

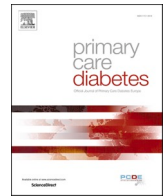


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Continuity of care in patients with type 2 diabetes in Croatian primary care setting during COVID-19 pandemic: A retrospective observational study

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ABSTRACT

Aim: To examine the differences in the continuity of health care for type 2 diabetic patients before and during COVID pandemic in family medicine depending on whether the physician who provided care finished vocational training in family medicine or not.

Methods: This retrospective longitudinal research lasted from 2018 to 2020 in eight family medicine practices on 648 patients with type 2 diabetes diagnosed before 2018, and without Sars-Cov2 infection in previous medical history in Zagreb, Croatia. Follow-up parameters (HbA1c, LDL, eGFR, blood pressure, BMI, eye fundus and neurological findings, number of check-ups and vaccination against the flu) were noted before (2018, 2019), and in the COVID period (2020) in the care of family medicine specialists (FMPs) and without it (FMPws).

Results: No differences were found between the gender and age of patients. A decrease was seen in existing laboratory findings (64–47%, $P < 0.001$), eye fundus check-ups (39–37%, $P = NS$), neurologist check-ups (28–25%, $P = NS$) and FMP check-ups (382–321, $P < 0.001$) during the COVID period with significant differences between FMPs and FMPws. Significant changes were seen in LDL cholesterol (2.7–2.4 mmol/L, $P < 0.001$) and eGFR (83–80 ml/min/1.73 m², $P = 0.002$), but BMI, blood pressure and HbA1c (>7% had 42% of patients) values did not differ during the COVID period.

Conclusion: According to the observed parameters, the continuity of care for diabetic patients in Zagreb has worsened during the COVID pandemic but remained significantly better in care of FMPs than in FMPws, without differences in achieving target values of follow-up parameters.

1. Introduction

Diabetes mellitus is the third most common cause of death in Croatia in 2019 and presents a challenge to physicians and patients on a daily basis [1]. According to the CroDiab Register of People with Diabetes, 310 212 people with diabetes were registered in Croatia in 2020, and it is estimated that this is only 60% of all the patients with diabetes [2]. The outbreak of the COVID-19 pandemic has affected the healthcare

system around the world, and it is assumed that the real pandemic of chronic diseases is still to come [3]. Diabetic patients are at a risk due to greater susceptibility to infections caused by hyperglycaemia weakened immune response, vascular insufficiency, and colonisation of the skin by other pathogens [4]. More frequent complications of COVID-19 disease and admissions to intensive care units were recorded, along with longer hospitalisation and higher mortality in patients with diabetes mellitus, which makes the patient's propensity of delaying visits to family

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medicine offices understandable [5]. According to the current Croatian guidelines for pharmacological treatment of diabetes mellitus [6], glycated haemoglobin (HbA1c) targets are 7% and lower because the microvascular and macrovascular complications of diabetes have been proven to be lower in these values. According to the already mentioned CroDiab register, only 31.18% of patients in Croatia had well-regulated HbA1c values (<7,5%) in 2020 [2]. An unregulated disease has been proven to carry a higher mortality rate [7]. Age, comorbidities, poor prevention, insufficient lifestyle changes, difficulties in cooperation between doctors and patients, and insufficient education of patients are key problems in the care of people with diabetes [8]. The main and irreplaceable role in monitoring and motivating patients with diabetes mellitus to change all the risk factors mentioned above is played by family medicine practitioners, who are beneficial in the process of treating the disease [9]. Regular ophthalmologic examinations, foot examinations, monitoring of blood glucose level, glycolized haemoglobin and cholesterol values, vaccination, screening for nephropathies and blood pressure regulation can improve the care of diabetic patients [10]. The number of family medicine specialists in Croatia is lower than 50% of all physicians working in family practice offices. Offices without a permanent doctor are subject to frequent changes because young physicians rather choose other residencies than family medicine, which makes it difficult for the continuity of cooperation between patients and doctors.

The aim of this study was to examine the differences in the continuity of health care for type 2 diabetic patients before and during COVID pandemic in family medicine depending on whether the physician who provided care finished vocational training in family medicine or not.

