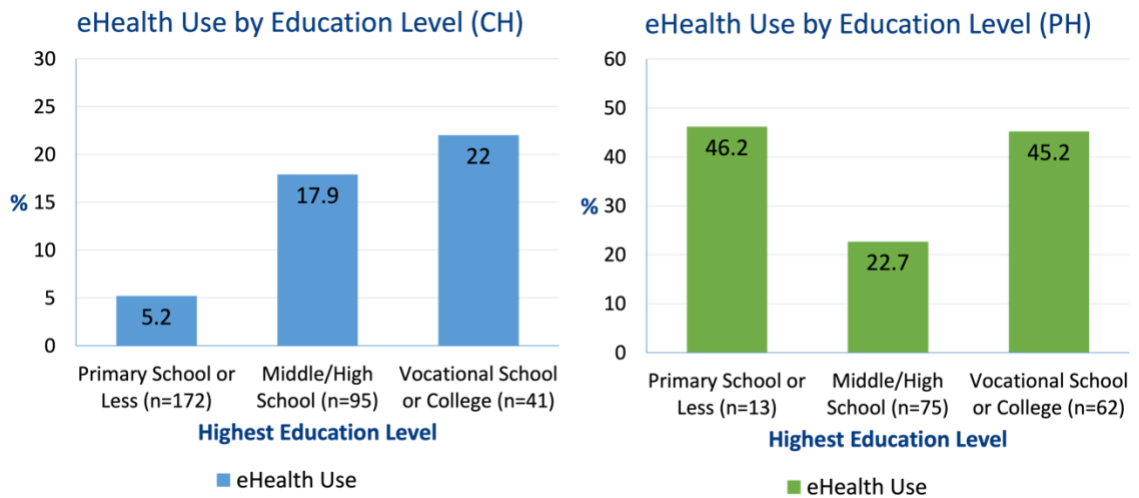


Figure 2. Proportion of eHealth users by education level in China and the Philippines.

We determined the strength of the associations between demographic factors and eHealth use using univariate logistic regression (Table 5). When reporting odds ratios for the associations, we found some changes in significance depending on the subgroups. In China, only age group 66-75 showed significant odds, indicating that those with older age had 0.22 (CI 0.08, 0.65) times the odds of eHealth use compared to the reference group. All categories of education level and household income during COVID-19 had significant higher odds of eHealth use compared to the

reference group. Chinese urban residents had 0.25 (CI 0.10, 0.61) times the odds of eHealth use than suburban residents. In the Philippines, age groups 55-65 (OR=0.38, CI 0.16, 0.89) and 66-75 (OR=0.22, CI 0.08, 0.56) had significant lower odds of eHealth use than the reference group. We note that the middle-income during COVID-19 category for the Philippines had significant lower odds of eHealth use (OR=0.36, CI 0.14, 0.90); however, the overall variable was not significantly associated with eHealth use.

Table 5. Estimated odds ratios (95% CI) from univariable logistic regression models for eHealth use in China and the Philippines during COVID-19 (2020-2022).

Demographics	China		Philippines	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Sex				
Male	Ref.	-	Ref.	-
Female	0.65 (0.32, 1.33)	0.2	0.99 (0.47, 2.09)	0.99
Age (Years)				
<55	Ref.	-	Ref.	-
55-65	0.49 (0.19, 1.26)	0.1	0.38 (0.16, 0.89)	0.03*
66-75	0.22 (0.08, 0.65)	0.006*	0.22 (0.08, 0.56)	0.002*
≥76	N/A ^b	-	0.20 (0.02, 1.97)	0.17
Education				
Primary School or Less	Ref.	-	Ref.	-
Middle/High School	3.95 (1.68, 9.25)	0.002*	0.34 (0.10, 1.15)	0.8
Vocational School or College	5.09 (1.88, 13.83)	0.001*	0.96 (0.29, 3.19)	0.9
Marital Status				
Single	Ref.	-	Ref.	-
Married	N/A ^b	-	1.67 (0.82, 3.37)	0.2
Residence Type				
Suburban	Ref.	-	N/A	-
Urban	0.25 (0.10, 0.61)	0.003*	N/A	-
Household Size (Total People)				
1-2	Ref.	-	Ref.	-
3-5	1.13 (0.54, 2.33)	0.7	1.13 (0.46, 2.78)	0.8
6+	0.40 (0.05, 3.21)	0.4	0.91 (0.34, 2.41)	0.8
Pre-Covid Household Monthly Income Level (2019)^a				
Low Income	Ref.	-	Ref.	-
Middle Income	1.28 (0.55, 2.95)	0.6	0.47 (0.12, 1.88)	0.3
High Income	2.32 (0.84, 6.42)	0.1	0.59 (0.13, 2.70)	0.5
Covid Household Monthly Income Level (2020-2022)^a				
Low Income	Ref.	-	Ref.	-
Middle Income	8.58 (1.13, 65.02)	0.04*	0.36 (0.14, 0.90)	0.03*
High Income	14.04 (1.77, 111.55)	0.01*	0.60 (0.19, 1.94)	0.4

Abbreviations: CH, China; CI, confidence interval; N/A, non-applicable; OR, odds ratio; PH, The Philippines; Ref., reference group

* Statistical significance ($\alpha = 0.05$)

^a Income level is different for each country based on respective distribution of absolute incomes.

^b No participants in this category, OR is non-applicable

3.3 eHealth Use and Diabetes Outcomes

For China (Table 6), we observed more people in the “Used eHealth” group had an FBS test in the last 3 months (100%), had lower average FBS value (7.57 mmol/L, n=35), and more were categorized as “DM Controlled per Last FBS” (54.3%) than non-users. For the Philippines, we noticed the same trend for FBS testing within 3 months (83.7%), FBS value (8.10 mmol/L, n=14), and DM control (43.1%). None of these proportions were significantly different between eHealth users and non-users except for measuring DM control per last FBS test in the Philippines (p=0.05).

For our Chinese participants, we saw fewer eHealth users had HbA1c tests in last 3 months (28.6%), lower HbA1c values (7.88%, n=6), and fewer were categorized as “DM Controlled per Last HbA1c” (8.6%) versus non-users (Table 7). In the Philippines, we observed more participants with eHealth use had an HbA1c test in the last three months (83.3%) and more of them had “DM controlled per last HbA1c” (43.1%) compared to non-users. The reported HbA1c values were higher on average for Filipino eHealth users (8.09%, n=11) compared to non-users. The only significant difference in proportions was for measuring DM control per last HbA1c in the Philippines (p<0.001).

Table 6. Proportions and bivariate association between eHealth use and diabetes clinical factors – fasting blood sugar tests.

	FBS Test in Last 3 Months (Row %)	p-value	Value of Last FBS (Mean, SD)	DM Control per FBS ^a (Row %)	p-value
China	(n=309)			(n=309)	
No eHealth Use	98.5%	-	7.82 (0.14) ^d	43.1%	-
Used eHealth	100%	1.0 ^b	7.57 (0.45) ^e	54.3%	0.2 ^c
Philippines	(n=116)			(n=150)	
No eHealth Use	77.6%	-	10.53 (0.80) ^f	27.3%	-
Used eHealth	83.7%	0.4 ^c	8.10 (1.01) ^g	43.1%	0.05^{*c}

Abbreviations: DM, Diabetes Mellitus; FBS, Fasting blood sugar test; SD, Standard deviation

* Statistical significance ($\alpha = 0.05$)

^a DM control is determined by self-reported answers to a “DM controlled or uncontrolled per last test” question AND based on their actual lab value

^b Performed Fisher’s exact test

^c Performed Chi-squared test

^{d,e} n=235, n=35

^{f,g} n=44, n=14

Table 7. Proportions and bivariate association between eHealth use and diabetes clinical factors – glycosylated hemoglobin tests.

	HbA1c Test in Last 3 Months (Row %)	p-value	Value of Last HbA1c (Mean, SD)	DM Control per HbA1c ^a (Row %)	p-value
China	(n=309)			(n=309)	
No eHealth Use	33.6%	-	7.33 (0.14) ^d	11.7%	-
Used eHealth	28.6%	0.6 ^c	7.88 (0.56) ^e	8.6%	0.8 ^b
Philippines	(n=67)			(n=150)	
No eHealth Use	64.0%	-	6.79 (0.81) ^f	12.1%	-
Used eHealth	83.3%	0.07 ^c	8.09 (1.06) ^g	49.0%	p<0.001^{*c}

Abbreviations: DM, Diabetes Mellitus; HbA1c, glycosylated hemoglobin test; SD, Standard deviation

* Statistical significance ($\alpha = 0.05$)

^a DM control is determined by self-reported answers to a “DM controlled or uncontrolled per last test” question AND based on their actual lab value

^b Performed Fisher’s exact test

^c Performed Chi-squared test

^{d,e} n=65, n=6

^{f,g} n=4, n=11

Using logistic and linear regression models, the data showed mixed results of whether eHealth users were more likely to have better clinical outcomes and disease management. For China, we were unable to calculate the odds ratio for FBS timing for eHealth users due to the sample: 100% of eHealth users had a FBS test in the last 3 months. For the Philippines, we were unable to perform a linear regression of HbA1c value predicted by eHealth because the sample size was too small ($n \leq 15$).

