Type 2 Diabetes Mellitus Control during COVID 19 Pandemic in Qatar 2020: A Retrospective Data Analysis

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Abstract

Background: Qatar is considered as one of highly prevalent countries of type 2 diabetes, with a prevalence of 17 %. Since the start of the global pandemic of COVID-19 the type of service and the access to health centers had changed during the pandemic, so we wanted to know the effect of this major change in the level of glycemic control in type 2 diabetes patients followed in the PHCC (Primary Health Care Corporation) and compare it with previous studies. Also we wanted to know the relation between level of glycemic control and number of phone consultations done for each patient and finally the prevalence of Covid 19 in type 2 diabetic patients followed in PHCC.

Methods: Cross-sectional retrospective data analysis extracted from medical records of patients with Diabetes Melittus type 2 followed at PHCC, in year 2020

Results: The data was extracted for 17,413 patients with type 2 diabetes. The mean HbA1c in our sample was 7.45±1.67% before the pandemic, and 7.34±1.61% during it (Paired t test P<0.001). The mean weight was 82.6±17.40 Kg before the pandemic, and 82.3±17.43 Kg during it (Paired t test P<0.001). Using unpaired t test and one way ANOVA, when analyzing the percentage changes in mean HbA1c among different groups of the sample, no clinical significant (P>0.05) changes in HbA1c was noticed among any group (although most of these groups showed statistical significance in which P<0.01 and this could be due to larger sample size studied). Pearson correlation analysis indicates percentage change in mean HbA1c didn't have any significant correlation with demographic and various comorbidities. A total of 8.06% (95% CI 7.66, 8.47) of the patients suffered a COVID-19 infection during the study period. Our sample patients received 45,701 consultations during the study period of which 60.60% were virtual.

Conclusion: The results showed no significant difference in level of glycemic control during the year 2020 as the mean of HbA1c had not changed; the mean was 7.45% and became 7.34%, with a prevalence of 8.06% for positive cases of Covid in the sample.

Key words: Type 2 diabetes control, COVID-19 pandemic, Qatar

Introduction

Type 2 diabetes mellitus (DM2) is a chronic disease with an increasing number of patients worldwide [1]. In 2017, DM2 was estimated to cause 6.7 million deaths, being the eighth leading cause of death worldwide [2]. The epidemic of diabetes is projected to rise from 425 million in 2017 to 629 million by the year 2045[2,3,4].

In Qatar, the prevalence of type 2 DM is estimated to be 17% and is expected to rise to 24% by 2050[5.6]. Many national programs have been established to prevent and decrease the disease prevalence and complications through early detection and prompt management. Updated National guidelines by the Ministry of Public Health are used to implement standardized high quality services among health care providers to provide the ultimate care to patients with type 2 diabetes [4]. A recent study assessing quality of care for patients with type 2 diabetes in Qatar showed that only "35% of patients attained the desired level of glycemic control (HbA1c < 7.0%), 27.7% had HbA1c between 7.0 and 7.9%, and there was poor glycemic control in a third of the patients with 20.9% of them recording HbA1c ≥ 9.0%"[7].

After the WHO announcement of COVID-19 on March 12, 2020[8] as a pandemic, the Ministry of Public Health (MoPH) and the Primary Health Care Corporation (PHCC) initiated a remote/phone consultation system to minimize the risk of possible COVID-19 infection at health care facilities while doing their routine visits and follow up in primary health care clinics. A well-designed protocol and pathway through phone consultation that allows feasible, safe and interactive patient-doctor communication was established. The main goal is to keep the continuous care quality to patients and enhance more education and self-management while monitoring basic needs, answering any new queries and providing guidance about the current situation along with medication modification when needed[9].

Due to remarkable innovations in medical field technology, and their tremendous contribution and applicability to the healthcare system, many different digital services have been studied and used. These technologies are considered as alternative means to the traditional face-to-face interaction or consultation between patients and healthcare providers. Examples are text messages, emails, applications, telephone and virtual consultation. A systematic review by Deborah et, al. (2017) showed that applying different types of technology in diabetes self-management education and support services has improved A1c. Another RCT by Yang et al. (2020) reported an effective glycemic control when implementing a mobile phone-based glucose-monitoring and feedback system while managing DM type 2 in primary care clinic settings [10,11,12].

According to the American Diabetes Association (ADA), a growing body of evidence suggests that various telemedicine modalities may be effective at reducing A1C in patients with type 2 diabetes compared with usual care or in addition to usual care [13,14,15,16].