2. Subjects and methods

This retrospective longitudinal study lasted from 1st January 2018–31st December 2020 and was conducted on eight family medicine practices (FMP) in the city of Zagreb, Croatia in February and March 2021.

2.1. Study sample

All patients with the verified diabetes mellitus type 2 (DM2) with or without complications were listed via Medicus (MCS) search engine by ICD-10 codes E11-E14. Follow-up criteria were specified by NICE guidelines for DM2 from 2020 (body mass index [BMI], blood pressure [BP], glycated haemoglobin (HbA1c), low-density lipoprotein (LDL) cholesterol, triglycerides, glomerular filtration rate [GFR]) (8). Additionally, we examined the consultation rate to the FMP and diabetologist, the number of DM2 panels in FMP, and data on flu vaccination and the presence of complications (diabetic retinopathy and/or neuropathy) in 2018 and 2019 (preCOVID period) and 2020 (COVID period). Because there were no statistical differences between the parameters from 2018 and 2019, to analyse the preCOVID period, data from 2018 and 2019 were included together and divided into FMP with family medicine specialist (FMPs) and those without it (FMPws). Exclusive criteria were diabetes diagnosed in 2018 and later, and Sars-Cov2 infection in the medical history.

2.2. Data sources

BP values taken from medical records were measured by OMRON^R BP monitor after 5 min of sitting in FMP. BMI values were determined by an analogue scale with a built-in measuring metre. Blood samples were collected by standard procedures for HbA1c, LDL cholesterol, triglycerides, and creatinine levels at the local lab in the Health centre Zagreb West. GFR was estimated by the CKD-EPI formula. Phone calls were counted if a patient asked for some advice about DM2 in his/her medical record. Ordering DM2 medication or aids (glucose test strips, sensors, etc.) was not considered as any type of consultation. Physical

check-up in family practice was considered if a patient had a record of physical examination due to DM2. A diabetologist check-up was counted only if a patient had a record of a diabetologist visit.

Checked comorbidities were (by ICD-10): I10-I15 (arterial hypertension with or without complications), E78 (hyperlipidaemia), a group of C diagnosis (malignancies), E03-E06 (thyroid diseases), I48 (atrial fibrillation), I50 (chronic heart failure), N18 (chronic kidney disease), F32-F33 (depression). Good regulation of DM2 was defined by HbA1c < 7%, BP < 130/80 mmHg, glomerular filtration rate (GFR) > 60 ml/min/1,73 m², triglycerides < 1,7 mmol/L, and LDL cholesterol < 2,6 mmol/L (because cardiovascular risk was not considered in our study).

Missing data of all variables from medical records were analysed separately to address the quality of the diabetic care.

2.3. Human subject protections

An application for full ethical approval was made to the Health centre Zagreb West Ethic committee and ethics consent was received on 16th February 2021. Informed consent was taken from all participants in this study verbally because of COVID-19 pandemic conditions and data was retrogradely collected from medical history encrypted by the code known only to the main investigator.

2.4. Statistical analyses

The normality of data distribution was checked with the Kolmogorov-Smirnov test. Variables that follow normal distribution were analysed with the Student t-test. For non-parametric analysis, we used the Mann-Whitney U test and Wilcoxon match test. Pearson's χ^2 test was used for categorical variable analysis. Correlations were checked with Spearman's non-parametric test. Normally distributed variables were shown as mean \pm standard deviation, while median (interquartile range) was used for other variables. $P < 0.05$ was considered significant. Data were processed with Statistica v.10.0.

3. Results

Of total 14 759 patients in analysed eight family medicine practices in Zagreb, the Croatian capital, 648 patients with DM2 were included (4.39%) in our study. 316 patients came from the three practices with a non-specialist physician (5.95%) and 332 (3.51%) patients came from five practices with a family medicine specialist.

The median of FMPs's age was 65 (55–65) years with the working experience of 38 (31–38) years, while FMPws had the working experience of 2 (2–3) years with the median of their age of 26 years ($P < 0.001$). We did not find any gender differences. The most common comorbidities were arterial hypertension and hyperlipidaemia, while the number of other comorbidities were low with no statistical differences between practices with FMPws and FMPs (Table 1). The size of the list of patients for each FMP did not influence the number of check-ups ($r = 0.156$; $P = \text{NS}$) and/or the number of other findings in diabetic patients.