In China (Table 8), without adjusting for demographic variables, participants who used eHealth had 1.56 (0.77, 3.18) times the odds of having DM control based on their last FBS test and their FBS value was 0.25 mmol/L (-1.03, 0.53) less than those who did not use eHealth. Participants with eHealth use had 0.79 (0.36, 1.72) times the odds of having an HbA1c test in the last 3 months and 0.71 (0.21, 2.45) times the odds of having DM control per their last HbA1c; they would also have 0.56% (-0.40, 1.51) higher HbA1c value than eHealth non-users. The reference group's last test values were approximately 7.82 mmol/L FBS and 7.33% HbA1c. When using different models to adjust for demographic characteristics in China, the ORs and coefficients described the same relationship with eHealth. None of the odds ratios nor beta coefficients for the Chinese data models were statistically significant.

In the Philippines (Table 9), without adjusting for demographic variables, participants who used eHealth had 1.48 (0.57, 3.83) times the odds of taking a FBS test in the last 3 months, 2.02 (1.00, 4.11) times the odds of having DM control per their last FBS test, 2.81 (0.89, 8.89) times the odds of having HbA1c test in the last 3 months, and 6.97 (3.08, 15.76) times the odds of having DM control per their last HbA1c than eHealth non-users. The eHealth users' FBS values were 2.42 mmol/L (-5.48, 0.63) less than those who did not use eHealth. The reference group's last test values were approximately 10.53 mmol/L FBS.

For Filipino Models 2 and 3, the odds ratio of getting an HbA1c test in the last three months was significantly higher for eHealth users than non-eHealth users, 3.46 (1.02, 11.79) and 3.64 (1.01, 13.15), respectively. Models 2 and 3 also showed significant higher odds of having DM control per last FBS with eHealth use, 2.46 (1.15, 5.26) and 2.19 (1.00, 4.78), respectively. For all four models, the odds of eHealth users having DM control per last HbA1c test was significantly higher than the reference group. No other odds ratios nor beta coefficients for the Filipino data models were statistically significant.

Table 8. The relationship between eHealth use and diabetes management outcomes in China during COVID-19 (2020), adjusting for demographic characteristics.^{a, b}

China Model^c	Value of Last FBS ^{d,e}	DM Control per FBS ^{f,g}	HbA1c Test in Last 3 Months ^f	Value of Last HbA1c ^{d,e}	DM Control per HbA1c ^{f,g}
Model 1					
No eHealth Use	7.82 (7.53, 8.10)	Ref.	Ref.	7.33 (7.05, 7.61)	Ref.
Used eHealth	-0.25 (-1.03, 0.53)	1.56 (0.77, 3.18)	0.79 (0.36, 1.72)	0.56 (-0.40, 1.51)	0.71 (0.21, 2.45)
Model 2					
No eHealth Use	-	Ref.	Ref.	-	Ref.
Used eHealth	-0.33 (-1.13, 0.48)	1.68 (0.81, 3.45)	0.76 (0.35, 1.68)	0.43 (-0.55, 1.41)	0.75 (0.21, 2.66)
Model 3					
No eHealth Use	-	Ref.	Ref.	-	Ref.
Used eHealth	-0.26 (-1.08, 0.56)	1.67 (0.80, 3.49)	0.67 (0.30, 1.50)	0.54 (-0.55, 1.62)	0.75 (0.21, 2.69)
Model 4					
No eHealth Use	-	Ref.	Ref.	-	Ref.
Used eHealth	-0.17 (-1.00, 0.65)	1.79 (0.83, 3.89)	0.86 (0.36, 2.05)	0.53 (-0.75, 1.81)	0.84 (0.22, 3.21)

Abbreviations: DM, Diabetes Mellitus; FBS, Fasting blood sugar test; HbA1c, glycated hemoglobin test; Ref., reference group

* $p \leq 0.05$

^a Sample size changed for each model due to missing values.

^b We were unable to obtain models for comparing eHealth with FBS Test in Last 3 Mo due to the disproportionate data (100% participants had FBS test in last 3 months)

^c Model 1 measures eHealth association with outcome without adjustment; Model 2 adjusted for sex and age; Model 3 adjusted for sex, age, and education; Model 4 adjusted for sex, age, education, pre-COVID income, and during-COVID income.

^d Intercepts and coefficients from linear regression (95%CI)

^e intercepts for models 2-4 not reported since intercepts are not comparable after adjustment.

^f Odds ratio from logistic regressions (95%CI)

^g DM control is determined by self-reported answers to a “DM controlled or uncontrolled per last test” question AND based on their actual lab value

Table 9. The relationship between eHealth use and diabetes management outcomes in the Philippines during COVID-19 (2021-2022), adjusting for demographic characteristics. ^{a,b}

Philippines Model^c	FBS Test in Last 3 Months ^d	Value of Last FBS ^{e,f}	DM Control per FBS ^{d,g}	HbA1c Test in Last 3 Months ^d	DM Control per HbA1c ^{d,g}
Model 1					
No eHealth Use	Ref.	10.53 (9.03, 12.03)	Ref.	Ref.	Ref.
Used eHealth	1.48 (0.57, 3.83)	-2.42 (-5.48, 0.63)	2.02* (1.00, 4.11)	2.81 (0.89, 8.89)	6.97* (3.08, 15.76)
Model 2					
No eHealth Use	Ref.	-	Ref.	Ref.	Ref.
Used eHealth	1.85 (0.66, 5.18)	-2.41 (-5.49, 0.66)	2.46* (1.15, 5.26)	3.46* (1.02, 11.79)	7.79* (3.22, 18.82)
Model 3					
No eHealth Use	Ref.	-	Ref.	Ref.	Ref.
Used eHealth	1.68 (0.59, 4.84)	-1.70 (-4.99, 1.59)	2.19* (1.00, 4.78)	3.64* (1.01, 13.15)	7.30* (2.94, 18.10)
Model 4					
No eHealth Use	Ref.	-	Ref.	Ref.	Ref.
Used eHealth	1.91 (0.59, 6.21)	-0.84 (-5.30, 3.63)	2.19 (0.92, 5.20)	2.41 (0.52, 11.21)	9.98* (3.41, 29.18)

^a Abbreviations: DM, Diabetes Mellitus; FBS, Fasting blood sugar test; HbA1c, glycated hemoglobin test; Ref., reference group

^{*} $p \leq 0.05$

^a Sample size changed for each model due to missing values.

^b We were unable to obtain models for comparing eHealth with Value of last HbA1c due to the extremely small sample size $n \leq 15$.

^c Model 1 measures eHealth association with outcome without adjustment; Model 2 adjusted for sex and age; Model 3 adjusted for sex, age, and education; Model 4 adjusted for sex, age, education, pre-COVID income, and during-COVID income.

^d Odds ratio from logistic regressions (95%CI)

^e Intercepts and coefficients from linear regression (95%CI)

^f intercepts for models 2-4 not reported since intercepts are not comparable after adjustment.

^g DM control is determined by self-reported answers to a “DM controlled or uncontrolled per last test” question AND based on their actual lab value

Figure 3 and 4 show the estimated odds ratios and 95% CI for DM control per last FBS and HbA1c test, respectively. Models that are statistically significant are demarcated with an asterisk (*), and the CI does not cross the null (1). In Figure 3, we note the OR are not statistically significant, but the confidence intervals are shifted above the null and may suggest significance.

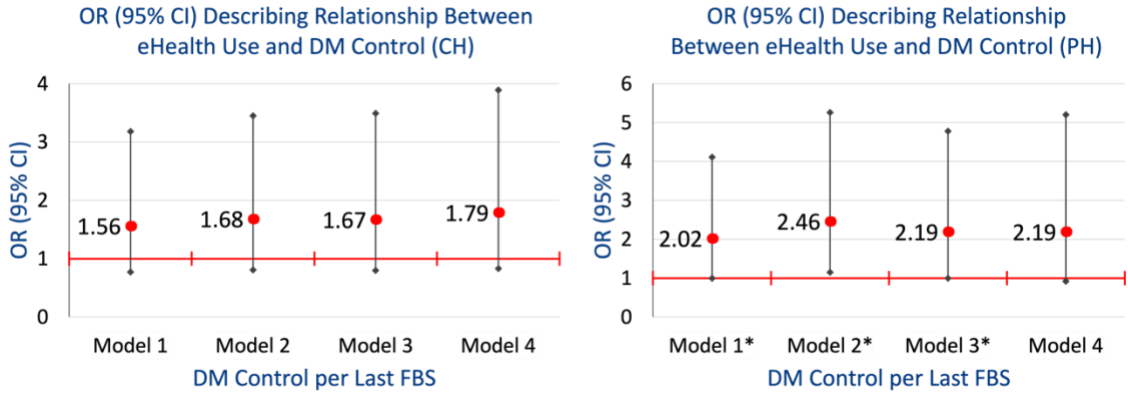


Figure 3. Odds ratios and 95% CI of DM Control per Last FBS with eHealth Use in China and the Philippines.