Glycated hemoglobin (hemoglobin A1c, HbA1c, A1C, or Hb1c) is a form of hemoglobin that is measured primarily to identify the three months average plasma glucose concentration. Although it has some limitations with blood diseases, ADA and PHCC guidelines for adults with type 2 diabetics consider that HbA1c is the best available tool/marker for monitoring and should be done at least twice per year for each patient [17,18].

In this study we aimed to study the level of diabetes control among type 2 diabetes patients who were followed by telephone consultations in Primary Health Care Corporations in a six-month period from the start of the pandemic of COVID-19 in 2020.

Methods

Cross-sectional retrospective data analysis extracted from medical records of patients with Diabetes Melittus type 2 followed at PHCC.

In this study we measured the effect of the pandemic and change of type of health service done in Qatar during the year 2020, as PHCC is the main public provider of primary care for the whole population living in Qatar. A total of 27 health centers spread across Qatari are subdivided into 3 main regions North, West and Central, PHCC and cover all members of the population in Qatar. At EMR namely, the Cerner Millennium® patient administration system is used, and during the pandemic the PHCC developed a phone consultation service to avoid face to face consultation and decrease the number of visits to health centers. The patients were assigned to a family physician and he called them through the land line.

Inclusion and exclusion criteria:
Adult type 2 diabetic patients more than 18 years and less than 65 year who received virtual, face to face or both consultations with HbA1c done 3 months before and during the first 6 months of the pandemic.

We excluded the following:
If patient did not have HbA1c done before and after the pandemic period (within our time frame) 3 months before March and 3 months after September, Newly diagnosed patients during the pandemic, Patients with only one HbA1c reading in medical records before and after the pandemic to eliminate bias of lab errors and Hospital admission for any cause during the pandemic including causes related to diabetes complications as stress related admissions could affect the control and bias the final result. Also during admission patient medication may be changed, or a new one added or removed, some may be started on Insulin and mostly patients will have a follow up visit in HMC as an outpatient.

Statistical analysis:
Descriptive statistics were used to summarize and determine the sample characteristics and distribution of various considered parameters related to demographic, anthropometric, clinical and other related features of the study participants. The normally distributed data and results were reported with mean and standard deviation (SD); the remaining results were presented with median and interquartile range (IQR). Categorical data were summarized using frequencies and percentages. Mean changes in HbA1c measured between the two time points (pre-pandemic and during COVID-19 period) were analyzed using paired t test or Wilcoxon signed ranked test as appropriate. Mean changes in HbA1c between the two and more than two independent groups were analyzed using unpaired t and one-way analysis of variance (ANOVA) as appropriate. Relationship between two quantitative variables were examined using Pearson's correlation coefficients. Pictorial presentations of the key results were made using statistical graphs, histogram and Box plots. All P values presented were two-tailed, and P values <0.05 was considered as statistically significant. All Statistical analyses were done using Statistical Packages SPSS version 27.0 (Armonk, NY: IBM Corp).

Results

Descriptive data:
The data was extracted from 17,413 patient records with type 2 diabetes. 56.60% of them were males (9850) and 43.40% were females (7563) (Table 1). The mean age was 49.77 years with a standard deviation (SD) of 9.02 years (Figure 1). 38.00% of the patients were followed in the health centers of the central region, 34.80% in the western region, and 27.20% in the northern region. The most common comorbidity among the patients was dyslipidemia; present in 71.80%, followed by hypertension in 59.50%, thyroid disorders in 20.60%, asthma in 13.90%, and lastly cardiovascular diseases in 7.20%. Data showed that 66.90% of the patients were non-smokers, 18.30% were smokers, and smoking status was not documented in 14.80% of the patients. Of the sample collected, 8.06% (95% CI 7.66, 8.47) endured a COVID-19 infection; most of them were females (11.30%), almost double the number of males (5.56%).

Main results:
The mean HbA1c in our sample was 7.45% before the pandemic, and 7.34% during it. The median was 7.00% and became 6.90%. The 25th, 50th, and 75th percentiles were 6.30%, 7.00%, and 8.20% respectively before COVID-19 and during it they became 6.20%, 6.90% and 8.10% respectively (Table 2, Figure 2).