Recorded parameters for the sufficient DM2 control i.e., care quality parameters, were much higher in practices with FMPs than with FMPws in the COVID period. In this period, FMPs noticed a significant decrease of noted BMI results by 12.83% ($P = 0.042$), lab results by 27.14% ($P < 0.001$), DM2 panels of FMPs by 46.77% ($P < 0.001$) and the number of FMPs check-ups by 20.13% ($P < 0.001$). An increase of the number of BP results by 31.58% ($P < 0.001$) was found by FMPws, DM2 panels in FMPws by 43.33% ($P < 0.001$) and the diabetologist check-ups by 70.25% ($P < 0.001$). In both periods, the ratio of patients checked of FMPs, having BP, eye fundus and neurologist results was statistically significantly higher than of FMPws (Fig. 1). Differences from the entire cohort are shown in Table 2.

A higher number of FMP check-ups, phone consultations, referrals to neurologists, ophthalmologists and patients who received flu vaccine

Table 1

Differences between diabetic patients in care of FMPws or FMPs in 2020. FMP = family medicine physician; DM = diabetes mellitus.

Variable	FMP non-specialists (3 practices)	FMP specialists (5 practices)	P
Median (interquartile range)			
Patient's age (years)	70.0 (65.0–77.0)	69.0 (61.0–77.0)	0.074*
Number of patients per FMP	1989 (1920–2050)	1748 (1480–2082)	0.765*
Patients with DM per FMP	102 (101–113)	73 (38–91)	0.136*
Disease duration (age)	10.0 (7.0–12.0)	9.0 (5.0–12.0)	< 0.001*
Number of comorbidities	2 (2–3)	2 (1–3)	< 0.001*
Counts – patient's characteristics	N = 316	N = 332	
Male patients	183 (57.91%)	176 (53.01%)	
Female patients	133 (42.09%)	156 (46.99%)	0.210 [†]
Arterial hypertension	237 (75.00%)	258 (77.71%)	0.417 [†]
Hyperlipidemia	125 (39.56%)	123 (37.05%)	0.511 [†]
Chronic kidney disease	36 (11.39%)	36 (10.84%)	0.824 [†]
Malignancies	34 (10.76%)	38 (11.45%)	0.781 [†]
Smoker	51 (16.14%)	51 (15.36%)	0.786 [†]

*Mann-Whitney U test, [†]Pearson χ^2 test.

($P < 0.001$ in both examined periods) are noticed in FMPs.

Changes in the COVID period in FMPs are noticeable in 23.29% fewer FMP check-ups (527 or 2 per patient vs. 687 or 3 per patient, $P < 0.001$), 33.12% less phone consultations (313 vs. 468 calls) although the number of patients who used the phone was nearly the same (145 vs. 134 patients, $P = 0.387$), while the number of diabetologist check-ups decreased by 18,64% (48 vs. 59, $P = 0.246$) compared to the preCOVID period. An increase of phone consultations by 60.00% (35 vs. 56 calls, $P = 0.017$) in care of FMPws was noticed, but no change in the number of phone consultation users (38 vs. 34 patients, $P = 0.616$). The diabetologist check-ups were increased by 70.00% (85 vs. 50, $P < 0.001$), and 40.84% more patients received the flu vaccine (71 vs. 100, $P = 0.009$) than in the preCOVID period. No significant change was found in FMPws check-ups compared to the preCOVID period (114 vs. 123, $P = 0.459$). All findings are listed in Table 2.

At least 41% of FMPws and 50% of FMPs patients had unregulated

BP values ($P = 0.051$), while HbA1c $> 7\%$ was measured in 43.15% of FMPws patients and 41.87% of FMPs patients in the COVID period ($P = 0.822$). However, 27% in preCOVID and 30% patients older than 70 years in COVID period had HbA1c between 7% and 8%. Although LDL cholesterol was better regulated in the COVID period ($P = 0.014$), 40% of patients had LDL above 2.6 mmol/L. An increase of HbA1c value was associated with deterioration of kidney function ($r = 0.564$, $P < 0.001$). Chronic kidney disease (CKD) was found in 12.12% of patients in FMPws in the preCOVID period and 20.34% in the COVID period ($P = 0.041$), while in FMPs an increase was not statistically significant ($P = 0.062$).

