Quality and Outcome of Diabetes Care During the COVID-19 Pandemic in Switzerland

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ABSTRACT

The COVID-19 pandemic has not only challenged health services around the globe, but also had a major impact on the economy. In the context of this global pandemic, management of chronic non-communicable diseases such as diabetes, hypertension and dyslipidemia can be affected in a multitude of ways. Even in the absence of an overload of COVID-19 cases, patients may not receive standard care because of disease control measures. Previous studies on the effects of the pandemic on diabetes care have shown conflicting results in the short term, some indicating worsening glycemic control, and others showing improvements. This study aims to determine the long-term impact of the SARS-CoV-2 pandemic on the quality and outcome of diabetes care. We will compare quality and outcomes of diabetes care in two cohorts of patients before and during the pandemic (between March 17th 2018 and March 16th 2021), using standardized measures of quality in diabetes care from national and international guidelines. We will measure the difference of the absolute change in prevalence of quality indicators between the two cohorts to estimate the impact of the pandemic on diabetes care.

BACKGROUND

In order to measure the impact of the pandemic on public health, not only the direct effects of SARS-CoV-2 infection need to be considered, but also the impact of disease control measures and the economic recession on the management of non-communicable diseases (NCDs). In fact, the COVID-19 pandemic not only challenged health services around the globe, but also had a major impact on the economy, leading to unemployment and wage loss. Public response has been focused on the control of the epidemic and the mitigation of its economic consequences.

In the context of a global pandemic, management of chronic NCDs such as diabetes, hypertension and dyslipidemia can be affected in several ways. Even in the absence of an overload of COVID-19 cases, patients may not receive standard care because of disease control measures. In Switzerland, non-urgent patient care was prohibited by emergency laws from March 17th, 2020 to April 26th, 2020 [1]. In addition, the pandemic and disease control measures might have a more indirect impact on accessibility of health care. Isolation of patients at risk of severe COVID-19, social distancing and therefore lack of social control, restrictions of public and private transportation, disruption of supply chains for medications, and patients who skip their appointment at their doctor's office for fear of

infection, are only a few examples to be named [2]. Economic models also predict a rise of chronic illnesses due to the recession [3].

NCDs are responsible for significant proportion of mortality and morbidity in Switzerland.[4] Diabetes mellitus is not only a NCD, but also a risk factor for other NCDs, such as coronary heart disease. The prevalence of diabetes mellitus in Switzerland is about 5% [5,6]. Several studies have examined the impact of the COVID-19 pandemic on glycemic control in patients with type 1 and type 2 diabetes mellitus, with conflicting results. Studies from Italy and Turkey showed worsening HbA1c-levels in patients with type 2 diabetes [7–9]. On the other hand, studies from Italy, Spain and the UK showed improved glycemic control in type 1 diabetics during lockdown [10–12]. One cohort study including 2240 patients with type 2 diabetes mellitus in India also showed improved glycemic control [13]. However, all of these studies measured the short-term effects of the pandemic, with an observation period of 8 weeks to 3 months, and were, with the exception of the Indian study, rather small with study populations ranging between 33 and 572 patients.

There have been numerous efforts to measure the quality of diabetes care. The Quality and Outcomes Framework (QOF) has been developed by the National Health System (NHS) in the United Kingdom since 2004 to measure and promote good quality care. The latest set of indicators before the pandemic has been published for 2019-2020 [14]. The Swiss Quality and Outcome Framework is an adaptation of the NHS QOF 2010-2011, that has been used to analyze data from the FIRE project previously [15]. The Swiss Society of Endocrinology and Diabetology has also published recommendations with a set of indicators for a "good" disease management of diabetes in primary care [16]. EQUAM is a Swiss foundation that provides certification of quality in chronic care, including diabetes care, for general practitioners [17].

To our knowledge, there have been no efforts to measure the impact of the COVID-19 pandemic not only on levels of HbA1c, but also on a more comprehensive measure of quality.

OBJECTIVES

This study aims to assess the long-term impact of the SARS-CoV-2 pandemic on the quality and outcome of diabetes care in the primary care setting in Switzerland.

Primary objectives

- To compare the overall quality and outcomes of diabetes care before and during the COVID-19 pandemic, using a composite score including 15 indicators of quality.
- To determine the impact of the COVID-19 pandemic on the quality of diabetes care, defined as the difference in absolute change of the composite score, comparing two cohorts of diabetes patients before and during the begin of the first lock-down in Switzerland.

Secondary objectives

- To evaluate how each indicator changes due to the effect of COVID-19 pandemic.
- To identify patients at risk for worse quality and outcome of diabetes care.

METHODS

Using the data from the FIRE project (Family Medicine ICPC Research Using Electronic Medical Records), we want to compare the prevalence, quality and outcomes of diabetes care before the pandemic (March 17th, 2019 to March 16th, 2021) to the first year of the pandemic (March 17th, 2020 to March 16th, 2021), using indicators of quality and outcomes of diabetes care, based on four national and international recommendations and frameworks[14–17], as described in **Table 1**.