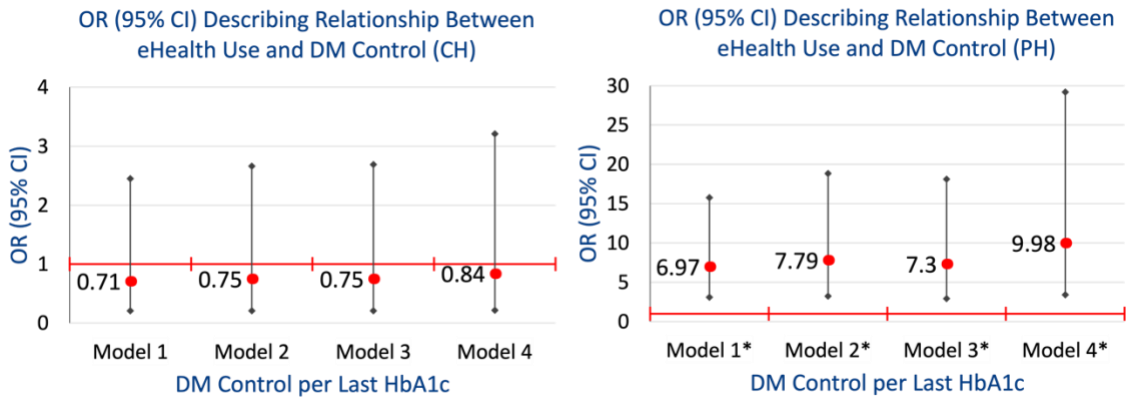


Figure 4. Odds ratios and 95% CI of DM Control per Last HbA1c with eHealth Use in China and the Philippines.

4. Discussion

4.1 *Factors Associated with eHealth*

In this study, we aimed to determine the factors associated with eHealth use in China and the Philippines during COVID-19. Our data showed age and highest education level were significantly associated with eHealth use among diabetic patients in both countries. A higher proportion of adults 65 or younger used eHealth; this is explained by younger generations' increased eHealth and social media literacy.²² Those with higher education may have had higher technological literacy and more experience or comfort with devices or software that lead to higher eHealth usage.

In China, suburban residence type, married marital status, and higher monthly income during COVID-19 were also significantly associated with eHealth use. We found that the Chinese suburban residents had higher average income level than urban residents, which could have led to more access to internet or devices; therefore, higher income and suburban participants were more likely to have higher eHealth use. This supports previous findings that areas with more resources and better digital infrastructure are more likely to use eHealth.¹³¹⁴

Of note, during logistic regression analysis, we observed middle-income level during COVID-19 had significant lower odds of eHealth use (compared to low-income level) in the Philippines, but the overall variable was not significantly associated with eHealth use. This may indicate that eHealth is associated with income in the Philippines, but we were unable to detect significance due to the sample size. Additionally, we see a difference in results here, which we suspect came from the difference in sampling methods or may reflect true differences between the countries. An analysis with combined data would have allowed us to determine if the strength of the associations with age and education were the same for both countries; however, many variables were not able to be easily standardized for cross-country analysis.

4.2 *eHealth and Diabetes Outcomes*

Our second aim was to determine if eHealth was associated with diabetes management or disease status during COVID-19 in China and the Philippines. Using the time since the last FBS and HbA1c tests as a measurement of DM management, we observed no significant association with eHealth use. In the Philippines, a significantly higher proportion of eHealth users had DM control per their last FBS and HbA1c tests. Just by observing proportions, the data showed more eHealth users had FBS test in last 3 months and had controlled DM at their last FBS test than non-users. The data showed a shift in this pattern for HbA1c in China: fewer eHealth users had HbA1c tests in the last 3 months and DM control per HbA1c than non-users. In both countries, the average FBS value was lower for those who used eHealth, but, contrary to our hypothesis, the HbA1c value was higher for those who used eHealth. We suspect this may be a result of the small sample size and not generalizable across the populations (note the small n for Table 4 values), especially in the Philippines where more eHealth users had DM control per their last HbA1c.

The linear and logistic regression models supported our association calculations. For China, the data showed a lower FBS value for eHealth users and a higher odds of DM control per FBS. We also saw lower odds of getting HbA1c test in the last 3 months, higher HbA1c value with eHealth use, and worse odds of DM control per HbA1c. We noted the CIs for “HbA1c Test in Last 3 Months” and “DM control per Last FBS” and “...HbA1c” seemed to be shifted away from the null value and concluded these results are suggestively significant and indicate better diabetes clinical outcomes and management for eHealth users.

After adjusting for various demographic characteristics in the linear regressions (test value outcomes), we can see the strength of the association between eHealth and the outcomes decreased. We can attribute this to the confounding effect of the demographic variables, especially age and education considering their significant association with eHealth. Many logistic models showed a

higher OR after adjusting for sex and age (Model 2); this was a result of the negative relationship between age and eHealth use. When adding education to Model 3, we noticed the ORs generally decreased again, denoting that education has a positive relationship with eHealth use and was likely a confounding variable. Finally, when adding income (before and after COVID) to Model 4, we observed another fluctuation in the OR. The final OR for the odds of getting an FBS or HbA1c test in the last 3 months or having DM control for eHealth users was higher than the crude value, but we observed a 95%CI positively skewed away from the null, which suggested a possible positive relationship between eHealth use and better DM management.

For our analysis, participants who did not recall their lab value or did not answer the question of DM control per their last lab tests were combined with the “Uncontrolled” group. This increased the number of data points in the “Uncontrolled” group and may have influenced our data. We used this method in order to have strict limits for DM “Control,” although some people with unknown control could have had normal lab values at their last tests. We also consider that these missing data points could be an indication of poor DM management; patients with good DM treatment and follow-up with their providers would likely have remembered if their last value was normal. If our population of diabetic patients were unable to remember their last lab tests, this may also be a reflection of barriers or disruptions to diabetes care during COVID-19.

Most previous control trials have shown eHealth interventions can improve FBS and HbA1c levels of diabetic patients during COVID-19,^{15-17,19} and our data supports this for FBS and HbA1c in the Philippines. Our results from China may suggest better DM management for eHealth users based on the shifted CI, and this continues to follow previous studies. However, we were unable to determine if eHealth use was related to better HbA1c and DM control per HbA1c in China. We suspect there could have been unaccounted confounding causing this pattern, or this could represent no relationship between eHealth use and HbA1c values for this population.

Additionally, there is a possibility of reverse causality in this situation: people with poor HbA1c values or worse DM management may use eHealth more. Finally, there is the possibility that eHealth could lead to worse DM management if eHealth users obtained false information or were discouraged from getting tested or going to their follow-ups. We are unable to prove causality in this study and cannot provide a firm justification for this phenomenon.

Overall, for both countries, the data indicated that eHealth users from the two countries were more likely to have better DM control and management. Of note: For all models, the intercept value of the last FBS and HbA1c tests would be considered above the “normal” lab values, and clinically would still need treatment and regular monitoring.²⁰ Previous studies from the US and Italy,^{17,19} both high-income countries,⁹ described eHealth interventions that improved DM outcomes for patients during COVID-19, and our data also suggested people living with DM in middle-income countries may also benefit from eHealth during the pandemic. The populations surveyed had variable access to internet and electronic devices, which may have affected the overall eHealth use of the participants. Surveys of the emergence of eHealth around the world noted communication and technology infrastructure and financial resources were barriers to eHealth use in many countries, especially those with limited access before the pandemic.¹³ We found that income level during COVID-19 was associated with eHealth use, and thus believe that this may be a barrier to large scale implementation in LMIC health systems.

4.3 Study Strengths and Limitations

This study was able to summarize the use of eHealth in two Asian middle-income countries based on cross-sectional data; however, there were some noteworthy limitations. Our sampling methods from larger epidemiological studies may have introduced bias and using sampling weights for future analyses may be prudent. The surveys conducted in China and the Philippines obtained data at one point in time and may have been affected by participant recall bias. We were unable to

determine causal relationships based on the cross-sectional data. Due to the limited sample size of eHealth users, we had limited ability to detect statistical significance for regressions, and our conclusions cannot be confidently generalized to larger populations. Lastly, we couldn't statistically compare country data, but we kept the comparison variables the same as much as possible to provide a probable contrast.

4.4 Implications for Further Research

We believe the future of medicine during the pandemic will incorporate eHealth in many ways. This research did not explore the various uses of eHealth nor the public acceptability of eHealth technology. We posit more quantitative and qualitative research is needed for the impacts of eHealth on clinical outcomes as well as the methods for eHealth implementation and integration in LMIC. Larger sample sizes for similar studies will be necessary to support results and generalize conclusions, and cross-country statistical analysis would be useful. Longitudinal research or further clinical trials would be appropriate to fully determine eHealth's impact on clinical outcomes. As COVID-19 continues to affect the globe, and in preparation for future pandemics, more information about eHealth and those who would benefit from utilizing eHealth should be investigated.

