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RESEARCH LETTER

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An update on the incidence of type 1 diabetes during the COVID-19 pandemic years

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1 | BACKGROUND

There have now been several reports that the incidence of type 1 diabetes (DM1) increased during the COVID-19 pandemic, particularly in young children,[1–3] although some data are conflicting.[4] Overall, however, there is emerging evidence from diabetes registries that this observed increase is real. Northern Italy was the first European area hit by the COVID-19 pandemic, and it had high rates of hospitalization and death during the so-called 'first wave'. In Piedmont, a region in northwestern Italy with 4.4 million inhabitants, there was a significant increase in new cases of DM1 in the 0-14 and 15-29 age groups in 2021,[5] a finding confirmed in a long-term study across Italy.[6] Here, we update these data for 2022.

2 | METHODS

The study population was the cohort of patients cared for by the NHS (National Health Service) regional network of 19 diabetes care units and four paediatric units in Piedmont (4 400 000 inhabitants in northwest Italy). The network feeds the regional registry of diabetes and the Piedmont DM1 Surveillance Register. This register was established in January 1990 and has since prospectively collected data on all new cases of DM1 in the region.[6,7] In compliance with privacy law, patient data were pseudo-anonymized using the same encryption algorithm used by the technical service of the Regional Health Authority and enriched with a unique anonymous identifier. The data were then transmitted to the Epidemiology Unit for analysis.

Incidence rates were calculated from registry data by dividing the reported number of new cases in each year (2017-2022), sex and two age groups by the corresponding resident populations on 1 January of each year. Incidence rate ratios (RR) were calculated as the ratio of the incidence for each year to the incidence in 2017 (reference year) along with 95% confidence intervals (CI).

3 | RESULTS

The population study included all 1029 newly diagnosed DM1 cases, 621 males and 408 females, both with a mean age of 13.9 ± 7.7 years. It was confirmed that the stable trend in the incidence of DM1 between 2017 and 2020 changed abruptly in 2021, when the RR increased significantly by 31%. We now report that this increase did not persist in 2022 across the entire cohort nor in the 0-14 and 15-29 age groups (Table 1). Nevertheless, as reported in Table 2, the incidence rate appears to have been higher across the 3 years of the pandemic (2020, 2021 and 2022) than in the three years before the pandemic (2017, 2018 and 2019). Indeed, the mean 2017-2019 rate was 14.01 (CI 12.81-15.32) and

TABLE 1 Raw incidence rates (IR) of type 1 diabetes in Piedmont (Italy) by 100 000 residents and rate ratios (RR), 2017-2022, according to age groups

Year	Age range	Number	Population	IR	95% CI	RR	95% CI
2017	0-29	159	1 149 634	13.83	11.84-16.16	1	
2018	0-29	155	1 143 739	13.55	11.58-15.86	0.98	0.83-1.16
2019	0-29	166	1 132 899	14.65	12.58-17.06	1.06	0.90-1.24
2020	0-29	169	1 123 360	15.04	12.94-17.49	1.08	0.92-1.27
2021	0-29	205	1 114 340	18.4	16.04-21.1	**1.31**	1.13-1.51
2022	0-29	175	1 102 103	15.88	13.69-18.41	1.14	0.98-1.33
Year	**Age range**	**Number**	**Population**	**IR**	**95% CI**	**RR**	**95% CI**
2017	0-14	103	553 945	18.59	15.33-22.55	1	
2018	0-14	99	545 564	18.15	14.9-22.1	0.98	0.80-1.21
2019	0-14	91	535 335	17	13.84-20.88	0.93	0.75-1.15
2020	0-14	95	525 438	18.08	14.79-22.11	0.98	0.79-1.21
2021	0-14	126	517 864	24.33	20.43-28.97	**1.28**	1.07-1.54
2022	0-14	104	507 904	20.48	16.9-24.82	1.10	0.90-1.35
2017	15-29	56	595 689	9.4	7.23-12.22	1	
2018	15-29	56	598 175	9.36	7.2-12.16	1.00	0.75-1.32
2019	15-29	75	597 564	12.55	10.01-15.74	**1.29**	1.01-1.64
2020	15-29	74	597 922	12.38	9.85-15.54	1.27	0.99-1.63
2021	15-29	79	596 476	13.24	10.62-16.51	**1.35**	1.06-1.71
2022	15-29	71	594 199	11.95	9.47-15.08	1.23	0.96-1.59

Note: Top section, data for 0-29 year age group; bottom section, data for 0-14 and 15-29 year age groups. Statistically significant values are shown in boldface.

TABLE 2 Raw incidence rates (IR) of type 1 diabetes in Piedmont (Italy) by 100 000 residents and rate ratios (RR), comparison between before and during the COVID pandemic years.

