COVID-19 infection and outcomes in a population-based cohort of 17 203 adults with intellectual disabilities compared with the general population

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ABSTRACT

Background Adults with intellectual disabilities (ID) may be at higher risk of COVID-19 death. We compared COVID-19 infection, severe infection, mortality, case fatality and excess deaths, among adults with, and without, ID.

Methods Adults with ID in Scotland's Census, 2011, and a 5% sample of other adults, were linked to COVID-19 test results, hospitalisation data and deaths (24 January 2020–15 August 2020). We report crude rates of COVID-19 infection, severe infection (hospitalisation/death), mortality, case fatality; age-standardised, sex-standardised and deprivation-standardised severe infection and mortality ratios; and annual all-cause mortality for 2020 and 2015–2019.

Findings Successful linkage of 94.9% provided data on 17 203 adults with, and 188 634 without, ID. Adults with ID had more infection (905/100 000 vs 521/100 000); severe infection (538/100 000 vs 242/100 000); mortality (258/100 000 vs 116/100 000) and case fatality (30% vs 24%). Poorer outcomes remained after standardisation: standardised severe infection ratio 2.61 (95% CI 1.81 to 3.40) and mortality ratio 3.26 (95% CI 2.19 to 4.32). These were higher at ages 55–64: 7.39 (95% CI 3.88 to 10.91) and 19.05 (95% CI 9.07 to 29.02), respectively, and in men, and less deprived neighbourhoods. All-cause mortality was slightly higher in 2020 than 2015–2019 for people with ID: standardised mortality ratio 2.50 (95% CI 2.18 to 2.82) and 2.39 (95% CI 2.28 to 2.51), respectively.

Conclusion Adults with ID had more COVID-19 infections, and worse outcomes once infected, particularly adults under 65 years. Non-pharmaceutical interventions directed at formal and informal carers are essential to reduce transmission. All adults with ID should be prioritised for vaccination and boosters regardless of age.

INTRODUCTION

The first case of COVID-19 was confirmed in the UK on 24 January 2020 and a pandemic declared by WHO on 12 March 2020. There is global concern that adults with intellectual disabilities may be at higher risk of death from COVID-19, but there are gaps in the evidence.[1] The WHO defines intellectual disabilities as impairments in adaptive, social, and intellectual functioning (IQ<70), requiring daily support, with the onset in the developmental phase (<18 years).[2] People with intellectual disabilities account for <1% of the global population,[3 4] and about 0.5% of adults.[4] They experience substantial health inequalities, including multimorbidity[5] and premature mortality,[6 7] often from respiratory conditions.[8 9] They are more likely to live in congregate settings or be in receipt of social care[10]; recent studies have reported high rates of COVID-19 mortality within multioccupancy residences.[11] However, questions remain as to whether people with intellectual disabilities are more likely to contract COVID-19, and whether they have more severe infections, and higher COVID-19 mortality compared with others.

Existing evidence is inconclusive and has limitations. Five studies reported COVID-19 mortality compared with the general population. One cohort study linked data for over 17 million people on general practitioner registers in England across two waves (1 March 2020–31 August 2020 and 1 September 2020–8 February 2021) investigating COVID-19 hospital admissions and deaths in children and adults.[12] Adults with intellectual disabilities were over five times more likely to have a COVID-19 hospital admission (HR 5.3, 95% CI 4.9 to 5.8) and eight times more likely to die from COVID-19 (HR 8.2, 95% CI 7.2 to 9.4). Results were similar in wave 2 ((4.3, 95% CI 4.1 to 4.6 COVID-19 hospital admission; 7.2, 95% CI 6.4 to 8.1 COVID-19 deaths). They acknowledged their methods of population ascertainment may have led to possible overestimates of HRs. A Canadian cohort study used health records for the province of Ontario to investigate COVID-19 infection rates, hospital admissions and deaths between 15 January 2020 and 10 January 21 for adults with intellectual and developmental disabilities, and with Down syndrome compared with the general population.[13] Infection rates for people with intellectual and developmental disabilities were 1.28 times higher, and 1.42 times higher for those with Down syndrome. For adults with intellectual and developmental disabilities risk of hospitalisation (RR 2.21, 95% CI 1.93 to 2.5) and death (RR 2.23, 95% CI 1.86 to 2.67)) was also higher compared with the general population. Population ascertainment was via hospital health records and therefore excludes those with intellectual and developmental disabilities who may have not been correctly classified or had contact with hospitals. A large US study of data from 547 healthcare organisations investigated risk of COVID-19 infection, hospitalisation and death in people with intellectual disabilities compared with