5. Conclusion

Our data showed eHealth use could positively affect the diabetes clinical and management outcomes for people with type 2 diabetes in China and the Philippines. The present study found that eHealth use among patients with DM was significantly associated with younger age and higher educational level in China and the Philippines. eHealth was also significantly associated with marital status, residence type, and monthly household income during COVID-19 in China. We also found eHealth use significantly improved the odds of participants in the Philippines getting an HbA1c test in the last 3 months and reporting DM control per their last HbA1c test, adjusting for various demographic characteristics. Though the data was not significant, likely attributable to the small sample sizes in the two countries, we also observed eHealth use may have higher odds of getting formal diabetes labs and improve the value of the FBS score during COVID-19.

eHealth has the possibility of improving diabetes care and management in middle-income countries of Asia. Using diabetes as a tracer condition for health systems and NCD care, eHealth can be utilized to bolster disease management and improve the equity of healthcare services, especially during times of health system strain like the COVID-19 pandemic. Finally, for eHealth use to be widespread and available, gaps in infrastructure, technology, and medical systems need to be addressed in resource-poor areas.

Appendix A

Original Questionnaire from ICoDe-PC : China

COVID-19 and Diabetes: Diabetes net value research network preliminary sample questions July 13, 2020

Lijing L. Yan, Shangzhi Xiong, and Enying Gong

Translated by Yiqian Xin based on the final questionnaire in Chinese

Demographics

1. SID
2. Rural vs Urban (V102) - "De facto type of place of residence. Type of place of residence where the respondent was interviewed as either urban or rural. Note that this is not the respondent's own categorization, but was created based on whether the cluster or sample point number is defined as urban or rural."
3. In what month and year were you born? (YYYYMM)
4. How old were you on your last birthday? - "Make sure to compare the two answers"
5. What is the total number of household members? - "Number of usual residents above 18 years old"
6. Income (average monthly household income **per capita**)
7. Are you covered by any health scheme or any health insurance?
 - a. yes
 - b. no
8. (If Yes for Q7) What type of health scheme or health insurance do you have? (select ALL that applied)
 - a. Urban employee basic medical insurance
 - b. Urban rural resident basic medical insurance (merged)
 - c. Catastrophic medical insurance (大病医保)
 - d. Medical aid programme (医疗救助)
 - e. Other Health Insurance through Employer
 - f. Other Privately Purchased Commercial Health Insurance
 - g. Other, please specify it: _____
 - h. N/A
9. Which level of health facility you usually get to for routine testing and treatment for diabetes?
 - a. Community Health Station
 - b. Community Health Centre
 - c. Secondary Hospital
 - d. Tertiary Hospital
 - e. Others
10. Is distance to that health facility (you chose in 9th question) a big problem, a small problem, or no problem?
 - a. Big problem
 - b. Small problem
 - c. No problem
11. Do you own a mobile phone?
 - a. Yes, feature phone
 - b. Yes, smart phone
 - c. No
12. (If Yes for Q11) If yes, do you share your phone with others?
 - a. Yes
 - b. No

13. Do you have access to internet? (Through phone, pad, laptop or any other media)
- a. Yes
 - b. No

COVID-19 Section

14. What was your location when the “social distance restriction” announced? _____ (city name)

15. When did you went back to this city?

- a. In late January
- b. In early/mid-/late February
- c. In early/mid-/late March
- d. In early/mid-/late April
- e. In May or later

16. Was your area under “lockdown” or did it practice social distance restriction (for movement and/or work)? When did these restrictions begin?

- a. Yes
- b. In late January
- c. In early/mid-/late February
- d. In early/mid-/late March
- e. In early/mid-/late April
- f. In May or later

17. If yes, when did these restrictions end?

- a. In late January
- b. In early/mid-/late February
- c. In early/mid-/late March
- d. In early/mid-/late April
- e. In May or later

18. Were you diagnosed or treated for COVID-19?

- a. Yes
- b. No

19. (If Yes for Q18) If yes, were you hospitalized for COVID-19?

- a. Been hospitalized
- b. Not been hospitalized, but used medications
- c. Spontaneous cure
- d. Other, please specify it: _____

20. Were any of your immediate family members diagnosed with COVID-19? If yes, were they hospitalized?

- a. Yes, and been hospitalized
- b. Yes, but not been hospitalized
- c. Yes, but had spontaneous cure
- d. No
- e. N/A
- f. Other, please specify it: _____

21. Have you or members in your immediate family experienced a loss in income as a result of COVID-19?

- a. Yes
- b. No
- c. N/A

22. How much did you or members in your immediate family lost in average monthly income?

- a. Great loss
- b. Average loss
- c. Small loss

23. Have you or your family members' health insurance changed as a result of COVID-19?

- a. Yes
- b. No
- c. N/A

24. (If Yes for Q23) If yes, how have your or your family members' health insurance changed as a result of COVID-19?

- a. Lost social insurance
- b. Lost commercial insurance
- c. Bought new insurance
- d. Other

Diabetes treatment and management

25. Do you currently have diabetes?

- a. Yes
- b. No
- c. N/A

26. In the past month, how frequently did you monitor your glucose?

- a. Once or more every day
- b. 2~5 times a week
- c. Once a week
- d. 2~3 times a month
- e. Once a month or 2 months
- f. Once 3 months
- g. Less or none

27. When was your last time to test for Fasting Blood Sugar?

- a. This week
- b. This month
- c. Last 3 month
- d. Longer before

28. and what was the value? Or, if do not know exact number, do you know if it was under control or out of control?

- a. The value: ____
- b. Forgot the value, but I know it was under control
- c. Forgot the value, but I know it was out of control
- d. Totally forgot

29. Have you had HbA1c test in the past three months?

- a. Yes
- b. No

30. What was the value? Or, if do not know exact number, do you know if it was under control or out of control?

- a. The value: ____
- b. Forgot the value, but I know it was under control
- c. Forgot the value, but I know it was out of control
- d. Totally forgot

Diabetes treatment and management before and during COVID-19 crisis

(If Yes for Q25)

31. What was your diabetes treatment **before the COVID-19 crisis**? (select ALL that applied)

- a. No treatment
- b. Oral medicines, how many types of medicines for glucose reduction ____ (0, 1, 2, or 3)
- c. Insulin injection
- d. insulin pump
- e. Other medicines besides diabetes medicines, how many ____ (0, 1, 2, 3, or more)

32. Did your diabetes treatment change **since the COVID-19 crisis**?
- Yes
 - No
33. (If Yes for Q32) What type of changes did you experience? (select ALL that applied)
- Increase in the dose of medicines
 - Decrease in the dose of medicines
 - Increase in the type of medicines
 - Decrease in the type of medicines
 - Begin in insulin injection
 - End in insulin injection
 - Others, please specify: _____
34. (If Yes for Q32) Did you consult any healthcare providers before making such changes?
- Yes
 - No
35. Have your symptoms of diabetes or high blood sugar worsened since the social-distance restriction was announced in your area of residence?
- Yes
 - No
36. Since the Covid-19 crisis, have you had any needs to access health services for diabetes or diabetes-related complications?
- Yes, for acute symptoms or event
 - Yes, for follow-up treatment (such as normal monitoring or repeated prescription)
 - No
37. Have you experienced difficulties accessing medication or treatment for diabetes, due to **financial factors** since the COVID-19 crisis? (select ALL that applied)
- Yes, I have difficulties due to decrease in routine income since the COVID-19 crisis
 - Yes, I have difficulties due to increase in treatment expenses for diabetes
 - Yes, I have other difficulties due to financial factors, please specify: _____
 - No
 - N/A
38. Have you experienced difficulties accessing medication or treatment for diabetes, due to **nonfinancial factors** since the COVID-19 crisis?
- Yes
 - No
39. (If Yes for Q38) If yes, what are those factors? (select ALL that applied)
- Not being able to buy medical equipment and consumables (e.g. blood sugar test paper, insulin, pump, etc.)
 - Shutdown of hospitals causing restrictions to routine visiting
 - Restrictions to foods and activities causing blood sugar out of control
 - Not being able to rent a car to go to a drugstore, health station, or hospital
 - Upset and anxiety due to “lockdown” at home
 - Not being able to participate in routine activities (mutual-help group, community health education)
 - Others, please specify: _____

eHealth services

40. Have you ever used **telehealth consultation/appointment** to get diabetes-related treatment? (Diabetes-related telehealth consultation/appointment refers to consultation or appointment made with healthcare providers to access diabetes treatment via phone-based or internet-based calls or videos without a face-to-face meeting)
- No
 - Yes, phone-call based telehealth services