The ratio of recorded quality parameters was significantly different between FMPws and FMPs, and between the preCOVID and COVID period ($P < 0.001$). In both periods, 35 patients of FMPws patients (11.07%) had recorded BMI values, 49 (15.51%) had their BP values recorded, and 105 patients (33.23%) had their GFR noted. In FMPs, in both periods, BMI values were checked in 89 (26.81%) patients, BP in 137 patients (41.26%), while 113 patients (34.04%) had their GFR noted. HbA1c was continuously monitored in 88 (27.85%) patients in FMPws and 118 (35.54%) patients in FMPs in both periods (Table 3).

Most patients had HbA1c values between 6% and 8% (Figs. 2, 1a and 1b) without statistically significant differences between FMPs and FMPws in preCOVID and COVID periods ($P = 0.663$). On the other hand, the kidney function (Figs. 2, 2a and 2b) significantly deteriorated in the COVID period in both FMPs and FMPws ($P < 0.05$) showing a significant difference in the ratio of patients in GFR groups between FMPs and FMPws ($P < 0.01$).

4. Discussion

The decline in the number of recorded findings (BMI, blood pressure, laboratory) as well as control examinations during the pandemic shows that the COVID 19 pandemic significantly reduced the follow-up of patients in the care of FMPs, while the follow-up in FMPws was equally poor in both periods. These changes can be seen in the decrease of the regular laboratory check-ups from 71% to 52% in a pandemic in FMPs, 21% fewer check-ups, 33% less phone consultations and 18% less diabetologist check-ups in FMPs. The number of laboratory findings of FMPws is higher than the number of control examinations performed in both periods, which indirectly shows the poorer quality of care in these

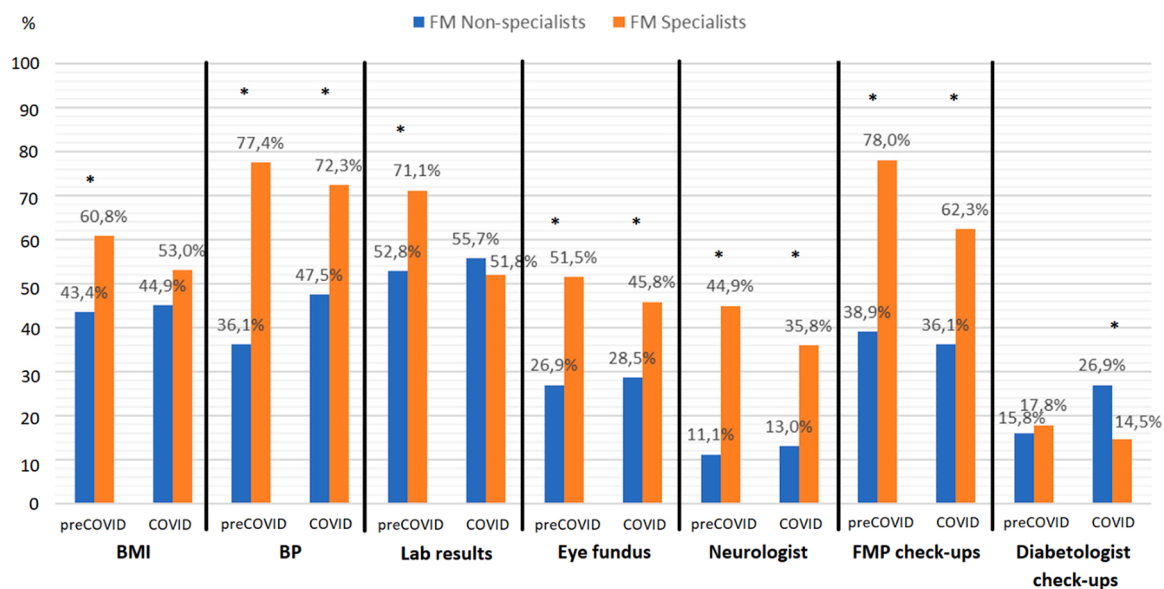


Fig. 1. Comparison of care quality parameters in diabetic patients type 2 during the preCOVID with COVID period in family medicine practices depending on physicians' specialisation. FM = family medicine; BMI = body mass index; BP = blood pressure; FMP = family medicine physician. *Represents significant statistical difference ($P < 0.01$).