the general population, between January 2019 and November 2020.[14] People with intellectual disabilities were significantly more likely to become infected with COVID-19 (3.1% vs 0.9%, p<0.001) and be admitted to hospital (63.1% vs 29.1%, p<0.001). The authors recognised ascertainment of intellectual disabilities in these data was much lower than expected. One non-peer-reviewed study, used three data sources from England to identify adults with intellectual disabilities who definitely or possibly died from COVID-19 from 1 February 2020 to 5 June 2020.[15] Underestimates and uncertainty around figures were acknowledged in the report, due to limitations in data sources. Analysis of two of these data sources resulted in crude COVID-19 mortality rates of 240/100 000 (2.3 times the general population) and 192/100 000 (3.1 times the general population). Welsh general practice records, 1 March 2020–26 May 2020, recorded 31 deaths from COVID-19 among people with intellectual disabilities, equating to a higher age-standardised COVID-19 mortality than observed in the general population.[16]

Five studies reported COVID-19 case-fatality rates, though with biased samples and conflicting results. Electronic medical records from 42 healthcare organisations, across 30 countries, up to 14 May 2020, ascertained >30 000 patients with COVID-19 infections.[17] No difference was found in overall case-fatality rates between the 150 people with intellectual disabilities and those without, but possibly higher case-fatality rates among younger ages.[17] A large US study using private insurance claims, between 1 April 2020 and 31 August 2020, reported higher COVID-19 case-fatality among people with intellectual disabilities compared with those without (OR 2.75, 95% CI 1.66 to 4.56), especially at <70 years of age (OR 3.61, 95% CI 1.89 to 6.93).[18] These results may not be generalisable as they did not include people with public insurance or no insurance. A large self-selected sample of English general practices covering >4 million patients reported higher COVID-19 case-fatality among people with intellectual disabilities over weeks 2–20 of 2020 (OR 1.97, 95% CI 1.22 to 3.18).[11] Another large study of people with intellectual and developmental disabilities living in New York state's residential settings were indirectly compared with the general population, reporting COVID-19 infection rate to be about four times higher, case-fatality almost double, and mortality rate 7.8 times higher.[19] Gleason et al[14] reported that people with intellectual disabilities were more likely to die than those in the general population following COVID-19 infection (8.2% vs 3.8%, p<0.001).

A prediction algorithm of COVID-19 mortality risk following infection, was derived (24 January 2020–30 April 2020) and validated (1 May 2020–30 June 20) using a large English primary care database of >8 million patients.[20] It reported higher fatality among adults with intellectual disabilities without Down syndrome (men: HR 1.36, 95% CI 1.14 to 1.60), women: HR 1.36, 95% CI 1.11 to 1.65); and a further increase risk in the small sample of adults with Down syndrome (men: HR 9.80, 95% CI 4.62 to 20.78), women: HR 32.55, 95% CI 18.13 to 58.42). This led to the inclusion of Down syndrome, but not intellectual disabilities, onto the clinically extremely vulnerable list used in the UK.[21]

Adults with intellectual disabilities may be at greater risk of contracting COVID-19 and at greater risk of case fatality, though evidence for both is currently limited. This study investigated in a whole-country adult population with intellectual disabilities, COVID-19 infection, severe infection, mortality, case fatality and excess deaths, compared with adults without intellectual disabilities, during the first wave of the COVID-19 pandemic (24 January 2020–15 August 2020).

METHODS
Population, data sources and record linkage
We used Scotland's Census 2011 to ascertain all adults recorded with intellectual disabilities[4] and a random 5% sample of the general population (without intellectual disabilities or autism) linked to COVID-19 laboratory tests, hospital admissions, and death registrations. Scotland's Census, 2011 provides information on Scotland's population, recorded on 27 March 2011. The Scottish Morbidity Record (SMR) 01 records acute hospital admissions including International Classification of Diseases 10th Revision (ICD-10) diagnoses. Laboratory results from COVID-19 tests are stored electronically within the Electronic Communication of Surveillance in Scotland (ECOSS) database. Personal identifiers from Census 2011 have previously been linked to allow Census 2011 data to be further linked to Public Health Scotland health data for research purposes.[22]