Year		Age range	Number	Population	IR	95% CI	RR	95% CI
2017-2019	All	0-29	480	3 426 272	14.01	12.81-15.32	1	
2020-2022	All	0-29	549	3 339 803	16.44	15.12-17.87	**1.17**	1.08-1.28
2017-2019	Boys	0-29	285	1 771 206	16.09	14.33-18.07	1	
2020-2022	Boys	0-29	336	1 729 179	19.43	17.46-21.62	**1.21**	1.08-1.35
2017-2019	Girls	0-29	195	1 655 066	11.78	10.24-13.56	1	
2020-2022	Girls	0-29	213	1 610 624	13.22	11.56-15.31	**1.12**	0.98-1.29
Year		**Age range**	**Number**	**Population**	**IR**	**95% CI**	**RR**	**95% CI**
2017-2019	All	0-14	293	1 634 844	17.92	15.98-20.1	1	
2020-2022	All	0-14	325	1 551 206	20.95	18.79-23.36	**1.17**	1.05-1.31
2017-2019	All	15-29	187	1 791 428	10.44	9.04-12.05	0.58	0.50-0.67
2020-2022	All	15-29	224	1 788 597	12.52	10.99-14.28	0.70	0.61-0.80
2017-2019	Boys	0-14	163	842 038	19.36	16.6-22.57	1	
2020-2022	Boys	0-14	200	797 482	25.08	21.83-28.81	**1.30**	1.12-1.50
2017-2019	Boys	15-29	122	929 168	13.13	11-15.68	1	
2020-2022	Boys	15-29	136	931 697	14.6	12.34-17.27	1.11	0.93-1.33
2017-2019	Girls	0-14	130	792 806	16.4	13.81-19.47	1	
2020-2022	Girls	0-14	125	753 724	16.58	13.92-19.76	1.01	0.84-1.21
2017-2019	Girls	15-29	65	862 260	7.54	5.91-9.61	1	
2020-2022	Girls	15-29	88	856 900	10.27	8.33-12.66	**1.36**	1.09-1.70

Note: Top section, data for 0-29 year age group; bottom section, data for 0-14 and 15-29 year age groups and according to sex. Statistically significant values are shown in boldface.

the mean 2020-2022 rate was 16.44 (CI 15.12-17.87), an RR of 1.17 (CI 1.08-1.28); ($p < .01$).

4 | CONCLUSIONS

To our knowledge, this is the first study to report the incidence of DM1 in 2022 in the context of the COVID-19 pandemic. We now show that the 2021 peak did not persist into 2022. Although the exact reasons for this are speculative, we consider two hypotheses.

First, there have been two major variants of SARS-CoV-2 since May 2021, the delta variant followed by the omicron variant, which appeared during December 2021. Both mutations changed the phenotype of the virus and indeed may have reduced its diabetogenic effect, either directly or through subsequent immune-mediated damage. This phenomenon has been seen with SARS-CoV-2 and the incidence of other organ and system complications, such as long COVID, which also decreased as the virus transition from the initial wild variant to the delta and omicron variants.[8]

Second, vaccines administered to adolescents and children since 2021, combined with the number of subjects naturally immunized through having the disease, probably reduced contagiousness, diffusion, and the pool of subjects at risk for COVID-19, again reducing the diabetogenic impact of the virus.

However, strong evidence to link these diabetes incidence variations to the COVID-19 pandemic are lacking, and further studies are needed. DM1 is caused by progressive autoimmune-mediated loss of pancreatic β-cell mass via apoptosis. The onset of DM1 depends on environmental factors that interact with predisposing genes to induce autoimmunity towards β cells. Viral infections can act as an environmental trigger for the start of insulitis. This process takes time and may explain why, in our data, the onset of new cases was delayed with respect to the start of pandemic in 2020 and became evident in 2021. However, other hypotheses of a direct cytotoxic effect on β cells by binding to the angiotensin converting enzyme 2 receptor or indirectly through the infective inflammatory state cannot be ruled out.

We report these results, which are strengthened by reliable registry data, promptly, because we need to continue to learn lessons from the pandemic about how viruses cause chronic sequelae. Unfortunately, we do not have comprehensive data on formal virus testing nor on specific β cells autoantibodies to strengthen further the association between SARS-CoV-2 and DM1. Nevertheless, over the 3 years of the COVID-19 pandemic, the overall incidence of DM1 has remained ∼17% higher than before the pandemic, suggesting further work to understand the link between coronaviruses and diabetes is a priority.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/dom.15182.

DATA AVAILABILITY STATEMENT

Research data are not shared. Upon reasonable request to the corresponding author further analyses can be carried out.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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