Primary Care Diabetes 16 (2022) 588–590

Contents lists available at ScienceDirect

Primary Care Diabetes

journal homepage: www.journals.elsevier.com/primary-care-diabetes

No effects of the COVID-19 pandemic on the prescription of insulin in Germany

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ARTICLE INFO

Keywords:
Coronavirus disease 2019
COVID-19
Prescription of insulin
Germany

ABSTRACT

Aims: The aim of the study was to investigate the change of insulin doses in Germany between 2017 and 2021.
Methods: This retrospective study used data from the longitudinal prescription LRx database (IQVIA) and included all patients with at least two insulin prescriptions per year in 2017–2021. Calculated daily dose (CDD) was assessed in 2017, 2018, 2019, 2020, and 2021, separately.
Results: The number of patients was comprised between 1,079,894 in 2021 and 1,132,839 in 2018. Median (interquartile range) CDD of basal insulin was relatively stable across the years and ranged between 27.9 (18.5–38.8) in 2021 and 28.3 (18.7–39.5) in 2020. In terms of short-acting insulin, median (interquartile range) CDD slightly decreased from 40.1 (28.2–54.3) in 2017 to 38.1 (27.2–52.2) in 2021. A slight decrease was also observed for mix insulin, from 39.4 (27.5–55.3) in 2017 to 37.9 (26.5–54.2) in 2021. These results were corroborated in most age and sex subgroups.
Conclusions: COVID-19 had no substantial effects on insulin doses in Germany. Further data are warranted to corroborate or refute these findings in other settings and countries.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a global pandemic that has been associated with more than 440 million positive cases and almost six million deaths worldwide [1]. The respective numbers were 15 million and 124,000 in Germany. Healthcare systems have been disrupted since the beginning of the COVID-19 pandemic, and the management of multiple chronic conditions may have suffered from this health crisis [2]. However, the effects of the COVID-19 pandemic on glycemic control in patients with diabetes remain under debate [3–7]. For example, a study, including 101 individuals with type 2 diabetes from Turkey, revealed that glycated hemoglobin (HbA1c) had increased from 7.7% during the pre-lockdown period to 8.1% during the lockdown period, while fasting glucose had risen from 158 to 163 mg/dl [6]. In contrast, a study of 380 type 2 diabetes individuals from Greece found a decrease in HbA1c, body mass index, and total cholesterol values during the lockdown in this country [7]. In Germany, the first lockdown has had little impact on HbA1c, fasting glucose and several other metabolic parameters (e.g., blood pressure, cholesterol and triglycerides) in the type 2 diabetes population [4]. In addition to this scientific debate, only a few studies have compared the prescription of insulin in patients with diabetes between the pre-COVID-19 and the COVID-19 era [8,9]. Although these studies have advanced the field, they were based on data exclusively collected in 2020, and little is known on how COVID-19 impacted insulin consumption in the diabetes population in 2021. Therefore, this study aimed to investigate the prescription of insulin in Germany between 2017 and 2021.

Abbreviations: ATC, Anatomical Therapeutic Chemical Classification System; CDD, Calculated daily dose; EphMRA, European Pharmaceutical Market Research Association; HbA1c, Glycated hemoglobin.

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https://doi.org/10.1016/j.pcd.2022.04.007
Received 23 March 2022; Received in revised form 20 April 2022; Accepted 21 April 2022
Available online 25 April 2022
1751-9918/

2. Methods

This retrospective study used data from the longitudinal prescription LRx database (IQVIA). The LRx database contains data on approximately 80% of prescriptions reimbursed by statutory health insurance funds in Germany. For each prescription, information is available on brand, substance, package size, product form, and dispensed date. Besides, age and sex of patients are documented in the database. All data are anonymized in accordance with German data privacy laws. Finally, the LRx database has already been used in previous studies focusing on the prescription of insulin [10,11].

