Glycaemic control does not appear to correlate with mortality from COVID-19

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Key words: COVID-19, diabetes, deaths, HbA$_{1c}$, glycaemic control

Background
Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, otherwise known as COVID-19, was declared to be a pandemic by WHO in March 2020 with the virus claiming over 1.9 million lives worldwide. The UK has been the worst hit country in Europe, with the virus claiming close to 82,000 lives to date. Many of these patients have been identified to be elderly men with underlying comorbidities, and diabetes mellitus has been found to be a major comorbid disease associated with up to 34.6% of COVID-19-related deaths in some cohorts: 31.1% in Italy, 33.5% here in the UK and 34.6% in China.[1–4]

Aims
It is unclear if the diabetes-related COVID-19 deaths at our hospital were in people with demographics that were consistent with what is being reported elsewhere. This analysis was therefore undertaken to identify the characteristics of patients with diabetes who died from COVID-19 at our hospital during the peak of the pandemic.

Method
This was a retrospective analysis into the COVID-19 deaths recorded in the York Teaching Hospitals NHS Foundation Trust between March and June 2020. We collected data on age, gender, type of diabetes, duration of diabetes, last recorded glycated haemoglobin (HbA$_{1c}$), body mass index (BMI) and associated comorbidities in diabetes patients who died from COVID-19.

Results
The results are shown in Table 1 and Figure 1. There were 214 deaths from COVID-19 reported in our hospital over the period. Of these, 65 patients (30.1%) had diabetes; 97% of this cohort had type 2 diabetes, with only one patient having type 1 diabetes and one patient had drug-induced diabetes. 66% were male, 83.1% were aged >70 years and 72.3% had had diabetes for >5 years.

Of those with diabetes, 57% had well managed diabetes based on NICE guidance (HbA$_{1c}$ <58 mmol/mol); 70.8% had an HbA$_{1c}$ that would allow elective surgery if needed (HbA$_{1c}$ <69 mmol/mol) and 86.1% had HbA$_{1c}$ <86 mmol/mol. 63% of the patients were overweight or obese and 97% had at least one other comorbidity in addition to diabetes and obesity. The comorbidities were primarily hypertension, ischaemic heart disease, heart failure and cerebrovascular disease.

Discussion
Glycaemic control
Previous reports have reported an increased risk of infections in people with diabetes, especially respiratory tract infections like the severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and H1N1 influenza outbreaks, and this risk was increased with worsening glycaemic control.[5–7]

However, in the case of COVID-19, evidence from China and Italy suggests that diabetes does not increase the risk of contracting COVID-19. The prevalence of diabetes in people infected with COVID-19 was similar to or lower than the prevalence of diabetes in the general population of similar age groups. Instead, they found a higher prevalence of diabetes among patients with severe COVID-19 and, moreover, poor glycaemic control was associated with a higher risk of death.[2–4,8,9]

In our cohort, people with diabetes who died from COVID-19 had HbA$_{1c}$ measurements that would not be considered to be unduly elevated. In this group, more than half had HbA$_{1c}$ of 58 mmol/mol or lower.

Age and gender
Older age of ≥70 years is known to be an independent predictor of in-hospital mortality.[7] Our

Table 1 Demographics, diabetes history and body mass index (BMI)

Demographics		No (%) of patients
Gender	Male	43 (66.2%)
	Female	22 (33.8%)
Age (years)	<60	1 (1.5%)
	60–69	10 (15.4%)
	70–79	21 (32.3%)
	80–89	25 (38.5%)
	≥90	8 (12.3%)
Type of diabetes	Type 1	1 (1.5%)
	Type 2	63 (97%)
	Other (drug-induced)	1 (1.5%)
Diabetes duration (years)	<5	14 (21.5%)
	5–9	22 (33.8%)
	10–14	12 (18.5%)
	15–19	8 (12.3%)
	≥20	5 (7.7%)
	Unknown	4 (6.2%)
BMI (kg/m²)	<20	3 (4.6%)
	20–24.9	21 (32.3%)
	25–29.9	22 (33.8%)
	≥30	19 (29.2%)

Figure 1. Glycaemic control (HbA_{1c}, mmol/mol)

Legend: <48, 48-58, 59-69, >69, Unavailable
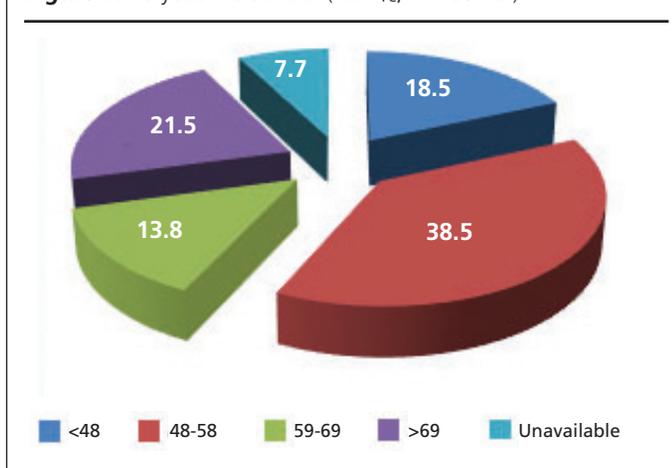
data found a similarly strong correlation between age and risk of death, with 83.1% of those diabetes patients who died being aged ≥70 years and almost all (98.5%) being ≥60 years. More severe disease was found in older males in almost all regions of the world, and our data were consistent with this with about twice as many deaths with COVID-19 and diabetes in males.[4]

Type of diabetes/duration of diabetes
Morbidity in COVID-19 has been found to be associated with predominantly type 2 diabetes. In addition, Baron *et al* reported that both type 1 and type 2 diabetes were independently associated with an increased risk of in-hospital mortality from COVID-19.[2–4] In our cohort, 97% of the patients had type 2 diabetes and only one

patient (1.5%) had type 1 diabetes. Over 72% had diabetes for 5 years or longer.

Obesity/other comorbidities
Our cohort was consistent with others, with 63% of those who died being overweight or obese and 97% had at least one comorbidity other than diabetes and obesity.

Conclusion
Consistent with previous reports, in our hospital people with diabetes who died from COVID-19 were more likely to be older males with a longer duration of diabetes and higher prevalence of obesity and other comorbidities. However, in contrast to previous reports, glycaemic control as measured by HbA_{1c} did not appear to correlate with mortality. We do acknowledge the possibility that this may be due to the small cohort size.

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