We presented demographic characteristics for adults with and without intellectual disabilities; sex, age and neighbourhood deprivation recorded at the time of the Census in 2011. To reduce the risk of disclosing personally identifiable information age was categorised as adults 18–54 years, 55–64 years and ≥65 years, and Scottish Index of Multiple Deprivation (SIMD) was categorised into two groups: more deprived (deciles 1–5) and less deprived (deciles 6–10). People <18 years in 2011 were excluded from analyses. Analysis was undertaken for the period 24 January (first UK confirmed COVID-19 case)—15 August for each year of the study. When analysing all outcomes, age was calculated at time of event for those who had an event of interest, or age at 24 January in the respective year of interest for people within the denominator population who did not have any events of interest.

Outcomes
Outcomes included: COVID-19 infection (positive COVID-19 test, hospitalisation for COVID-19, or death due to COVID-19); severe COVID-19 infection (hospitalisation for COVID-19 or death due to COVID-19); COVID-19 mortality; COVID-19 case fatality (death from any cause among those who had COVID-19 infection); and excess deaths (difference between average annual all-cause mortality rates 24 January 2015–15 August 2019 and all-cause death rate in 24 January 2020–15 August 2020).

Hospitalisation or death due to COVID-19 was defined by ICD-10 code of U07.1 (confirmed COVID-19 19) or U07.2 (suspected COVID-19 19) in any primary or secondary diagnostic or cause of death position, no timescale was applied.

Analyses
Complete (National Records of Scotland) NRS death data up to 15 August 2020 was available and results from 24 January 2020–15 August 2020 were investigated. Crude rates (per 100 000 people) were compared for those with and without intellectual disabilities using the number of people still alive within each group on 24 January 2020 as respective denominators. Crude outcomes included rates of COVID-19 infection, severe infection, mortality and case fatality. To take into account demographic differences between groups with and without intellectual disabilities, we performed indirect standardisation using sex, age and deprivation. We produced COVID-19-specific standardised mortality ratios (SMRs) and COVID-19-specific Standardised hospitalisation/mortality ratios for 2020. We then produced all-cause SMRs for deaths in 2020 and separately for deaths over the previous 5 years. For each standardisation we used the 5% sample of the census population without intellectual disabilities or autism as the standard population and compared relevant age-sex-deprivation specific rates to the population with intellectual

disabilities to ascertain expected and observed counts. Analyses were repeated within sex, age and deprivation subgroups, standardising each time for the other two variables.

When calculating standardised ratios for deaths and admissions in 2020, we used the respective denominator populations including everyone in the original linked census cohort minus those who died before 24 January 2020. When calculating standardised ratios for deaths between 2015 and 2019 we counted deaths between 24 January and 15 August in each of the respective years to enable an accurate comparison with 2020. People who died before the 24th January in each of the respective years from 2015 to 2019 were removed from the respective denominator populations. For all outcomes age was calculated at time of event (not age in 2011) for those with an event of interest (positive COVID-19 test, hospital admission, death) or age at 24 January in the respective year of interest for those people within the denominator population who did not have any events of interest.

RESULTS
Patient characteristics
Of the 269 771 people (24 264 with, and 245 507 without, intellectual disabilities) included in our Census 2011 cohort, 255 916 (94.9%) were linked to the NRS Population Spine. The linkage rate was 92.9% (n=22 538) among people with intellectual

disabilities and 95.1% (n=233 378) of the original 5% comparison sample with no intellectual disabilities or autism. People <18 years old were excluded (figure 1) leaving a final cohort of 213 062 adults (17 203 with intellectual disabilities and 188 634 without intellectual disabilities or autism).

As expected, there were more men than women with intellectual disabilities, who were younger and more likely to live in deprived areas (table 1).

Crude COVID-19 infection rates and outcomes
Adults with intellectual disabilities were almost twice as likely as those without to become infected with COVID-19 (905/100 000 vs 521/100 000) and 2.2 times as likely to have severe infection resulting in hospitalisation or death (538/100 000 vs 242/100 000) or fatal infection (258/100 000 vs 116/100 000) (table 2). Following COVID-19 infection, people with intellectual disabilities were more likely to die 28.5% (95% CI 23.3% to 32.3%) vs 22.3% (95% CI 20.5% to 23.9%).