- c. Yes, video-based telehealth services
 - d. Yes, both phone- and video-based telehealth services
41. During the COVID-19 crisis, did you use **telehealth consultation/appointment** to get diabetes related treatment?
- a. Yes, phone-call based telehealth services
 - b. Yes, video-based telehealth services
 - c. Yes, both phone- and video-based telehealth services
 - d. No, I don't know how to get the telehealth services
 - e. No, I don't have this need
42. (If Yes for Q41) Who provided the **telehealth services** or support to you? (select ALL that applied)
- a. GPs/family doctors/community-based health workers
 - b. Specialists in hospitals (endocrinologist, cardiologist, podiatrist)
 - c. Pharmacist
 - d. Other, specify _____
 - e. I don't know
43. (If Yes for Q41) Did you get **e-prescription** for diabetes-related medications after the telehealth session? (**e-prescription** is defined as getting medicine prescription via internet without face-to-face appointment with a healthcare provider)
- a. Yes
 - b. No

Self-management of diabetes

44. Have you ever used mobile applications on smartphone or tablet to support your **diabetes self management**? (Self-management activities include: self-learning of health knowledge, self monitoring of disease conditions, and self-maintained behavioral modifications. Specific examples are listed in Q45)
- a. Yes, diabetes-specific app
 - b. Yes, via we-chat program/we-chat group
 - c. Yes, others, please specify _____
 - d. No
45. (If yes for 44) What are your purposes of using these mobile applications? (select ALL that applied)
- a. Tracking and recording blood glucose levels
 - b. Carbohydrate counting or monitoring diet
 - c. Tracking physical activities
 - d. Maintaining mental health status (meditation, reduce anxiety, etc.)
 - e. Linking with other individuals with diabetes
 - f. Getting personalized treatment
 - g. Getting health related information
 - h. Making appointment with health service providers for face-to-face meetings
 - i. Getting consultation from healthcare providers
 - j. Others, please specify: _____
46. (If yes for 44) During the COVID-19 crisis, what was the frequency that you used those applications to help you self-manage diabetes?
- a. Once or more every day
 - b. 2~5 times a week
 - c. Once a week
 - d. 2~3 times a month
 - e. Once a month or less
 - f. No use at all

Appendix B

Original Questionnaire from ICoDe-PC : the Philippines.

Question	Pre-COVID	Present (past 6 months)
I. Demographics		
1. Patient identification number	<number>	
2. Age at last birthday (Ilang taon po kayo?)	<number>	
3. Year of birth (Anong taon po kayo pinanganak?)	<number>	
4. Sex	<input type="radio"/> Male <input type="radio"/> Female	
5. Marital status (May asawa po ba kayo? Biyudo/a? Hiwalay?)	<input type="radio"/> Never married <input type="radio"/> Currently married/Common law/Living with partner <input type="radio"/> Widowed <input type="radio"/> Separated /divorced/annulled	
6. Highest level of education <u>completed</u> (Ano po ang natapos ninyo sa pag-aaral?)	None <input type="radio"/> Primary <input type="radio"/> High School <input type="radio"/> Vocational School College/University <input type="radio"/> Unknown	
II. DM/Comorbidity Characteristics		
7. Year diagnosed (Kailan po kayo nasabihan na kayo ay may diabetes? Anong taon?)	<number>	
8. What other chronic medical conditions have you been diagnosed with previously <u>by a doctor</u> (select all that apply)? (Nasabihan na po ba kayo ng duktore na kayo po ay may sumusunod (isa-isahin) - <i>altapresyon o high blood heart failure o mahina ang puso may bara ang puso sakit sa bato/nagpapadialysis COPD o ibang sakit sa baga iba pa (specify)</i>)	<input type="radio"/> Hypertension <input type="radio"/> Heart failure <input type="radio"/> Ischemic heart disease <input type="radio"/> Chronic kidney disease <input type="radio"/> Chronic lung disease (COPD) <input type="radio"/> Others, specify: <free text>	
III. Socio-economic		
9. How many people live in your household? (Ilan po ang taong nakatira sa inyong tahanan?)	<number>	<number>
10. Do you have a means of livelihood (e.g. formal employment, self-employment, informal livelihood)? (May hanap-buhay po ba kayo o pinagkakakitaan?)	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
11. On average, how much income does your household earn in a month? (Magkano po ang total na kinikita ng lahat ng naghahanap-buhay sa inyong tahanan?)	<input type="radio"/> <5,000 <input type="radio"/> 5,000 - 20,000 <input type="radio"/> 20,000 - 50,000 <input type="radio"/> 50,001 - 80,000 <input type="radio"/> 80,001 - 110,000 <input type="radio"/> 110,001 - 140,000 <input type="radio"/> 140,001 - 170,000 <input type="radio"/> 170,001 - 200,000 <input type="radio"/> 200,001 - 230,000 <input type="radio"/> ≥ 230,001 <input type="radio"/> Unknown	<input type="radio"/> <5,000 <input type="radio"/> 5,000 to < 20,000 <input type="radio"/> < 20,000 <input type="radio"/> 20,000 - 50,000 <input type="radio"/> 50,001 - 80,000 <input type="radio"/> 80,001 - 110,000 <input type="radio"/> 110,001 - 140,000 <input type="radio"/> 140,001-170,000 <input type="radio"/> 170,001-200,000 <input type="radio"/> 200,001-230,000 <input type="radio"/> ≥ 230,001 <input type="radio"/> Unknown
12. What type of medical insurance/benefits do you have (select all that apply)? (Meron po ba kayong insurance tulad ng (enumerate) Philhealth Ibang private insurance miyembro ng HMO - wala)	<input type="radio"/> PhilHealth <input type="radio"/> Private health insurance <input type="radio"/> HMO membership <input type="radio"/> None	<input type="radio"/> PhilHealth <input type="radio"/> Private health insurance <input type="radio"/> HMO membership <input type="radio"/> None

<p>13. If yes, what <u>outpatient</u> medical benefits are covered (<i>select all that apply</i>)? (Ano po ang mga benepisyong pangoutpatient ang maaring bayaran o sakop ng inyong insurance (isa-isahin): consultation fee ng duktora mga gamot laboratory tests , wala , di alam)</p>	<p>o Consultation fees o Medications o Laboratory tests o None o Unknown</p>	<p>o Consultation fees o Medications o Laboratory tests o None o Unknown</p>
<p>IV. Consultations</p>		
<p>14. (Ch) Where do you consult/follow-up for your diabetes (<i>select all that apply</i>)? (Saan po kayo nagpapatingin para sa inyong diabetes?)</p>	<p>Local health center o Outpatient clinics in other government healthcare institutions o Outpatient clinics in private healthcare institutions</p>	<p>Local health center o Outpatient clinics in other government healthcare institutions o Outpatient clinics in private healthcare institutions</p>
<p>15. (Ch) How long have you been following up with the above healthcare facility for your diabetes? (Gaano na po kayong katagal na nagpapatingin dito?)</p>	<p><1 year to ≤2 years 1to ≤5 years 5 to 10 years >10 years</p>	<p><1 year to ≤2 years 1 To ≤5 years 5 to 10 years >10 years</p>
<p>16. (Av) Recently, how many times did you consult or follow-up with a healthcare provider for DM (outpatient consults)? (Ilang beses kayong nakapagpatingin para sa diabetes nitong nakaraang anim na buwan ng pandemya?)</p>	<p>N/A</p>	<p>o None o Once o Twice o Thrice Other, specify: <free text></p>
<p>17. (Av) If you consulted with a healthcare provider for DM recently, who did you consult? ((If yes to #16) Kanino po kayo nagpatingin/kumunsulta?)</p>	<p>N/A</p>	<p>o My regular healthcare provider (The one I used to consult with in 2019) <i>Yung dati nang tumitingin sa akin mula pa noong 2018</i> o Another healthcare provider – Local health center <i>Ibang health care worker (e.g. duktora/nurse/midwife/BHW) sa health center</i> o Another healthcare provider - Outpatient clinics in other government healthcare institutions <i>Ibang health care worker sa outpatient clinic ng ibang pampublikong ospital pasilidad</i> o Outpatient clinics in private healthcare institutions <i>Outpatient clinic sa mga pribadong pasilidad o ospital</i></p>