Weight also did not clinically increase through the pandemic. The mean weight was 82.67 Kg before the pandemic, and 82.33 Kg during it. The median was 80.70 Kg and became 80.00 Kg. The 25th, 50th, and 75th percentiles were 70.40 Kg, 80.70 Kg, and 92.00 Kg respectively before COVID-19 and during it they became 70.00 Kg, 80.00 Kg, and 92.00 Kg respectively. The stable weight correlates well with the stable HbA1c during this pandemic (Table 3).

Even when analyzing the change in HbA1c among different groups of the sample, no clinical significant change in HbA1c was noticeed among any group (Table 3). The mean HbA1c among males was 7.63% before the pandemic and 7.46% during it. Among females, it was 7.21% and became 7.19%. In addition, all three regions of health centers were similar in the stability of HbA1c. Patients followed in the central, northern, and western regions had a mean HbA1c of 7.45%, 7.46%, and 7.45% respectively before the pandemic and they became 7.36%, 7.35%, and 7.31% respectively.

Different comorbidities did not affect HbA1c change too. Patients with dyslipidemia, hypertension, thyroid disorders, asthma and cardiovascular diseases had mean HbA1c of 7.55%, 7.56%, 7.12%, 7.25%, and 7.7% before COVID-19 and they became 7.62%, 7.83%, 7.09%, 7.20%, and 7.56%.

Smokers had a mean HbA1c of 7.64% before COVID-19 and it became 7.48%, while non-smokers had a mean HbA1c of 7.37% that became 7.29% (Table 4).

Among patients of our sample 1,403 patients suffered a COVID-19 infection during the study period constituting 8.1% of the sample; most of them were female (855) with a percentage of 11.3%, while 548 males had COVID-19 with a percentage of 5.6% (Table 5).

Our sample patients received 45701 consultations during the study period. 60.60% of the consultations were virtual while 39.40% were face-to-face (Table 6, Fugure 3).

Table 1: Characteristics of the sample

Characteristics of the sample (n=17413)		
	Number	Percentage
Gender		
Male	9850	56.57%
Female	7563	43.43%
Region		
Central	6620	38.02%
Northern	4740	27.22%
Western	6053	34.76%
Chronic Diseases		
Dyslipidemia	12502	71.80%
Hypertension	10353	59.46%
Thyroid Disorders	3594	20.66%
Asthma	2421	13.90%
Cardiovascular Disease	1250	7.18%
Smoking Status		
Smokers	3179	18.26%
Nonsmoker	11653	66.92%
Status unknown	2581	14.82%