The present study included all patients with at least one prescription for insulin (Anatomical Therapeutic Chemical Classification System [ATC] of the European Pharmaceutical Market Research Association [EphMRA]: A10C) in 2017–2021. From these patients, only those receiving at least two prescriptions of the same type of insulin (i.e., basal [A10C2 and A10C5], short-acting [A10C1], and mix insulin [A10C3]) within one year were included. Finally, individuals with missing data on age or sex were excluded from the analysis.

Calculated daily dose (CDD) was assessed in 2017, 2018, 2019, 2020, and 2021, separately. CDD was defined as follows: (package size * number of packages) / number of days between two consecutive prescriptions. Mean CDD was obtained for each patient and, because data were not normally distributed, median (interquartile range) CDD was estimated for each year. The three types of insulin (i.e., basal, short-acting, and mix insulin) were studied separately, and analyses were stratified by age (i.e., 0-<18, 18–40, 41–50, 51–60, 61–70, 71–80, and >80 years) and sex (i.e., male and female). This study was of a descriptive nature, and no hypotheses were tested. All analyses were carried out using SAS version 9.4 (SAS institute, Cary, USA).

3. Results

The characteristics of the population are displayed in Table 1. The number of patients was comprised between 1,079,894 in 2021 and 1,132,839 in 2018. Mean (standard deviation) age decreased from 72.1 (29.4) years in 2017 to 66.9 (17.5) years in 2021, while the proportion of men increased from 52.7% to 53.5%. The most frequent type of insulin was basal insulin (75.4%−76.7%), whereas the least frequent type was mix insulin (4.8%−7.7%). CDD of insulin per year in the overall population and by age and sex is shown in Table 2. Median (interquartile range) CDD of basal insulin was relatively stable across the years and ranged between 27.9 (18.5–38.8) in 2021 and 28.3 (18.7–39.5) in 2020. In terms of short-acting insulin, median (interquartile range) CDD slightly decreased from 40.1 (28.2–54.3) in 2017 to 38.1 (27.2–52.2) in 2021. A slight decrease was also observed for mix insulin, from 39.4 (27.5–55.3) in 2017 to 37.9 (26.5–54.2) in 2021. These results were corroborated in most age and sex subgroups.

Table 1
Characteristics of patients in 2017–2021.

	2017	2018	2019	2020	2021
Number of patients	1,120,276	1,132,839	1,131,070	1,120,761	1,079,894
Age (in years)					
Mean (SD)	72.1 (29.4)	70.0 (20.3)	69.0 (17.0)	68.0 (17.0)	66.9 (17.5)
<18	0.8	0.9	1.1	1.3	1.5
18–40	5.5	5.8	6.1	6.6	7.0
41–50	4.4	4.7	4.9	5.3	5.7
51–60	11.2	11.9	12.7	13.5	14.5
61–70	20.6	21.4	22.2	22.9	23.7
71–80	24.7	24.8	24.8	24.7	24.5
>80	32.9	30.5	28.2	25.8	23.2
Sex					
Male	52.7	52.9	53.0	53.2	53.5
Female	47.3	47.1	47.0	46.8	46.5
Type of insulin[a]					
Basal	75.4	76.0	76.6	76.7	76.3
Short-acting	67.3	66.7	66.2	66.0	65.8
Mix	7.7	7.0	6.3	5.6	4.8

Abbreviation: SD standard deviation.
Data are percentages unless otherwise stated.
[a] Patients can receive more than one type of insulin.

4. Discussion

This retrospective study using data collected in 2017–2021 showed that COVID-19 had no effects on the prescription of insulin in Germany. The prescription of basal insulin was relatively stable between 2017 and 2021, while there was a slight and steady decrease in CDD for both short-acting and mix insulin during the study period. To the best of the authors' knowledge, this is the first study to have investigated the impact of the COVID-19 on the prescription of insulin not only in 2020 but also in 2021.

