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Application of a city wide digital population database for outcome analysis in diabetes: SARS-CoV-2, diabetes and hospital admission rate month by month in Greater Manchester, UK

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Access to longitudinal digital health records allows analysis of health trajectory for individuals with many long-term conditions and is of direct relevance in understanding the way in which SARS-CoV-2 virus (COVID-19) has affected the lives of millions of people across the world with diabetes, as it has also challenged our global healthcare systems [1].

People with diabetes are known to be at higher risk of becoming unwell following COVID-19 infection when compared to nondiabetes people [2]. Since the start of the COVID-19 pandemic in early 2020, the monthly incidence of infection in populations has varied in all populations. Such variations have been manifest both between countries/within countries. The infection incidence has varied at even higher resolution across counties and within cities.

It is important to appreciate for common chronic conditions such as diabetes, what the consequence of this might be at the level of hospital admission/how hospital admission rates have varied month by month since the start of the COVID-19 pandemic. In this study, using digital health records, we identified across a 16-month period, the relative likelihood of hospital admission each month for people previously diagnosed with type 2 diabetes (T2D) following confirmed COVID-19 infection.

Digitally coded anonymized data on 13 225 COVID-19-infected T2D individuals were extracted from the Greater Manchester Care (UK) Record (GMCR) Graphnet digital database [3]. This includes more than 99% of general practice patient records across the GM conurbation. The follow-up period ended on 30 June 2021. Anyone admitted to the hospital within 28 days of a positive COVID-19 test was included. Each odds ratio refers to the odds of being admitted in a given month, compared to July 2020.

We used July 2020 hospital admission rate as the baseline. We chose July 2020 as being the lowest point for COVID-19-related hospital admissions in that year. The odds ratio for someone with T2D of being admitted to hospital following a COVID-19 infection was greatest in March and April 2020 (Table 1), likely related to tests being hospital-based at the time. However, it was only slightly higher in January and February 2021 than in July 2020, with a progressive decrease in the odds ratio from the start of 2021. From December 2020, the proportion of T2D individuals vaccinated against COVID-19 steadily rose across GM for the first vaccination (86.16%) then subsequently for the second vaccination (77.92%) until the end of the analysis period on 30 June 2021.

The advent of treatment of unwell COVID-19-affected patients with dexamethasone has significantly reduced illness severity and mortality rates across the world [4]. However, in GM, this was hardly ever prescribed out of hospital. While we are not in a position to ascribe causality, the phenomena described here likely relate to a combination of accumulating benefits at a population level of the UK National Health Service-led COVID-19 vaccination programme and the COVID-19 virus itself [5,6].

With regards to limitations, we have not included an analysis of the relative admission rates for nondiabetes individuals. This is the subject of a separate study.

In conclusion, using a digital population database with nearly 100% coverage, we have confirmed a significantly higher relative hospital admission rate in T2D people following a COVID-19 infection in Spring 2020 compared with all future months and declining relative rates through 2021. Our findings indicate the value of digital health records in evaluating health outcomes in people with diabetes.

Table 1 Hospital admission odds ratio each month (compared to July 2020) and cumulative proportion of type 2 diabetes individuals vaccinated from March 2020 to June 2021

	OR (95% CI)	% with first vaccine	% with second vaccine
Intercept	0.15 (0.1–0.22)	0	0
Mar 20	5.18 (2.96–9.18)	0	0
Apr 20	2.76 (1.83–4.3)	0	0
May 20	1.82 (1.18–2.89)	0	0
Jun 20	1.43 (0.89–2.35)	0	0
Aug 20	0.86 (0.51–1.46)	0	0
Sep 20	1.36 (0.89–2.13)	0	0
Oct 20	1.17 (0.79–1.78)	0	0
Nov 20	1.1 (0.75–1.69)	0	0
Dec 20	1.45 (0.97–2.24)	2.83	0.05
Jan 21	1.39 (0.94–2.12)	25.77	0.91
Feb 21	1.28 (0.85–2)	64.94	1.2
Mar 21	1.18 (0.74–1.91)	81.45	9.41
Apr 21	1.09 (0.63–1.9)	83.57	39.75
May 21	0.59 (0.32–1.09)	85.28	70.22
Jun 21	0.99 (0.59–1.69)	86.16	77.92

The odds ratio relates to the likelihood of hospital admission in any month compared with July 2020.
CI, confidence interval; OR, odds ratio.

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Conflicts of interest

There are no conflicts of interest.

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