Figure 1

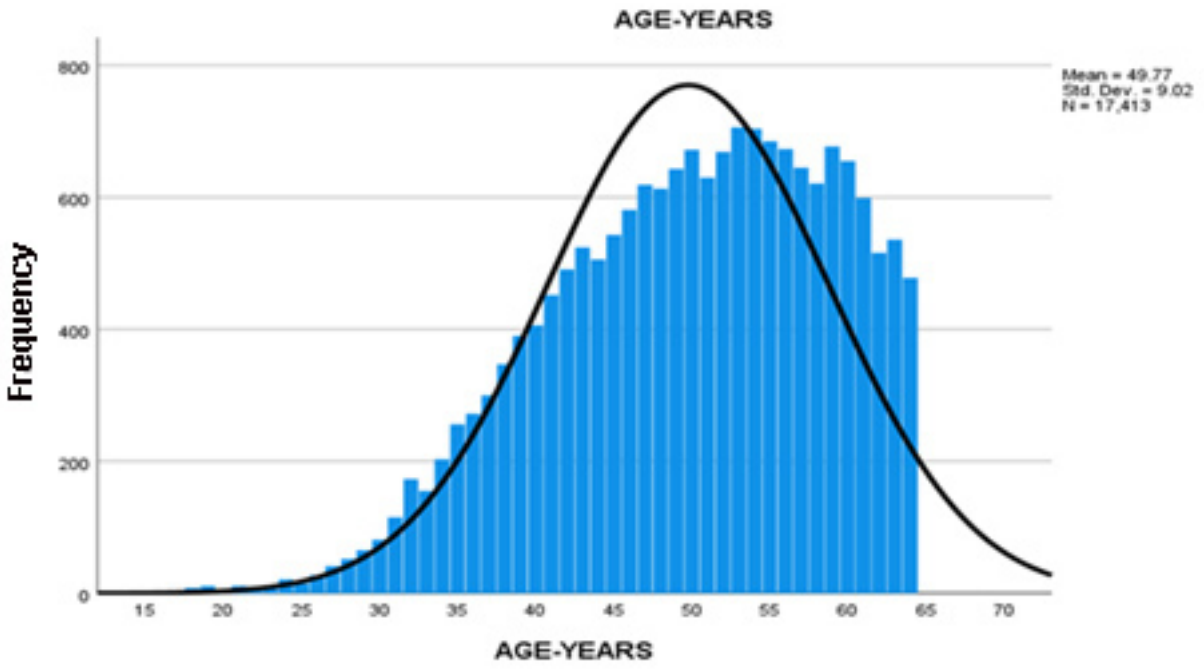

Table 2: Change in HbA1c

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		Last HbA1C Value (Pre-COVID-19)	Last HbA1c Value (During-COVID-19)	P-value*	% Change in HbA1C [(post-pre)/pre]*100
Mean		7.45	7.34	<0.001	-0.19
Median		7.00	6.90		0.00
Std. Deviation (SD)		1.67	1.61		15.83
Percentiles	25	6.30	6.20		-7.78
	50	7.00	6.90		0.00
	75	8.20	8.10		6.45

*Paired t test

Figure 2

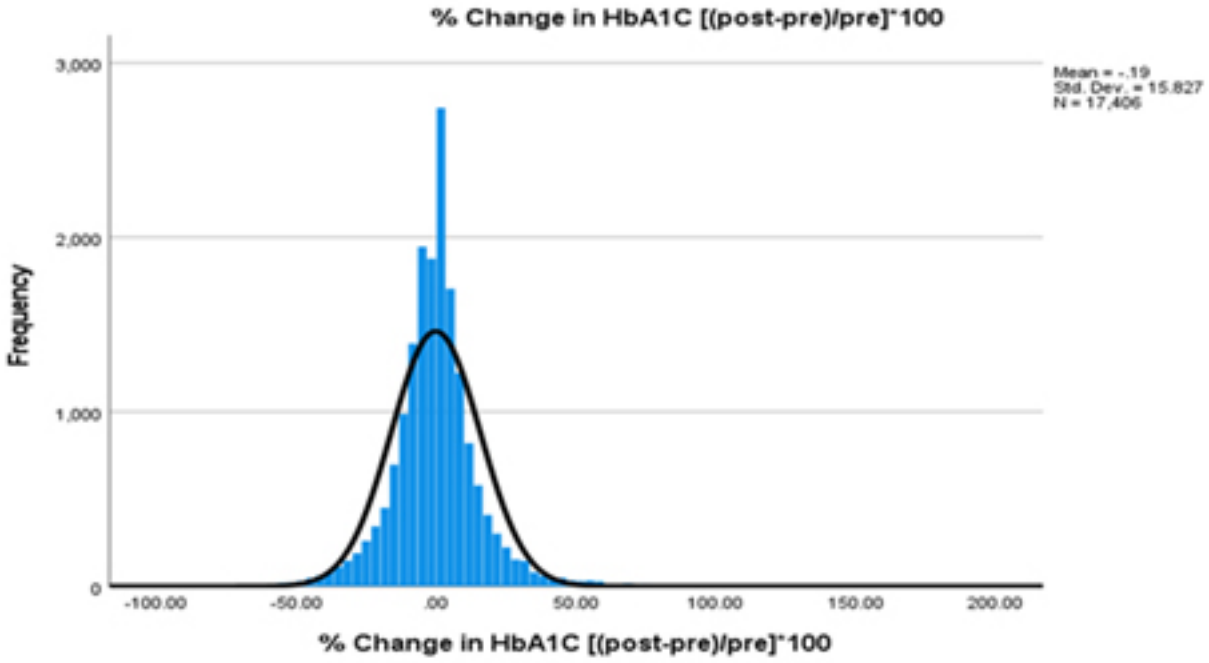


Table 3: Change in Weight (Kg)

		Last Weight (Pre-COVID-19)	Last Weight (During COVID-19)	P-value	% Change in Weight (kg) [(post-pre)/ pre]*100
Mean		**82.67**	**82.33**	**<0.001**	**-0.42**
Median		**80.70**	**80.00**		**0.00**
Std. deviation		**17.39**	**17.43**		**5.59**
Percentiles	**25**	70.40	**70.00**		**-2.59**
	50	80.70	**80.00**		**0.00**
	75	92.00	**92.00**		**1.76**