Table 2
Differences in care for diabetics between FMPs and FMPws in preCOVID and COVID period.

Variable	All		preCOVID period						COVID period						
	preCOVID (N = 648)		COVID (N = 648)		P	Non-specialists (N = 316)		Specialists (N = 332)		P	Non-specialists (N = 316)		Specialists (N = 332)		P
	Value	N	Value	N		Value	N	Value	N		Value	N	Value	N	
Number of patients with positive findings															
Retinopathy	61 (23.8%)	256 (39.5%)	64 (26.4%)	242 (37.3%)	0.424 [‡]	45 (26.9%)	85 (37.3%)	16 (51.5%)	171 (51.5%)	<	50 (28.5%)	90 (28.5%)	14 (45.8%)	152 (45.8%)	<
Neuropathy	48 (26.1%)	184 (28.4%)	52 (32.5%)	160 (24.7%)	0.131 [‡]	27 (11.1%)	35 (11.1%)	21 (44.9%)	149 (44.9%)	<	31 (12.9%)	41 (12.9%)	21 (35.8%)	119 (35.8%)	<
FMP check-ups	382 (58.9%)		321 (49.5%)		<	123		259		<	114		207		<
Phone consultations	168 (25.9%)		183 (28.2%)		0.001 [‡]	34		134		<	38		145		<
Diabetologist check-ups	109 (16.8%)		133 (20.5%)		0.087 [‡]	50		59		0.377 [‡]	85		48		<
Completed DM panel	261 (40.3%)		193 (20.5%)		<	60		201		<	86		107		0.163 [‡]
Received flu vaccine	216 (33.3%)		248 (38.3%)		0.064 [‡]	71		145		<	100		148		<
Means ± standard deviation															
BMI (kg/m ²)	29.52 ± 5.63	349 (53.9%)	29.67 ± 5.09	312 (48.1%)	0.717 [†]	29.05 ± 5.90	124 (39.2%)	29.78 ± 5.47	225 (67.8%)	0.248 [†]	29.64 ± 4.54	135 (42.7%)	29.69 ± 5.48	177 (53.3%)	0.919 [†]
BP systole (mmHg)	138.01 ± 17.21	373 (57.5%)	137.72 ± 15.66	362 (55.9%)	0.806 [†]	135.02 ± 16.98	116 (36.7%)	139.42 ± 17.16	257 (77.4%)	0.022 [†]	135.90 ± 14.69	159 (50.3%)	138.88 ± 16.67	203 (61.1%)	0.076 [†]
BP diastole (mmHg)	82.15 ± 11.39	373 (57.6%)	81.43 ± 8.53	362 (55.9%)	0.336 [†]	82.33 ± 14.02	116 (36.7%)	82.22 ± 10.23	257 (77.4%)	0.930 [†]	81.33 ± 6.61	159 (50.3%)	81.51 ± 9.79	203 (61.1%)	0.845 [†]
HbA1c (%)	7.19 ± 1.39	414 (63.9%)	7.17 ± 1.34	306 (47.2%)	0.841 [†]	7.35 ± 1.33	180 (56.9%)	7.07 ± 1.42	234 (70.5%)	0.047 [†]	7.16 ± 1.35	146 (46.2%)	7.19 ± 1.33	160 (48.2%)	0.842 [†]
Medians (interquartile range)															
LDL (mmol/L)	2.7 (2.0–3.4)	404 (62.3%)	2.4 (1.8–3.2)	318 (49.1%)	<	2.8 (2.1–3.4)	175 (55.4%)	2.5 (1.9–3.3)	229 (68.9%)	0.099*	2.4 (1.8–3.3)	165 (52.2%)	2.2 (1.8–3.0)	153 (46.1%)	0.148*
Triglycerides (mmol/L)	1.5 (1.1–2.2)	426 (65.7%)	1.6 (1.1–2.2)	321 (49.5%)	0.723*	1.60 (1.2–2.3)	185 (58.5%)	1.4 (1.1–2.1)	241 (72.6%)	0.289*	1.5 (1.1–2.1)	166 (52.5%)	1.6 (1.2–2.3)	155 (46.7%)	0.140*
GFR (ml/min)	83 (68–91)	403 (62.2%)	80 (61–90)	349 (53.9%)	0.002*	82 (70–90)	165 (52.2%)	83 (68–93)	230 (69.3%)	0.602*	80 (60–88)	177 (56.0%)	78 (62–90)	172 (51.8%)	0.364*