18. (Av) Did you miss a scheduled follow-up consultation with a DM healthcare provider recently? (Sa nakaraang anim na buwan, may nakaligtaan o na-miss po ba kayong schedule ng follow-up check-up para sa inyong diabetes?)	N/A	<input type="radio"/> Yes <input type="radio"/> No
19. (Av) On a scale of 1 to 10 (1 – <i>Very difficult</i> , 10 – <i>Very easy</i>), how easy is it to obtain a consultation slot with this healthcare provider? (Mula 1 (pinakamahirap) hanggang 10 (pinakamadali), gaano po kadaling makakuha ng appointment para sa inyong check-up para sa diabetes? Paki-rate po mula 1 (pinakamahirap) hanggang 10 (pinakamadali).)	<number from 1 to 10>	<number from 1 to 10>
20. (Ac) What mode of transportation do you use to reach the venue of your DM consultation (<i>select all that apply</i>)? (Paano po kayo bumabiyaha papunta sa inyong check-up: <ul style="list-style-type: none"> - namamasahe gamit ng bus, jeep, MRT/LRT - taxi, GRAB, Angkas, etc - tricycle, sidecar or pedicab - sariling sasakyan - bisikleta o naglalakad wala. Kumukonsulta ako sa telepono o video call)	Public transport - Mass transport (example: buses, jeeps, trains) Public transport - Taxi or contracted vehicle (example: Grab, Angkas) <input type="radio"/> Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) Private vehicle (example: motorcycle, car) <input type="radio"/> Bicycle or walking <input type="radio"/> None, I consulted remotely (example: through phone or video conferencing)	Public transport - Mass transport (example: buses, jeeps, trains) <input type="radio"/> Public transport - Taxi or contracted vehicle (example: Grab, Angkas) <input type="radio"/> Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) <input type="radio"/> Private vehicle (example: motorcycle, car) <input type="radio"/> Bicycle or walking <input type="radio"/> None, I consulted remotely (example: through phone or video conferencing)
21. (Ac) How many transfers/transportation changes did you have to make to reach the venue of your DM consultation? (Ilang sakay po bago kayo makarating sa clinic kung saan kayo nagpapa-check-up para sa diabetes? (May ask respondent to enumerate.))	<number>	<number>
V. Medications		
26. (Ch) What type of DM medications does your healthcare provider prescribe to you (<i>select all that apply</i>)? (Anong klaseng gamot po ang inireseta sa inyo ng inyong duktur para sa diabetes?)	<input type="radio"/> Tablet form: oral hypoglycemic agents, OHAs (example: metformin, glibenclamide)] <input type="radio"/> Insulin injections	N/A
27. (Ch) Were your DM medications changed (type, number, frequency, dose) recently? (May nabago po ba sa gamutan ninyo para sa	N/A	<input type="radio"/> Yes <input type="radio"/> No

diabetes (uri o type, bilang, dose, o dalas ng pag-inom) sa nakaraang 6 na buwan?)		
28. (Ch) If yes, what was the change to your DM treatment regimen (<i>select all that apply</i>)? (Ano po ang nabago sa gamutan ninyo para sa diabetes: - nadagdagan ang bilang o dose o dalas ng gamutan - nabawasan - napalitan ang uri o type ng gamot iba pa (specify))	N/A	<input type="radio"/> Increase in the number, dose (250 to 500mg) or frequency (2x/day to 3x/day) of medicines <input type="radio"/> Decrease in the number, dose, or frequency of medicines <input type="radio"/> Change in type (e.g. OHA to insulin or vice versa) <input type="radio"/> Others, please specify:
29. (Ch) If there was a change in your DM treatment regimen, did you consult any healthcare providers before making such change/s? (Kumunsulta po ba kayo sa inyong duktore bago binago ang inyong gamutan para sa diabetes?)	N/A	<input type="radio"/> Yes <input type="radio"/> No
30. (Av) On average, how frequently are you able to take your DM meds in one week? (Sa pangkaraniwan o on average, ilang beses sa isang linggo ninyo naiinom ang inyong gamot para sa diabetes?)	<input type="radio"/> Daily <input type="radio"/> 5 days/week <input type="radio"/> <input type="radio"/> 3 days/week <input type="radio"/> <input type="radio"/> 1 day/week <input type="radio"/> <1 day/week	<input type="radio"/> Daily <input type="radio"/> 5 days/week <input type="radio"/> <input type="radio"/> 3 days/week <input type="radio"/> <input type="radio"/> 1 day/week <input type="radio"/> <1 day/week
31. (Av) Do you have an identified source for your DM medications? (Meron po ba kayong regular na pinagkukuhanan ng inyong gamot para sa diabetes?)	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
32. (Av) Majority of the time, your DM medications are: (Kadalasan, saan niyo kinukuha ang inyong gamot para sa diabetes: binibili sa pharmacy o drugstore libre mula sa health center o bigay)	<input type="radio"/> Bought from a pharmacy <input type="radio"/> Obtained for free (from local health center, other local government units, private donations)	<input type="radio"/> Bought from a pharmacy <input type="radio"/> Obtained for free (from local health center, other local government units, private donations)
33. (Av) On a scale of 1 to 10 (1 – <i>Very difficult</i> , 10 – <i>Very easy</i>), how easy was it to find a source for your DM medications? (Mula 1 (pinakamahirap) hanggang 10 (pinakamadali), gaano po kadalang makahanap ng pagkukuhanan ng gamot para sa diabetes? Paki-rate po mula 1 (pinakamahirap) hanggang 10 (pinakamadali).)	<number from 1 to 10>	<number from 1 to 10>
34. (Ac) What mode of transportation do you or the person who obtains your medications for you use to reach the place where your DM medications are from (<i>select all that apply</i>)? (Paano po	<input type="radio"/> Public transport - Mass transport (example: buses, jeeps, trains/MRT/LRT)	<input type="radio"/> Public transport - Mass transport (example: buses, jeeps, trains/MRT/LRT)

<p>kayo o ang bumibili ng gamot para sa inyo pumupunta sa pinagkukuhanan ng gamot ninyo para sa diabetes?</p> <ul style="list-style-type: none"> - namamasahé gamit ng bus, jeep, MRT/LRT - taxi, GRAB, Angkas, etc - tricycle, sidecar or pedicab - sariling sasakyan - bisikleta o naglalakad <p>wala. Dinideliver ang gamot ko sa akin)</p>	<ul style="list-style-type: none"> o Public transport - Taxi or contracted vehicle (example: Grab, Angkas) o Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) o Private vehicle (example: motorcycle, car) <p>Bicycle or walking o None, my medication/s were delivered to me</p>	<ul style="list-style-type: none"> o Public transport - Taxi or contracted vehicle (example: Grab, Angkas) o Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) o Private vehicle (example: motorcycle, car) <p>Bicycle or walking o None, my medication/s were delivered to me</p>
<p>35. (Ac) If you or the person who buys obtains medications for you had to go to the place where you get your DM medications, how many transfers/transportation changes did it take to reach the place? (Ilang sakay po bago makarating sa pinagkukuhanan ng gamot ninyo para sa diabetes?)</p>	<p><number></p>	<p><number></p>
<p>36. (Ac) On a scale of 1 to 10 (<i>1 – Very difficult, 10 – Very easy</i>), how easy is it to reach the place where you get your DM medications from? (Mula 1 (pinakamahirap) hanggang 10 (pinakamadali), gaano po kadaling marating o puntahan ang pinagkukuhanan ng gamot ninyo para sa diabetes? Paki-rate po mula 1 (pinakamahirap) hanggang 10 (pinakamadali).)</p>	<p><number from 1 to 10></p>	<p><number from 1 to 10></p>
<p>37. (Af) On average, how much does your DM medications cost you (Magkano pa ang inyong nagagastos para sa inyong gamot para sa diabetes kadalíngo/kada-buwan?)</p> <p><i>(Note to interviewer: Select one option and provide applicable cost. When the participant is unable to recall the cost of DM medications alone, you may record cost of all maintenance medications as a last option)?</i></p>	<p>Weekly cost of DM medications: <number> Monthly cost of DM medications: <number> Weekly cost of all maintenance medications: <number> o Monthly cost of all maintenance medications: <number> o Unknown</p>	<p>Weekly cost of DM medications: <number> Monthly cost of DM medications: <number> Weekly cost of all maintenance medications: <number> o Monthly cost of all maintenance medications: <number> o Unknown</p>