*Paired t test

Table 4: HbA1c change in each group

	Value (Pre-COVID-19)	Value (During-COVID-19)		HbA1C [(post-pre)/pre]*100
	Mean ± SD	Mean ± SD		Mean ± SD
Gender				
Male	7.63±1.70	7.46±1.61	*<0.001*	-0.68±17.03
Female	7.22±1.62	7.19±1.60	**0.023**	0.45±14.08
P-value	*<0.001*	*<0.001*		*<0.001*
Region				
Central Region	7.45±1.67	7.36±1.60	*<0.001*	0.15±16.01
Northern Region	7.46±1.71	7.35±1.65	*<0.001*	-0.26±15.85
Western Region	7.45±1.65	7.31±1.60	*<0.001*	-0.50±16.60
P-value	*0.844*	*0.225*		*0.065*
Dyslipidemia				
Yes	7.55±1.63	7.46±1.60	*<0.001*	0.06±15.61
No	7.21±1.76	7.04±1.61	*<0.001*	-0.83±16.35
P-value	*<0.001*	*<0.001*		*<0.001*
HTN				
Yes	7.56±1.63	7.48±1.60	*<0.001*	0.03±15.50
No	7.29±1.71	7.14±1.60	*<0.001*	-0.51±116.29
P-value	*<0.001*	*<0.001*		**0.029**
Thyroid Disorders				
Yes	7.12±1.54	7.09±1.54	**0.054**	0.30±14.08
No	7.54±1.70	7.41±1.63	*<0.001*	-0.32±16.25
P-value	*<0.001*	*<0.001*		**0.039**
Asthma				
Yes	7.25±1.52	7.20±1.52	**0.032**	0.11±14.00
No	7.48±1.70	7.37±1.63	*<0.001*	-0.24±16.11
P-value	*<0.001*	*<0.001*		**0.315**
Cardiovascular Disease				
Yes	7.66±1.64	7.56±1.66	**0.008**	-0.35±14.59
No	7.46±1.68	7.33±1.61	*<0.001*	-0.18 ±15.92
P-value	*<0.001*	*<0.001*		**0.713**
Smokers				
Yes	7.64±1.71	7.48±1.66	*<0.001*	-0.64±17.54
No	7.37±1.62	7.29±1.57	*<0.001*	-0.36±5.63
P-value	*<0.001*	*<0.001*		**0.031**