N = number of patients; BMI = body mass index, BP = blood pressure, GFR = glomerular filtration rate, DM = diabetes mellitus.

†Student t-test; *Mann-Whitney U test; ‡Pearson χ^2 test.

Table 3
Differences in values of quality parameters in both preCOVID and COVID period in care of FMPs or FMPws.

Variable	FM non-specialists (N = 316)			P	FM specialists (N = 332)			P
	preCOVID	COVID	N		preCOVID	COVID	N	
BMI (kg/m ²)	29.39 (26.00–32.00)	28.71 (26.00–33.00)	35 (11.08%)	0.190	29.00 (26.23–33.00)	29.28 (26.00–33.00)	89 (26.81%)	0.002
SBP (mmHg)	135.00 (130.00–140.00)	132.50 (130.00–140.00)	49 (15.51%)	0.274	140.00 (130.00–150.00)	140.00 (130.00–150.00)	137 (41.26%)	0.994
HbA1c (%)	7.10 (6.40–8.05)	7.00 (6.40–7.80)	88 (27.85%)	0.904	6.80 (6.30–7.50)	6.85 (6.40–7.70)	118 (35.54%)	0.329
LDL (mmol/L)	2.80 (2.10–3.41)	2.40 (1.83–3.30)	91 (28.80%)	0.021	2.50 (1.90–3.30)	2.20 (1.80–3.00)	99 (29.82%)	0.184
GFR (ml/min)	82.00 (70.00–90.00)	80.00 (60.00–88.00)	105 (33.23%)	< 0.001	83.00 (68.00–93.00)	78.00 (62.00–90.50)	113 (34.04%)	0.003

BMI = body mass index; SBP = systolic blood pressure; GFR = glomerular filtration rate. Medians and interquartile range are shown. Wilcoxon matched pairs test was used.