Age-standardised, sex-standardised, deprivation-standardised COVID-19 outcomes
In 2020, the age-standardised, sex-standardised, deprivation-standardised ratio for severe COVID-19 infection among adults with intellectual disabilities compared with those without was
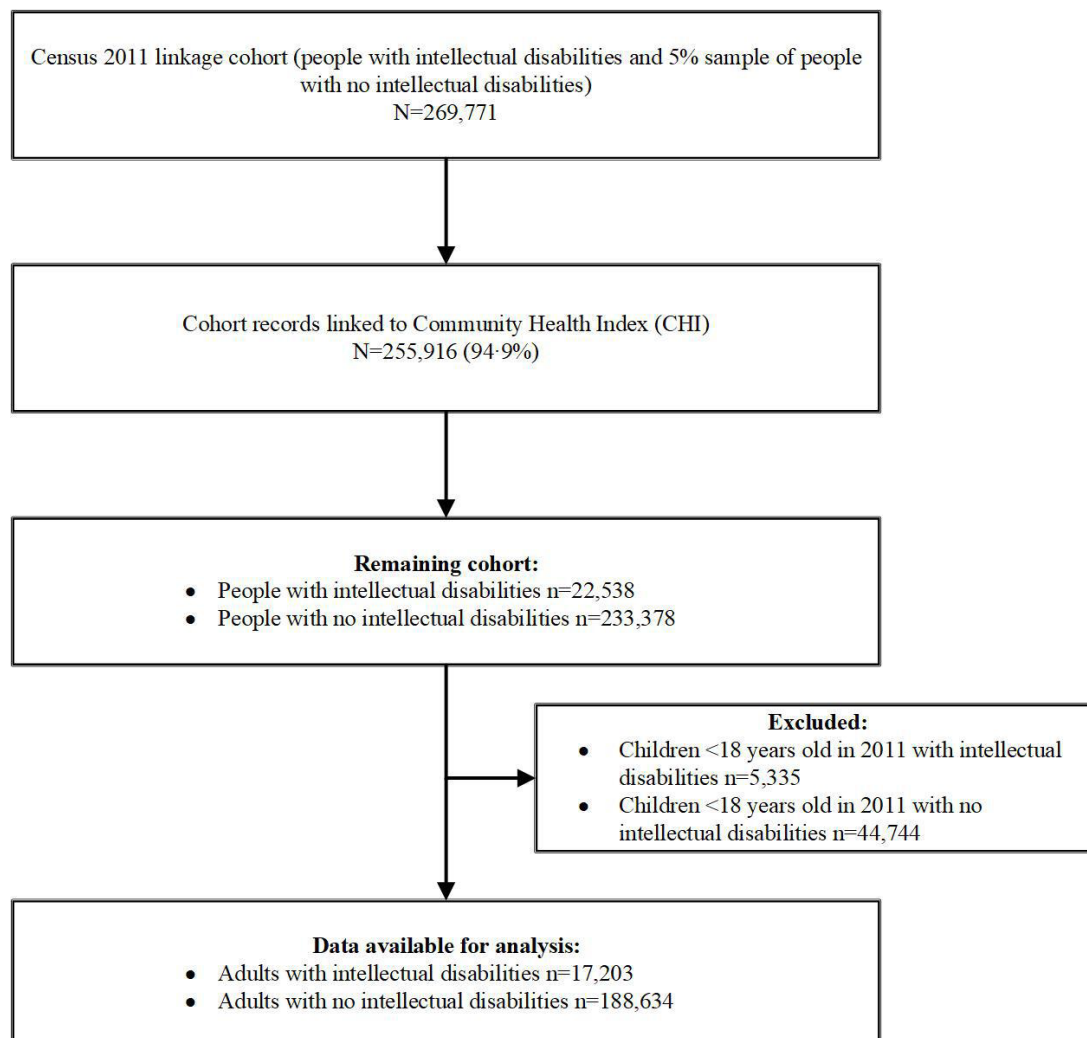
Figure 1 Participant flow diagram.