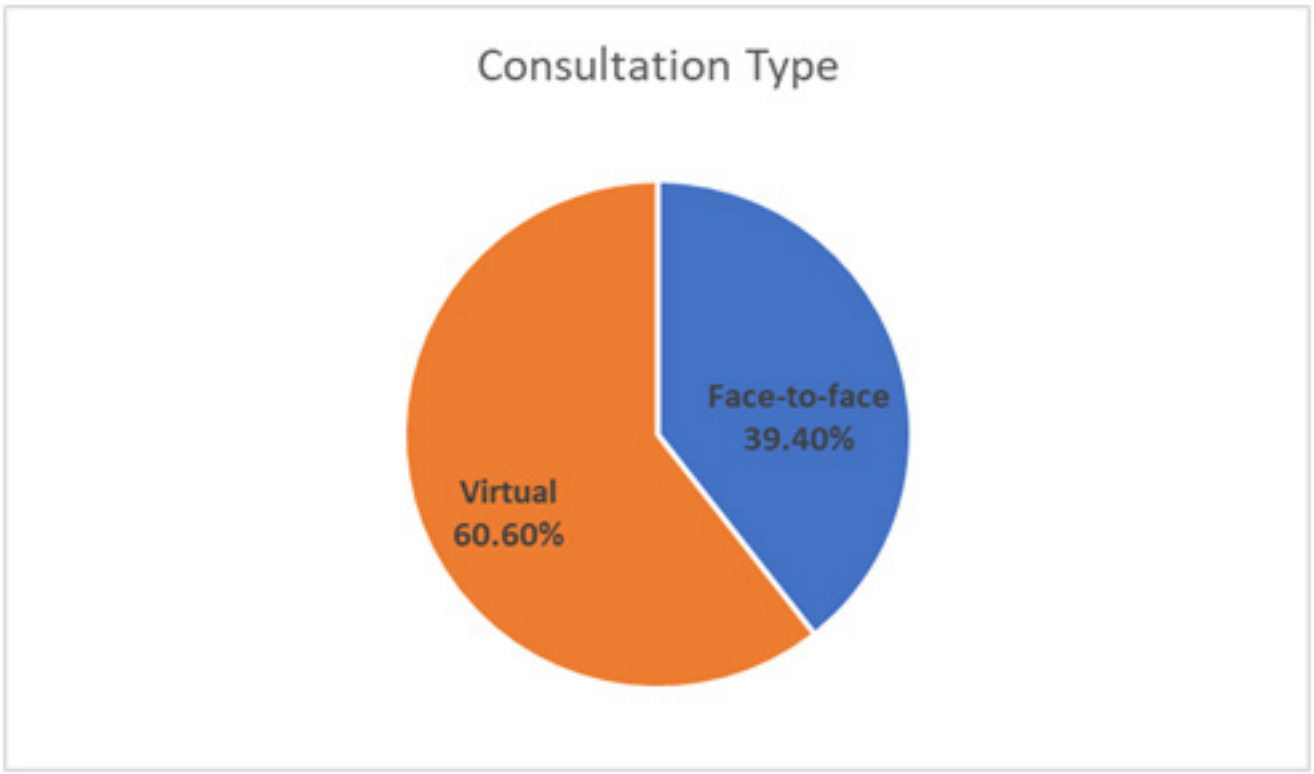
Table 5: Covid-19 Positive cases

	Positive for COVID 19	Percentage (95% Confidence interval)
Male	548/9850	5.56% (5.13, 6.03)
Female	855/7563	11.30% (10.61, 12.04)
Total	1403/17413	8.06% (7.66, 8.47)

Table 6: Type of consultation

Type	Number	Percentage
Face-to-Face	18005	39.40%
Virtual	27696	60.60%
Total	45701	100.00%

Figure 3



Discussion

Results showed that the COVID-19 pandemic did not impair the control of type 2 diabetes in Qatar. As noticed from our results, the mean HbA1C is not significantly changed, which led us to conclude that in Primary Health Care Corporation in Qatar despite the change in type of consultation and shift to a virtual consultation module we successfully managed to keep the level of glycemic controlled without change. Despite the large proportion of consultations being virtual, we managed to succeed. We expected it to be worse but fortunately it was not. We consider it a great success of the health system here in Qatar.

Compared to a previous recent study (assessing quality of care for patients with type 2 diabetes in Qatar) which showed that only "35% of patients attained the desired level of glycemic control (HbA1c < 7.0%), 27.7% had HbA1c between 7.0 and 7.9%, and there was poor glycemic control in a third of the patients with 20.9% of them recording HbA1c ≥ 9.0%" [7], our study showed better glycemic control among the patient with 50% of patients having HbA1C of 7%.

Total number of consultations was 45,701, with an average of 2.6 consultations per patient, accepted as no clear guidelines for the minimum number of consultations number for each patient'scare but we consider 2 consultations is the lowest acceptable number. As the results showed no significant changes, we did not calculate the relation between the level of glycemic control and number of phone calls called received. Another reason fr not doing that, as mentioned above, is the quality and content of phone consultation could not be assessed.

Results showed no change in weight and this surprised us as we expected the weight to increase during the pandemic, as lifestyle of patient is changed due to being less physically active due to many closures.

Also, there were no clear relation and effect of other comorbidities on the level of Glycemic control among our patients.

Our data is large enough but unfortunately it does not represent all diabetic patients in Qatar, as some of them are followed in private and secondary care facilities. Also we excluded the old aged (above 65) and below 18 for ethical considerations. In addition, patients who were admitted to hospital for any reason - including COVID-19 patients - were excluded as we consider admission as bias because during admission medications may be changed, for example a patient may be started on insulin etc.

Regarding the type of consultation, we may know the number, but we cannot judge the quality and the content of the consultation virtually, which may limit our study conclusion as we should only consider the virtual consultations that only focus on the chronic disease and its manifestations which is hard to achieve.

The prevalence of COVID-19 in Type 2 DM patients which is not possible to be calculated because the sample is not 100% representative of the accurate number of patients, but the percentage of the positive case gives us an idea about the prevalence of infection in our sample.

Conclusion

The results showed no significant difference in the level of glycemic control during the year 2020 as the mean HbA1c was 7.45% and became 7.34%. Weight also was stable; with a mean of 82.67 Kg before the pandemic and 82.33 Kg during it. The prevalence of positive cases of COVID-19 in the sample was 8.06%. Patients received around 2.6 consultation per patient during the study period, of which 60.60% were virtual.