The FIRE database contains diagnosis codes according to the International Classification of Primary Care 2nd edition (ICPC-2), measurements of vital signs, laboratory values, as well as medication. Only indicators that can be extracted from the database, will be considered for this study. Indicators that are not reliably represented in FIRE, such as screening of diabetic polyneuropathy and retinopathy, as well as smoking status and lifestyle counselling, will be omitted from this study.

Table 1: Indicators of quality and outcomes in diabetes care

	INDICATOR	THRESHOLDS	POINTS
1	At least 2 patient encounters within the last year	40-90%	3
2	At least 1 measurement of weight or BMI within the last year	40-90%	3
3	At least 2 measurements of HbA1c within the last year	40-90%	3
4	Average HbA1c ≤7.0% within the last year	40-50%	17
5	Average HbA1c ≤8.0% within the last year	40-70%	8
6	Average HbA1c ≤9.0% within the last year	40-90%	10
7	At least 2 measurements of blood pressure within the last year	40-90%	3
8	Average blood pressure <145/85 mmHg within the last year	40-90%	18
9	At least 1 measurement of LDL-cholesterol and within the last year	40-90%	3
10	Average LDL-cholesterol < 2.6 mmol/l within the last year	40-70%	6
11	At least 1 measurement of serum creatinine and urine albumin/creatinine ratio within the last year	40-90%	3
12	Influenza vaccination within the last year	40-85%	3
13	Treatment of patients with microalbuminuria with a RAAS-inhibitor.	40-90%	3
14	Treatment of patients > 40 years of age and without history of CVD with a statin	40-90%	4
15	Treatment of patients with history of CVD with a statin.	40-90%	3

BMI: body mass index; HbA1c: Hemoglobin A1c; LDL: low density lipoprotein; RAAS: renin-angiotensin-aldosterone system; CVD: cardio-vascular disease (ischemic heart disease, ischemic cerebrovascular disease, peripheral arterial disease). The lower threshold represents the percentage, at which points are attributed. If the value is below this threshold, no points are attributed. The upper percentage represents the threshold, at which all points are attributed. For values between the upper and lower percentage, points are attributed pro rata. For example, if an average HbA1c of ≤9.0% is achieved in 80% of patients, 8 points will be attributed.

Study population

Inclusion criteria for the study are shown in **Table 2**. We will include all patients aged 18 years or more with a diagnosis of diabetes mellits type 1 or 2, that had at least one patient encounter between March 17th, 2018 and March 16th, 2020. From this sample, we will build two cohorts. Cohort 1 will include all patients and at least one patient encounter between March 17th, 2018 and March 16th. Cohort 2 will include all patients and at least one patient encounter beween March 17th, 2019 and March 16th, 2020. We will then observe each cohort for two years.

Table 2: Inclusion Criteria

CRITERION	VARIABLE	DEFINITION
1) DIAGNOSIS OF DIABETES MELLITUS TYPE 1 OR 2	Laboratory diagnosis	At least one measurement - HbA1c ≥6.5% - fasting glucose ≥7.0 mmol/l - non-fasting glucose ≥11.1mmol/l
	Diagnosis through medication	Prescription of any antidiabetic medication (ATC A10)
	Diagnosis through ICPC-2	Any ICPC-Diagnosis Code T89 or T90
2) REGULAR CARE	Regular patient care	At least one patient encounter between 17.03.2018 and 16.03.2020
3) AGE	Age ≥ 18 years	Born before 17.06.2000

Variables

Table 3 shows definitions of variables we plan to extract from the FIRE database. To measure overall quality of care, we will build an updated Swiss Quality and Outcomes Framework, using 15 indicators that can be abstracted from the FIRE database, as described in **Table 1**.

Statistical analysis

To measure overall quality of care, we will report the prevalence of each of the 15 indicators and calculate a composite score by adding the points from each of the indicators, for each of the 3 years in the observation period (i.e. 17.03.2018 – 16.03.2019; 17.03.2019 – 16.03.2020; and 17.03.2020 – 16.03.2021). We will report the composite score for the whole sample, as well as the prevalence of each indicator and the average HbA1c with 95% confidence intervals. We will also report the average composite score, as well as the average prevalence of each indicator, achieved by the individual physicians with standard deviation. We will report the prevalence of comorbidities, such as hypertension, dyslipidemia, obstructive lung diseases, cardio-vascular disease, thyroid disorders, as well demographic variables as numbers and percent, or mean and standard deviation, as appropriate.

To measure the change in quality and outcomes attributable to the COVID-19 pandemic, we will compare the evolution from the first to the second year of each cohort, i.e. the absolute change of the composite score, the absolute change in prevalence of the individual indicators, as well as the absolute change in mean HbA1c levels and the number of patients lost to follow-up. We will use χ^2-test to compare the differences in the composite score, the prevalence of each indicator and the number of patients lost to follow-up between the two cohorts, and Student's t-test to compare the difference in average HbA1c.