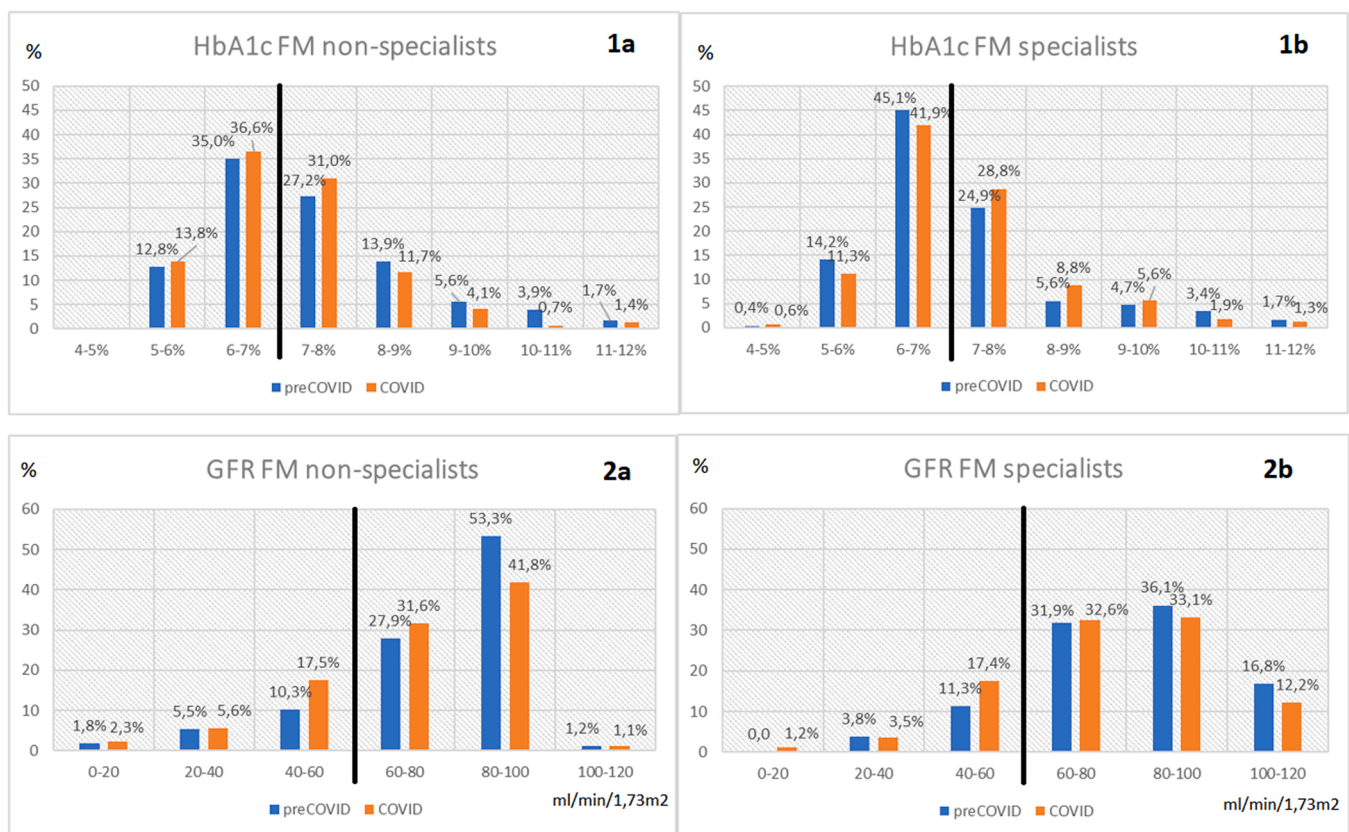


Fig. 2. Ratio of diabetic patients by recorded HbA1c (1a, 1b) and glomerular filtration rate (GFR) values (2a, 2b) in preCOVID and COVID period in care of FMPws or FMPs. HbA1c > 7% is considered as poor controlled value while GFR < 60 ml/min/1.73 m² represents CKD (black vertical line).

practices, and it should be noted that the number of referrals to diabetologists was almost two times higher than of FMPs (27% vs. 14%). Also, no statistical differences were found in achieving target values of follow-up parameters.

There is an increase in number of “temporary” or “substitute” physicians in primary health care systems that are necessary for the continuous function of the health care system [11]. Some data show that there are more complaints and sanctions on the work of substitute physicians, but empirical evidence on the quality of their work is very scarce, insufficient for serious analysis and requires further research [12, 13]. In our study, FMPs worked for an average of 35 years mainly in the same practice, while FMPws were young physicians at the beginning of their careers who have changed at least one practice a year during this study. We can conclude that the better care was given to patients who had FMPs both in the COVID and preCOVID period.

In 7 out of the 12 published studies [14–19], higher physician age

was associated with the poorer quality of care which is contradicted to our results, possibly because of the FMPs higher academic rank and longer continuity of care.

Comparing our results with other countries in the preCOVID period, 80.4% of diabetic patients in a Swiss study [20], 45% in Canadian [21] and 47.6% in an American study [22] had at least one recorded HbA1c measurement in one year. In addition to coverage data, in our study we see significantly better regulation of glycemia in favour of FMPs, but only in the preCOVID period (7.07% vs 7.35%). The data on continuous monitoring was poor, and only 27.85% of the same patients in the care of FMPws and 35.54% of the same patients in FMPs had their HbA1c values measured in each year of monitoring. In addition, nearly half of the existing HbA1c values were above 7% which caused additional deterioration of renal function during the follow-up period. Considering that the average age of the patients in the study was around 70 years, the data that 27% of patients in preCOVID and 30% of patients in the COVID

period had HbA1c in the range of 7–8%, and if they are in the older age group and/or already have expressed complications of diabetes, it may even indicate sufficient glycaemic regulation.