38. (Af) Are you able to afford having enough DM medications so that you could take them regularly, at the prescribed dose? (Lagi po bang sapat ang inyong budget para regular ninyong mainom ang mga inirisetang gamot sa inyo para sa diabetes?)	<input type="radio"/> Never <input type="radio"/> Rarely <input type="radio"/> Sometimes <input type="radio"/> Often <input type="radio"/> Always	<input type="radio"/> Never <input type="radio"/> Rarely <input type="radio"/> Sometimes <input type="radio"/> Often <input type="radio"/> Always
39. (Af) Do you have to forego other necessities (example: food, medications, paying your utility bills on time) or borrow money in order to afford your DM medications? (Kinakailangan niyo po bang ipagpaliban ang ibang gastusin tulad ng pagkain, tubig, kuryente o kaya'y mangutang para makabili kayo ng inyong gamot para sa diabetes?)	<input type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
VI. Laboratories		
40. (Ch) Which of the following blood tests for DM does your healthcare provider advise you to do (<i>select all that apply</i>)? (Anong test po ang pinapagawa sa inyo ng inyong duktor para ma-monitor ang inyong blood sugar? FBS (yung sa braso kinukuhanan ng dugo) HbA1c (di kailangan ng fasting, yung pang 3 months na sukat) Wala)	<input type="radio"/> Fasting blood sugar (FBS) <input type="radio"/> HbA1c <input type="radio"/> None	<input type="radio"/> Fasting blood sugar (FBS) <input type="radio"/> HbA1c <input type="radio"/> None
41. (Ch) How many times a year does your healthcare provider advise you to test your FBS? (Ilang beses sa isang taon pinapatest ng duktor ninyo ang inyong blood sugar?)	<input type="radio"/> Monthly <input type="radio"/> Quarterly (every 3 months) <input type="radio"/> Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text>	<input type="radio"/> Monthly <input type="radio"/> Quarterly (every 3 months) <input type="radio"/> Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text>
42. (Ch) How many times a year did you actually test your FBS? (Ilang beses sa isang taon naman kayo nakakapagpatest ang inyong blood sugar?)	<input type="radio"/> Monthly <input type="radio"/> Quarterly (every 3 months) <input type="radio"/> Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text>	<input type="radio"/> Monthly <input type="radio"/> Quarterly (every 3 months) <input type="radio"/> Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text>
43. (Ch) When was your FBS last tested? (Kailan kayo huling nagpakuha ng FBS?)	<input type="radio"/> N/A	<number>
44. (Ch) What was the numerical value of your last FBS result? (Ano po ang resulta ng huli ninyong FBS?)	<input type="radio"/> N/A	<number>
45. (Ch) Were your sugars controlled during your last FBS test? (Kontrolado o nasa normal po ba ang resulta ng huling FBS ninyo?)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown

<p>46. (Ch) How many times a year does your healthcare provider advise you to test your HbA1c? (Ilang beses sa isang taon po kayo pinapakuhanan ng HbA1c ng inyong duktor?)</p>	<p>Monthly Quarterly (every 3 months) Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text></p>	<p>Monthly Quarterly (every 3 months) Semi-Annually (every 6 mo) annually (every 12 mo) <input type="radio"/> Others, specify: <free text></p>
<p>47. (Ch) How many times a year did you actually test your HbA1c? (Ilang beses sa isang taon ninyo napapagawa ang HbA1c?)</p>	<p>Monthly Quarterly (every 3 months) Semi-Annually (every 6 mo) <input type="radio"/> annually (every 12 mo) <input type="radio"/> Others, specify: <free text></p>	<p>Monthly Quarterly (every 3 months) Semi-Annually (every 6 mo) annually (every 12 mo) <input type="radio"/> Others, specify: <free text></p>
<p>48. (Ch) When was your HbA1c last tested? (Kailan kayo huling nagpakuha ng HbA1c?)</p>	<p><input type="radio"/> N/A</p>	<p><number></p>
<p>49. (Ch) What was the numerical value of your last HbA1c result? (Ano po yung resulta ng huling HbA1c ninyo?)</p>	<p><input type="radio"/> N/A</p>	<p><number></p>
<p>50. (Ch) Were your sugars controlled during your last HbA1c test? (Kontrolado ba o nasa normal yung resulta ng huling HbA1c ninyo?)</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown</p>	<p><input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown</p>
<p>51. (Av) Do you have an identified laboratory that could do your DM laboratory tests (example: FBS, HbA1c) for you? (Meron po ba kayong regular na laboratory kung saan kayo nagpapagawa ng test para sa diabetes (halimbawa, blood sugar)?)</p>	<p><input type="radio"/> Yes <input type="radio"/> No</p>	<p><input type="radio"/> Yes <input type="radio"/> No</p>
<p>52. (Av) On a scale of 1 to 10 (1 – <i>Very difficult</i>, 10 – <i>Very easy</i>), how easy is it to find a laboratory for your DM tests? (Mula 1 (pinakamahirap) hanggang 10 (pinakamadali), gaano po kadalang makahanap ng laboratory kung saan pwedeng magpagawa ng mga test para sa diabetes? Paki-rate po mula 1 (pinakamahirap) hanggang 10 pinakamadali.)</p>	<p><input type="radio"/> <number from 1 to 10></p>	<p><number from 1 to 10></p>
<p>53. (Ac) What mode of transportation do you use to reach the venue of your DM laboratory test (<i>select all that apply</i>)? (Paano kayo pumupunta sa laboratory kung saan kayo nagpapagawa ng test para sa diabetes? - namamasahé gamit ng bus, jeep, MRT/LRT - taxi, GRAB, Angkas, etc - tricycle, sidecar or pedicab - sariling sasakyan - bisikleta o naglalakad wala. Nagpapa-home service po ako para sa blood test)</p>	<p><input type="radio"/> Public transport - Mass transport (example: buses, jeeps, trains) <input type="radio"/> Public transport - Taxi or contracted vehicle (ex: Grab, Angkas) <input type="radio"/> Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) <input type="radio"/> Private vehicle (example: motorcycle, car)</p>	<p>Public transport - Mass transport (example: buses, jeeps, trains) Public transport - Taxi or contracted vehicle (ex: Grab, Angkas) <input type="radio"/> Public transport - Tricycles and other short-distance mode of public transportation (e.g. pedicab, sidecars) Private vehicle (example: motorcycle, car) Bicycle or walking <input type="radio"/> None, I availed of a laboratory service that</p>

	Bicycle or walking o None, I availed of a laboratory service that came to my home to extract my blood samples	came to my home to extract my blood samples
54. (Ac) How many transfers/transportation changes did you have to take to reach the venue of your DM laboratory test? (Ilang sakay po bago makarating kayo sa laboratory kung saan kayo nagpapakuha ng blood test para sa diabetes?)	<number>	<number>
55. (Ac) On a scale of 1 to 10 (<i>1 – Very difficult, 10 – Very easy</i>), how easy was it to reach the venue of your DM laboratory test? (Mula 1 (pinakamahirap) hanggang 10 (pinakamadali), gaano po kadalang mapuntahan o marating ang laboratory kung saan kayo nagpapagawa ng mga test para sa diabetes? Paki-rate po mula 1 (pinakamahirap) hanggang 10 (pinakamadali).)	<number from 1 to 10>	<number from 1 to 10>
56. (Af) Each time that your DM healthcare provider requests for laboratory tests to be done, how much does it cost you (on average)? (Magkano inaabot ang gastusin para sa mga lab test tuwing nagrerequest ng mga ito ang duktor na tumitingin sa inyong diabetes?)	<number>	<number>
57. (Af) Are you able to afford having your DM laboratory tests <u>as frequently as your healthcare provider advised</u> ? (Lagi po bang sapat ang inyong budget para maipagawa ninyo ang mga laboratory test para sa diabetes nang kasing dalas ng pagrequest nito ng inyong duktor?)	o Never o Rarely o Sometimes o Often o Always	o Never o Rarely o Sometimes o Often o Always
58. (Af) Do you have to forego other necessities (example: food, medications, paying your utility bills on time) or borrow money in order to afford your DM laboratory tests? (Kinakailangan niyo po bang ipagpaliban ang ibang gastusin tulad ng pagkain, tubig, kuryente o kaya’y mangutang para maipagawa ninyo ang laboratory tests para sa diabetes?)	o Yes o No	o Yes o No
VII. DM Deterioration		
59. (Det) Have your DM symptoms worsened during the ECQ period? (Nitong nakalipas na anim na buwan ng pandemya, lumala po ba ang mga nararanasan ninyong mga sintomas ng diabetes?)	N/A	Yes, specify symptom/s: <free text> No
60. (Det) Did you develop new DM symptoms during this period? (Nitong nakalipas na anim na buwan ng pandemya, may nararanasan po ba kayong bagong sintomas ng diabetes?)	N/A	Yes, specify symptom/s: <free text> No

61. (Det) Did you consult at an emergency room due to your DM during this period? (Nitong nakalipas na anim na buwan ng pandemya, nakapagpatingin po ba kayo sa emergency room dahil sa inyong diabetes?)	N/A	<input type="radio"/> Yes <input type="radio"/> No
62. (Det) Were you admitted to a hospital due to your DM during this period? (Nitong nakalipas na anim na buwan ng pandemya, na-confine po ba kayo sa ospital dahil sa inyong diabetes?)	N/A	<input type="radio"/> Yes <input type="radio"/> No
VIII. COVID-19		
63. (Cv) On a scale of 1 to 10 (<i>1 – Not affected</i> <i>10 – Very affected</i>), in general, to what extent was your life affected by the COVID lockdown (Enhanced Community Quarantine, ECQ)? (Mula 1 (hindi naapektuhan) hanggang 10 (lubos na naapektuhan), gaano kalaki ang naging epekto ng COVID sa inyong pamumuhay? Paki-rate po mula 1 (hindi naapektuhan) hanggang 10 (lubos na naapektuhan).)	N/A	<number from 1 to 10>
64. (Cv) Were you or a household member infected with COVID during the first Metro Manila lock-down (Enhanced Community Quarantine, ECQ, March to July 2020) (<i>select all that apply</i>)? (Nagkaroon po ba kayo <input type="radio"/> ang inyong kasama sa bahay ng COVID?)	N/A	<input type="radio"/> Yes - self <input type="radio"/> Yes - household members <input type="radio"/> No
65. (Cv) SELF If yes, where did you stay during the time that you had your COVID-infection (<i>if yes, select all that apply</i>): (Saan po kayo nanatili habang may COVID po kayo?)	N/A	At home At a community-based facility Hospital (not ICU) <input type="radio"/> Hospital ICU Others, specify: <free text>
66. (Cv) If SELF yes, was the management of your DM (in terms of consultation/follow-up, medications, laboratory tests) disrupted as a result of your being infected with COVID? (Naantala po ba ang pangangalaga ng inyong diabetes (halimbawa, yung follow-up/check-up, gamutan, o pagpapa-laboratory test) dahil sa pagkakaroon ninyo ng COVID?)	N/A	Yes <input type="radio"/> No
67. (Cv) HOUSEHOLD MEMBER If yes, where did they stay during the time that they had their COVID-infection (<i>select all that apply</i>): (Saan po nanatili ang inyong kasama sa bahay habang siya/sila ay may COVID?)	N/A	At home At a community-based facility Hospital (not ICU) Hospital ICU