These findings are partially in line with the literature. As a matter of fact, the mean number of prescriptions of insulin has been found to decrease in the United States in 2020 [9]. Other data from Germany have indicated that the number of individuals receiving insulin prescriptions increased by 18% during the first quarter of 2020 [8]. In contrast, one German study of 32,399 patients with type 2 diabetes found a 0.04% increase in HbA1c values between June – November 2019 and the same period in 2020, while there was no substantial change in weight and metabolic control [4].

The present results corroborate the findings of this last study, as there was no apparent increase in CDD of insulin in this country during the COVID-19 pandemic. The lack of substantial effects of the COVID-19 on the prescription of insulin may be explained by healthier behaviors in 2020 and 2021, such as increased physical activity, healthier diets, and decreased stress levels. Nonetheless, more data on the impact of this health crisis on lifestyle behaviors are needed, as most studies on this topic have been conducted early during the COVID-19 pandemic, and as this impact has likely changed over time.

The strengths of this study are the large sample size and the use of data collected between 2017 and 2021. However, the study results should be interpreted in light of two limitations. First, CDD may overestimate prescribed insulin doses [12], and this may have biased the analyses. Second, only prescriptions reimbursed by statutory health insurance funds are documented in the LRx database, and the findings may not be generalized to Germany.

Overall, COVID-19 had no substantial effects on insulin prescription in Germany. Further data are warranted to corroborate or refute these findings in other settings and countries.

Author contributions

Louis Jacob contributed to the design of the study, managed the literature searches, wrote the first draft of the manuscript, and corrected the manuscript. Karel Kostev contributed to the design of the study, and corrected the manuscript. Balaji Yakkali and Mahir Parekh performed the statistical analyses. All authors contributed to and have approved the final manuscript.

Statement of ethics

German law allows the use of anonymous electronic medical records for research purposes under certain conditions. According to this legislation, it is not necessary to obtain informed consent from patients or approval from a medical ethics committee for this type of observational study that contains no directly identifiable data.

Table 2
Calculated daily dosage of insulin per year in the overall population and by age and sex.