Table 1 Characteristics of the study population in 2011

	Adults with intellectual disabilities		5% sample of adults with no intellectual disabilities or autism	
	N=17 203		N=188 634	
	n	%	n	%
Sex				
Male	9565	55.6	88 863	47.1
Female	7638	44.4	99 771	52.9
SIMD decile				
1–5 (more deprived)	11 099	64.5	90 406	47.9
6–10 (less deprived)	6104	35.5	98 228	52.1
Age (years) at 2011 census				
Adults ≤54	12 637	73.5	116 534	61.8
55–64	2494	14.5	31 022	16.4
≥65	2072	12.0	41 078	21.8

SIMD, Scottish Index of Multiple Deprivation.

2.61 (95% CI 1.81, 3.40) and for COVID-19 mortality was 3.26 (95% CI 2.19, 4.32) (table 3). The standardised ratios were slightly higher in men than women and in less deprived areas. They were higher in people under 65 years of age and particularly high in the 55–64 years age group where the risk of severe infection, resulting in hospitalisation or death, was more than 7 times higher and the risk of death was over 19 times higher (table 3).

Excess overall mortality

Overall, age-standardised, sex-standardised, deprivation-standardised all-cause mortality ratios for adults with intellectual disabilities were 2.39 (95% CI 2.28 to 2.51) over the 5 years prior to COVID-19, and only slightly higher at 2.50 (95% CI 2.17 to 2.81) in 2020 (table 4). In the subgroup analyses, the largest increase occurred in the 55–64 years age group where the standardised all-cause mortality ratio increased from 4.27 (95% CI 3.87 to 4.67) between 2015 and 2019 to 5.12 (95% CI 3.95 to 6.29) in 2020. However, the CIs still overlapped.

DISCUSSION
Principal findings and interpretation

This is the first comprehensive study investigating COVID-19 infection, severe infection, mortality, case fatality and excess mortality among a whole country's population of adults with intellectual disabilities compared with the general population. Adults with intellectual disabilities were twice as likely to become

Table 2 Crude outcomes of study populations

	Adults with intellectual disabilities			5% sample of adults without intellectual disabilities or autism		
	N	Crude rate per 100 000	95% CI*	N	Crude rate per 100 000	95% CI*
COVID-19						
Infection†	126	905	747 to 1061	871	521	487 to 556
Severe infection‡	75	538	417 to 660	404	242	218 to 265
Mortality§	36	258	174 to 343	194	116	100 to 133

*95% CIs calculated based on normal approximation.
†Positive COVID-19 test, hospitalisation for COVID-19 or death from COVID-19.
‡Hospitalisation for COVID-19 or death from COVID-19.
§Death from COVID-19 in the population.

Table 3 Age-standardised, sex-standardised, deprivation-standardised COVID-19 outcomes, overall and by subgroup

		Standardised hospitalisation /mortality ratio (95% CI)*	Standardised mortality ratio (95% CI)*
Overall		2.61 (1.81 to 3.40)	3.26 (2.19 to 4.32)
Sex	Male	2.93 (1.85 to 4.02)	3.70 (2.22 to 5.18)
	Female	2.10 (0.96 to 3.25)†	2.63 (1.14 to 4.12)†
Deprivation	SIMD 1–5 (more deprived)	2.27 (1.43 to 3.11)	3.09 (1.92 to 4.25)
	SIMD 6–10 (less deprived)	3.81 (1.74 to 5.88)†	3.90 (1.35 to 6.45)‡
Age (years)§	Adults ≤54	2.83 (1.08 to 4.59)†	7.47 (2.29 to 12.65)¶
	55–64	7.39 (3.88 to 10.91)†	19.05 (9.07 to 29.02)**
	≥65	1.41 (0.67 to 2.15)†	1.51 (0.72 to 2.31) †

*95% CIs calculated based on normal approximation.
†Ratios are based on less than 20 observed events in the intellectual disabilities group.
‡Ratios are based on less than 10 observed events in the intellectual disabilities group.
§Age at time of event.
¶Ratios are based on less than 10 observed events in the intellectual disabilities group and less than 10 observed events in the 5% sample of the general population.
**Ratios are based on less than 20 observed events in the intellectual disabilities group and less than 10 observed events in the 5% sample of the general population.
SIMD, Scottish Index of Multiple Deprivation.

infected with COVID-19, 2.2 times as likely to have severe infection resulting in hospitalisation or death, and following COVID-19 infection, had a case fatality of 30% compared with 24% in the general population. The risk of severe or fatal COVID-19 infection, relative to the general population, was higher among non-elderly age groups and particularly high in