According to the guidelines [23] more than 55% of patients in the care of FMPs had unsatisfactory values of blood pressure (>130/80 mmHg), with worrying data on the number of diabetic patients without recorded values of arterial blood pressure in the medical record. Even though a slightly higher number of diabetic patients in FMPs care had their blood pressure recorded during the COVID pandemic than before (47% vs 36%), patients covered by the FMPs had their blood pressure recorded in a significantly higher percentage of diabetics involved, 77% in preCOVID and 72% in the COVID period. For comparison, in a Swiss study [20], 75% of diabetics that were involved had regular blood pressure data recorded, and the set target value (<140/85 mmHg) was reached by 50% of subjects.

Retinopathy screening by an ophthalmology specialist is recommended once a year [8], but in our study only a quarter of patients that were in the care of FMPs had an ophthalmologist's examination in both periods, that suggested that more than 50% of examined diabetics had verified signs of diabetic retinopathy. Situation was significantly better in the FMPs practice, where half of the patients were screened by an ophthalmologist, and only about 10% of them had verified signs of diabetic retinopathy. Those results require a significant change of approach to detect diabetic retinopathy in time to prevent blindness [24, 25]. When we think about the existence of neurological findings, the situation is much worse. Patients in the care of FMPs only had 11–13% of patients screened for polyneuropathies, while as many as 77% of examined patients had signs of polyneuropathy regardless of type. Since the number of patients with diabetic polyneuropathy in care of FMPs is identical in both periods (14%), we can assume that during the COVID period fewer patients were referred for neurological examination to prevent polyneuropathy. On the other hand, the number of neurological examinations was decreased due to less check-ups of patients with DM2. It is estimated that about 50% of diabetic patients suffer from polyneuropathy, and half of the patients remain asymptomatic [26].

Prevention can be improved by a more active approach for which we need to analyse data that have more updated panels and BMI values, which, in our study, only 43% of diabetics had in FMPs. On the other hand, patients who had their data was recorded, the average value of BMI was even higher than 29 kg/m². Although somewhat better regulation of LDL cholesterol was achieved during the analysed period, its values are still around 40% greater than in the guidelines (2.6 mmol/L) [27].

Continuous medical education showed a significant improvement in diabetes management in Iranian FMP showing no difference between the effectiveness of FMP and internal medicine specialists [28]. We need to develop a better plan for achieving more successful continuity of care and prevention of diabetic complications in family practices with an emphasis on patient education, and at least once-a-year check-ups that include BMI, BP measurement, laboratory, ophthalmology, and neurology testing. With quality continuous care diabetic patients can develop better life habits and achieve greater cooperation in taking the prescribed therapy and significantly reduce the chance of developing complications [29].

4.1. Limitations

The lack of almost half of the patient's test results (HbA1c, cholesterol, BMI, etc.) limited the interpretation of our results. In the Croatian population, almost half of the patients with DM2 do not have the diagnosis of the disease and consequently could not be included in this study [2]. Because this study was conducted in the western region of Zagreb (the capital) we cannot claim that our results reflect the situation on the national level. To improve the accuracy of results, FMP from rural and less developed regions should also be included. Because DM2 is a chronic disease and this research included the first year of the COVID

pandemic, the long-lasting impact of the pandemic will be noticed in years to come and cannot be examined in this research. There is a need for more extensive and long-lasting research, as well as qualitative studies, to understand lockdown impact on patients with chronic diseases. All patients without lab results and check-ups for a year or more will be called afterwards, referred to a local laboratory, and checked in FMP.

5. Conclusion

The continuity of care for diabetic patients has worsened during the COVID pandemic but remained statistically significantly better in family practices with family medicine specialists than in practices without specialists, although there were no significant differences in achieving target values of follow-up parameters. COVID pandemic has been forcing family medicine physicians to develop a different approach and methods in the care of diabetic patients and we need to encourage their implementation in further care.

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Conflict of interest

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

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Author contributions

J.J. and I.P. conceived and planned the study. All authors have contributed by collecting the data. J.J. and S.S.P. contributed to the interpretation of the results. J.J., S.B. and A.R. wrote the manuscript. F. B., M.P. and S.B. provided critical feedback and helped shape the research. J.J. performed the statistical calculations. S.S.P. supervised the project.

Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author, Juraj Jug, upon reasonable request (juraj2304@gmail.com).

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