Type of insulin	2017	2018	2019	2020	**2021**
Overall					
Basal	28.0 (18.6–39.2)	28.0 (18.6–39.3)	28.1 (18.6–39.3)	28.3 (18.7–39.5)	27.9 (18.5–38.8)
Short-acting	40.1 (28.2–54.3)	39.6 (28.0–53.9)	39.1 (27.6–53.3)	39.0 (27.5–53.1)	38.1 (27.2–52.2)
Mix	39.4 (27.5–55.3)	39.2 (27.4–55.2)	38.8 (27.0–54.9)	38.7 (26.8–54.8)	37.9 (26.5–54.2)
0-< 18 years					
Basal	25.8 (17.2–36.1)	27.3 (17.9–37.5)	29.6 (19.4–39.1)	29.5 (19.5–39.9)	29.1 (19.5–39.0)
Short-acting	40.4 (29.4–53.9)	42.0 (30.5–55.3)	43.5 (32.0–56.0)	43.9 (32.1–56.4)	43.6 (32.1–56.4)
Mix	36.7 (26.3–49.1)	34.5 (24.6–47.3)	32.4 (25.7–48.0)	32.6 (20.6–48.2)	39.0 (26.8–53.5)
18–40 years					
Basal	30.8 (21.8–41.5)	30.9 (21.8–41.5)	30.8 (21.7–41.4)	30.6 (21.3–41.3)	30.0 (21.0–40.4)
Short-acting	42.8 (30.6–56.5)	42.9 (30.6–56.7)	42.3 (30.4–56.5)	41.8 (29.8–56.0)	41.7 (29.6–56.1)
Mix	41.9 (28.6–55.5)	39.5 (26.5–55.0)	37.2 (24.4–52.2)	40.0 (25.6–53.7)	39.4 (23.5–54.4)
41–50 years					
Basal	30.0 (20.5–41.6)	30.0 (20.4–41.6)	30.0 (20.5–41.5)	29.8 (20.2–41.4)	29.6 (20.0–40.5)
Short-acting	40.3 (28.4–55.4)	40.8 (28.7–55.9)	40.5 (28.4–55.9)	40.4 (27.9–55.8)	39.8 (27.7–55.6)
Mix	41.7 (28.2–55.6)	40.2 (27.8–55.4)	39.2 (27.0–53.7)	38.9 (26.1–53.6)	37.5 (26.1–52.2)
51–60 years					
Basal	29.8 (20.0–41.4)	29.9 (20.0–41.5)	30.0 (20.3–41.7)	30.1 (20.1–41.9)	29.7 (19.9–41.0)
Short-acting	39.8 (27.6–56.0)	39.7 (27.7–56.0)	39.6 (27.5–56.0)	39.7 (27.3–56.1)	38.9 (26.8–55.6)
Mix	41.7 (29.1–56.3)	41.0 (28.9–55.4)	41.1 (29.2–55.5)	41.1 (29.1–55.2)	40.5 (28.9–55.3)
61–70 years					
Basal	29.8 (20.0–41.5)	29.9 (20.0–41.5)	30.0 (20.0–41.5)	30.2 (20.1–41.6)	29.7 (19.9–40.8)
Short-acting	41.0 (28.4–57.8)	40.7 (28.3–57.5)	40.3 (28.0–57.2)	40.2 (28.0–57.2)	39.3 (27.5–56.5)
Mix	42.6 (29.7–57.0)	41.9 (29.6–56.5)	41.5 (29.4–56.2)	41.4 (29.8–55.6)	40.8 (29.5–55.4)
71–80 years					
Basal	28.7 (19.1–40.0)	28.6 (18.9–39.7)	28.4 (18.8–39.5)	28.5 (18.8–39.5)	27.8 (18.5–38.5)
Short-acting	40.3 (28.3–56.6)	39.7 (27.8–56.1)	39.0 (27.3–55.4)	38.7 (27.0–55.2)	37.4 (26.2–53.9)
Mix	42.0 (29.6–56.1)	41.7 (29.5–55.9)	40.9 (28.9–54.9)	40.6 (28.8–54.7)	39.3 (28.6–53.6)
> 80 years					
Basal	25.0 (16.7–35.7)	24.9 (16.6–35.4)	24.7 (16.5–35.3)	24.6 (16.5–35.2)	24.3 (16.4–34.5)
Short-acting	36.5 (25.4–51.8)	35.9 (25.0–51.3)	35.2 (24.5–50.3)	34.9 (24.2–49.9)	33.9 (23.5–48.5)
Mix	39.0 (27.3–53.0)	38.4 (27.0–52.4)	37.7 (26.7–51.6)	37.3 (26.4–51.1)	36.5 (25.9–50.0)
Male sex					
Basal	28.6 (19.0–39.9)	28.6 (19.0–40.0)	28.7 (19.1–40.2)	28.8 (19.1–40.2)	28.6 (19.0–39.5)
Short-acting	40.7 (28.5–56.7)	40.5 (28.4–56.6)	40.1 (28.0–56.3)	40.0 (28.0–56.3)	39.3 (27.5–55.7)
Mix	40.7 (28.6–55.0)	40.1 (28.3–54.6)	39.5 (28.0–53.8)	39.5 (28.1–53.8)	38.6 (27.5–53.2)
Female sex					
Basal	27.3 (18.2–38.5)	27.4 (18.2–38.5)	27.5 (18.2–38.5)	27.5 (18.2–38.7)	27.2 (18.0–38.0)
Short-acting	38.0 (26.5–53.7)	37.7 (26.3–53.6)	37.3 (26.0–53.2)	37.2 (25.8–53.1)	36.3 (25.3–52.4)
Mix	39.7 (28.0–53.7)	39.3 (27.7–53.5)	38.8 (27.3–52.7)	38.5 (27.1–52.5)	37.7 (26.9–51.5)

Data are median (interquartile range).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgments

None.

Conflicts of interest

The authors declare no conflicts of interest.

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