To identify patients at risk for negative outcomes, defined as rising HbA1c, we will use unadjusted and multivariable-adjusted generalized linear models using change in HbA1c as dependent variable, and demographics, comorbidities and other indicators as independent variables. To correct for repeated measurements within patients, we will use a mixed model with random effects.

We plan to perform the following subgroup analyses: insulin-dependent and non-insulin-dependent diabetes mellitus; rural, urban and suburban area, using physician postal code and the Eurostat degree of urbanization classification (DEGUBRA) 2011 [18]; and patients with and without multimorbidity, defined as the presence of two or more chronic diseases using pharmaceutical cost groups and ICPC-2-codes.

Table 3: Variables and definitions

TOPIC	VARIABLE	DEFINITION	OBSERVATION PERIOD
DEMOGRAPHICS	Age of the patient	17.03.2018 – date of birth	
	Gender of the patient	Male or female	
	Patient ID	Unique identifier of the patient	
	Physician ID	Unique identifier of the physician	
	Physician locality	Postal code of the physician's practice	
COMORBIDITIES	Number of prescription drugs	Number of different ATC codes	17.03.2018-16.03.2021
	List of prescription drugs	List of different ATC codes	17.03.2018-16.03.2021
	Pharmaceutical cost group	Number of PCGs	17.03.2018-16.03.2021
	Number of diagnoses	Number of different ICPC-2 codes	Whole patient history
	List of diagnoses	List of ICPC-2 codes	Whole patient history
INDICATOR 1	Number of patient encounters	Number of patient encounters within the observation period.	17.03.2018-16.03.2021
INDICATOR 2	Number of BMI measurements	Number of documented weight or BMI measurements within the observation period.	17.03.2018-16.03.2021
	Values of BMI measurements	List of weight or BMI measurements. within the observation period.	17.03.2018-16.03.2021
	Patient height	Value of latest height measurement within the observation period.	Whole patient history
INDICATOR 3	Number of HbA1c measurements	Number of HbA1c measurements within the observation period.	17.03.2018-16.03.2021
INDICATOR 4-6	Values of HbA1c measurements	List of HbA1c values within the observation period.	17.03.2018-16.03.2021
INDICATOR 7	Number of BP measurements	Number of blood pressure measurements within the observation period.	17.03.2018-16.03.2021
INDICATOR 8	Values of BP measurements	List of blood pressure values within the observation period.	17.03.2018-16.03.2021
INDICATOR 9	Number of LDL measurements	Number of LDL-cholesterol measurements within the observation period.	17.03.2018-16.03.2021
INDICATOR 10	Values of LDL measurements	List of LDL values within the observation period.	17.03.2018-16.03.2021
INDICATOR 11	Influenza vaccination	Included in the list of ATC-codes (see comorbidity)	17.03.2018-16.03.2021
INDICATOR 12	Number of CREA measurements	Number of serum creatinine measurements within the observation period.	17.03.2018-16.03.2021
	Values of CREA measurements	List of creatinine measurements within the observation period.	17.03.2018-16.03.2021
	Vaules of eGFR	List of estimated glomerular filtration rates within the observation period*	17.03.2018-16.03.2021
	Number of microalbumuria measurments	Number of measurements of urine creatinine and albumin or urine albumin/creatinine ratio.	17.03.2018-16.03.2021
	Values of microalbuminuria measurements	List of urine albumin, creatinine or albumin/creatinine ratio measurements within the observation period.	17.03.2018-16.03.2021
INDICATOR 13	Diagnosis of diabetic nephropathy	At least one measurement of albumne/creatinine ratio	Whole patient history
	Treatment with RAAS-I	ATC-Codes C09	17.03.2018-16.03.2021
INDICATOR 14-15	History of cardio-vascular disease	ICPC-2 diagnoses K74-K77, K89-K92	Whole patient history
	Treatment with statin	ATC-Codes C10AA, C10AX10, C10BA and C10BX	17.03.2018-16.03.2021

* can be calculated from creatine, age and gender of the patient using CKD-EPI or MDRD formulas

EXPECTED BENEFITS

Understanding the impact of a public health crisis, such as the COVID-19-pandemic, on the management of chronic diseases will help improving chronic disease management, and facilitate an evidence-based decision-making process in the public response during future crises, factoring in not only the direct impact the crisis, but also indirect effects on management of NCDs. Understanding which indicators of quality are the most affected, and which patients are at risk for worse quality and outcomes, will help clinicians better targeting their efforts during times of crisis.

PROJECT TIMELINE

Extraction of data from the FIRE database.	July, 2021
Analysis of data	August, 2021 to October, 2021
First draft of manuscript	November, 2021
Submission in a peer-reviewed journal	January, 2022

RESSOURCES

The team is experienced in observational research methodology and statistical analysis, and some of the authors have already published research using data from the FIRE database.

BUDGET

Item	**Amount**
FIRE database management	CHF 5’000.00
MD candidate gross wage (50%, 6 months, excl. social security fees)	CHF 12’000.00
Social security fees (8%)	CHF 1’000.00
Publication fees	CHF 2’500.00
Other expenses (travel, printing and materials)	CHF 1’000.00
Total	CHF 22’000.00

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