References

1. Diabetes [Internet]. Who.int. Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes
2. Qatar diabetes report 2010 — 2045 [Internet]. Diabetesatlas.org. Available from: https://diabetesatlas.org/data/en/country/161/qa.html
3. World Health Organization, Global Report on Diabetes, World Health Organization, Geneva, Switzerland, 2016.
4. Ministry of Public Health [Internet]. Moph.gov.qa. 2020 [cited 3 May 2020]. Available from: https://www.moph.gov.qa/english/strategies/Supporting-Strategies-and-Frameworks/nationaldiabetesstrategy/Pages/default.aspx
5. .A. Bener, M. Zirie, I. M. Janahi, A. O. A. A. Al-Hamaq,M. Musallam, and N. J. Wareham, "Prevalence of diagnosed and undiagnosed diabetes mellitus and its risk factors in a population-based study of Qatar," Diabetes Research and Clinical Practice, vol. 84, no. 1, pp. 99–106, 2009.
6. S. F. Awad, M. O'Flaherty, J. Critchley, and L. J. Abu-Raddad,"Forecasting the burden of type 2 diabetes mellitus in Qatar to 2050: a novel modeling approach," Diabetes Research and Clinical Practice, vol. 137, pp. 100–108, 2018
7. Attal S, Mahmoud M, Aseel M, Candra A, Amuna P, Elnagmi M et al. Indicators of Quality of Clinical Care for Type 2 Diabetes Patients in Primary Health Care Centers in Qatar: A Retrospective Analysis. 2020.
8. Euro.who.int. 2020. WHO Announces COVID-19 Outbreak A Pandemic. [online] Available at: <http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic>
9. Qatar launching new remote healthcare services [Internet]. Moph.gov.qa. 2020 [cited 3 May 2020]. Available from: https://www.moph.gov.qa/english/mediacenter/News/Pages/NewsDetails.aspx?ItemId=115
10. Greenhalgh T, Vijayaraghavan S, Wherton J, et al. Virtual online consultations: advantages and limitations (VOCAL) study. BMJ Open 2016;6:e009388. doi:10.1136/bmjopen-2015-009388

11. Greenwood, D., Gee, P., Fatkin, K. and Peeples, M., 2020. A Systematic Review Of Reviews Evaluating Technology-Enabled Diabetes Self-Management Education And Support.
12. Yeoree Yang, MD, Eun Young Lee, MD, PhD,and Jae-Hyoung Cho, MD, PhD. Effect of a Mobile Phone–Based Glucose-Monitoring and Feedback System for Type 2 Diabetes Management in Multiple Primary Care Clinic Settings: Cluster Randomized Controlled Trial. JMIR Mhealth Uhealth. 2020 Feb; 8(2): e16266.
13. Riddle, M.C. 1 Improving Care and Promoting Health in Populations: Standards of Medical Care in Diabetes-2020. Diabetes Care. [Online] 2020;43(1): S9. Available from: https://care.diabetesjournals.org/content/43/Supplement_1/S7.
14. Lee SWH, Chan CKY, Chua SS, Chaiyakunapruk N. Comparative effectiveness of telemedicine strategies on type 2 diabetes management: a systematic review and network meta-analysis. Sci Rep 2017;7:12680
15. Faruque LI, Wiebe N, Ehteshami-Afshar A, et al.; Alberta Kidney Disease Network. Effect of telemedicine on glycated hemoglobin in diabetes: a systematic review and meta-analysis of randomized trials. CMAJ 2017;189: E341–E364
16. Marcolino MS, Maia JX, Alkmim MBM, Boersma E, Ribeiro AL. Telemedicine application in the care of diabetes patients: systematic review and meta-analysis. PLoS One 2013;8: e79246
17. Heitkemper EM, Mamykina L, Travers J, Smaldone A. Do health information technology self-management interventions improve glycemic control in medically underserved adults with diabetes? A systematic review and meta-analysis. J Am Med Inform Assoc 2017;24:1024–1035
18. Improving Care and Promoting Health in Populations: Standards of Medical Care in Diabetes—2020 American Diabetes Association Diabetes Care Jan 2020, 43 (Supplement 1) S7-S13; DOI:10.2337/dc20-S001
19. American Diabetes Association, “Comprehensive medical evaluation and assessment of comorbidities: standards of medical care in diabetes—2019,” Diabetes Care, vol. 42, no. (Supplement 1), pp. S34–S45, 2018.