68. (Cv) HOUSEHOLD MEMBER If yes, was the management of your DM (in terms of consultation/follow-up, medications, laboratory tests) disrupted as a result of having a household member who was infected with COVID? (Naantala po ba ang pangangalaga ng inyong diabetes (halimbawa, yung follow-up/checkup, gamutan, o pagpapa-laboratory test) dahil nagkaroon ng COVID ang inyong kasama sa bahay?)	N/A	Yes No
IX. Access to e-Health Technologies		
69. Which of the following gadgets would be available to you on a daily basis (<i>select all that apply</i>)? (Anong mga gadget ang nagagamit ninyo o available sa inyo araw-araw: - sariling cellphone nakikigamit ng cellphone ng iba (shared) sariling tablet nakikigamit ng tablet ng iba (shared) sariling laptop o computer nakikigamit ng laptop o computer ng iba (shared) sariling landline sa bahay landline ng iba/kapit-bahay - pay phone wala)	Phone - own device o Phone - shared device o Tablet - own device o Tablet - shared device o Laptop/computer - own device Laptop/computer - shared device Landline phone o Household phone Public phone o None	Phone - own device Phone - shared device Tablet - own device Tablet - shared device Laptop/computer - own device Laptop/computer - shared device Landline phone Household phone Public phone None
70. What type of connection do you use to access the internet (<i>select all that apply</i>)? (Paano po kayo nakakacconnect sa internet: - mobile data o sa cellphone/pocket wifi - may internet sa bahay (e.g. Broadband/fiber/dsL))	Mobile data (including pocket wifi) o Home internet (through broadband, wired internet, etc.)	Mobile data (including pocket wifi) Home internet (through broadband, wired internet, etc.)
71. If you use mobile data, what type of plan do you use (<i>select all that apply</i>)? ((if mobile data) Prepaid po ba o postpaid?)	o Pre-paid o Post-paid	Pre-paid Post-paid
72. If you have a household landline, what type of plan do you use (<i>select all that apply</i>)? ((if landline) prepaid po ba o postpaid?)	o Pre-paid o Post-paid	Pre-paid Post-paid
73. Do you use online messaging apps such as FB Messenger or Viber? (Gumagamit po ba kayo ng mga online messaging app tulad ng FB messenger o Viber?)	o Yes o No	Yes No
74. If yes, what functions do you use them for (<i>select all that apply</i>)? ((If yes) Saan niyo po ito ginagamit: sa pagtext (messaging) sa pagtawag (voice call) sa video call)	o Messaging o Voice calls o Video calls o Not applicable	Messaging Voice calls Video calls o Not applicable

<p>X. Use of Technology for DM Care eHealth is the use of communication technologies such as telephones or the internet to support healthcare services. This include the use of telemedicine or teleconsultation, and healthcare apps on your cellphone or computer, among others. Ang eHealth ay ang paggamit ng mga teknolohiyang pang-komunikasyon tulad ng telepono o internet upang masuportahan ang mga serbisyong pangkalusugan. Kasama rito ang telemedicinie o telekonsulta, mga app sa cellphone at computer na pang-health, at iba pa.</p>		
<p>75. Did you use e-Health technologies for your DM care? (Nakagamit na po ba kayo ng eHealth para sa inyong diabetes?)</p>	<p><input type="radio"/> Yes <input type="radio"/> No</p>	<p><input type="radio"/> Yes <input type="radio"/> No</p>
<p>76. What tools/e-Health tech did you use to facilitate consultation with your healthcare provider for your DM care (including setting appointments) (<i>select all that apply</i>)? ((If yes to #75) Alin po sa mga sumusunod ang nagamit niyo na para mapadali ang inyong pagpapakonsulta para sa diabetes: - telepono (landline o cellphone) - text sa cellphone/ SMS - text gamit ang mga app tulad ng FB messenger o Viber email iba pa (specify))</p>	<p>Phone calls (landline/cellphone) SMS Online messaging platform Email Others: <free text></p>	<p>Phone calls (landline/cellphone) SMS Online messaging platform Email Others: <free text></p>
<p>77. What tools/e-Health tech did you use to obtain medications (<i>select all that apply</i>)? ((If yes to #75) Alin po sa mga sumusunod ang nagamit niyo na para mapadali ang pagkuha ninyo ng gamot para sa diabetes: - telepono (landline o cellphone) - text sa cellphone o SMS - text gamit ang mga app tulad ng FB messenger o Viber email online delivery apps tulad ng Grab iba pa (specify))</p>	<p><input type="radio"/> Phone calls (landline/cellphone) <input type="radio"/> SMS <input type="radio"/> Online messaging platform o Email o Online delivery apps (e.g. Grab) o Others: <free text></p>	<p><input type="radio"/> Phone calls (landline/cellphone) <input type="radio"/> SMS <input type="radio"/> Online messaging platform o Email o Online delivery apps (e.g. Grab) o Others: <free text></p>
<p>78. What tools/e-Health tech did you use to schedule laboratory tests and get results (<i>select all that apply</i>)? ((If yes to #75) Alin po sa mga sumusunod ang nagamit niyo na para makapagpaschedule ng laboratory test para sa diabetes at kunin ang test result: - telepono (landline o cellphone) - text sa cellphone o SMS - text gamit ang app tulad ng FB messenger o Viber email iba pa (specify))</p>	<p>Phone calls (landline/cellphone) SMS Online messaging platform Email <input type="radio"/> Others: <free text></p>	<p>Phone calls (landline/cellphone) SMS Online messaging platform Email <input type="radio"/> Others: <free text></p>
<p>79. What e-Health tech did you use to pay for DM-related services (including consultation, meds, lab) (<i>select all that apply</i>)? (Alin po sa mga sumusunod ang nagamit niyo na para</p>	<p>Online bank transfers Credit/debit card payments E-wallet (e.g. PayMaya,</p>	<p>Online bank transfers Credit/debit card payments E-wallet (e.g. PayMaya, GCash)</p>

<p>bayaran ang mga serbisyo na natanggap ninyo para sa diabetes kasama na ang consultation fee, gamot, at laboratory test: online bank tranfer credit card E-wallet GCash, PayMaya) iba pa (specify))</p>	<p>GCash) Others: <free text></p>	<p>Others: <free text></p>
<p>80. Did you use online apps to travel to clinic/lab for consultations/laboratory tests (e.g. Grab)? (Gumamit po ba kayo ng mga app tulad ng Grab o Angkas para makakuha ng masasakyan papunta sa clinic para sa check-up o sa laboratory para sa mga test ninyo para sa diabetes?)</p>	<p>Yes No</p>	<p>Yes No</p>
<p>81. Did you use any apps specifically designed for patient with diabetes (example: Freestyle Libre, Glucose Buddy)? (Gumamit po ba kayo ng mga app sa cellphone o computer na dinesenyo para talaga sa mga pasyenteng may diabetes tulad ng Freestyle Libre, Glucose Buddy?)</p>	<p>Yes, specify: <free text> No</p>	<p>Yes, specify: <free text> No</p>
<p>82. If you used a DM app, what purpose did it serve (<i>select all that apply</i>)? (If yes) Para saan niyo po ginamit ang app na ito: para maalala ang tamang pag-inom ng gamot o paggamit ng insulin - sa pag-monitor ng blood sugar para makatulong sa pag-exercise para mabantayan ang tamang pagkain o nutrisyon/diet para makatulong sa pagmonitor o pagbabawas ng timbang iba pa (specify))</p>	<p>Medication management Blood glucose management Physical activity features Nutrition or diet features Weight management Others, specify: <free text></p>	<p>Medication management Blood glucose management Physical activity features Nutrition or diet features Weight management Others, specify: <free text></p>
<p>83. If you used a DM app, was it a paid service? (If yes) Binabayaran niyo po ba ang paggamit ng app na ito?)</p>	<p>Yes No</p>	<p>Yes No</p>

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