Table 4 Age-standardised, sex-standardised, deprivation-standardised all-cause mortality, overall and by subgroup

		Standardised mortality ratio*	95% CI†
2015–2019			
Overall		2.39	2.28 to 2.51
Sex	Male	2.23	2.08 to 2.38
	Female	2.60	2.42 to 2.78
Deprivation	SIMD 1–5 (more deprived)	2.08	1.96 to 2.20
	SIMD 6–10 (less deprived)	3.38	3.11 to 3.66
Age (years)‡	Adults ≤54	4.55	4.09 to 5.00
	55–64	4.27	3.87 to 4.67
	≥65	1.68	1.57 to 1.79
2020			
Overall		2.50	2.17 to 2.81
Sex	Male	2.50	2.08 to 2.92
	Female	2.51	2.01 to 3.00
Deprivation	SIMD 1–5 (more deprived)	2.18	1.84 to 2.52
	SIMD 6–10 (less deprived)	3.65	2.82 to 4.47
Age (years)‡	Adults ≤54	4.79	3.52 to 6.04
	55–64	5.12	3.95 to 6.29
	≥65	1.55	1.25 to 1.85

*Standardised for age, sex, SIMD (whichever not used to define subgroup); referent to the 5% comparison group.
†95% CIs calculated based on normal approximation.
‡Age at time of event.
SIMD, Scottish Index of Multiple Deprivation.

those aged 55–64 years. Compared with the general population, risk was greater in less deprived areas due to the association of more deprived neighbourhoods with poorer outcomes in the general population, and perhaps as congregate housing for people with intellectual disabilities tends to be in more affluent areas (larger houses). Risk was also greater for men. This highlights the importance of action to reduce COVID-19 infection and mortality risks for adults with intellectual disabilities across all ages, and in all neighbourhoods. The overall risk of dying from any cause was already higher among adults with intellectual disabilities prior to the COVID-19 pandemic. The net effect of COVID-19 is a slight, non-significant increase in excess deaths from any cause.

Many people with intellectual disabilities require support with daily activities, meaning that public health advice on shielding has limited effectiveness as regular contact with other people is often unavoidable. They are also more likely to be residents in communal establishments and have higher rates of multimorbidity resulting in more frequent contact with healthcare workers. This highlights the importance of non-pharmaceutical interventions, such as social distancing, face coverings and hand hygiene in minimising risk of infection. It is also critical that public health policy and messaging increases awareness among caregivers and people with intellectual disabilities of COVID-19 symptoms, infection risk, the need for carers and people with intellectual disabilities to isolate when symptomatic, and to consider hospital early to improve outcomes given the higher risk to this population, as well as the high importance of vaccination. It is critical that further comparative research is conducted to investigate any disparities or inequalities in hospital treatment following admission for COVID-19 between people with intellectual disabilities and those without.

Comparison with previous studies

Previous studies have suggested variable COVID-19 outcomes for people with intellectual disabilities including: COVID-19 mortality rates 2–8 fold higher than the general population,[12–15 23] increased risk of infection,[13 14] increased risk of hospital admissions,[12–14] no difference in case-fatality,[17] overall case-fatality with OR=2.75 or OR=3.61 in the <70 years old,[18] and all-cause mortality in those with known COVID-19 with OR=1.97.[11] A study on adults with intellectual disabilities in residential settings (compared with whole-community general population) reported COVID-19 infection rates to be about four times higher, case fatality almost double and mortality rates 7.8 times higher.[19] Our study of a whole nation's adult population with intellectual disabilities found they were twice as likely to become infected with COVID-19, with a case fatality 26% higher and COVID-19 mortality 2.2 times higher than the general population. Poorer COVID-19 outcomes in younger adults compared with the general population were expected and have also been suggested.[13 15 17] This is in view of premature deaths resulting in people with milder intellectual disabilities and fewer comorbidities surviving into old age, and therefore, more closely resembling the elderly general population. This difference in the age profile of COVID-19 mortality is important given the current prioritisation of ongoing vaccination boosters in the UK, and initial vaccinations internationally in countries with lesser current coverage and on those in older age groups, which will potentially lead to increased levels of potentially preventable COVID-19 mortality in unvaccinated younger people with intellectual disabilities.

What is already known

► To date, five studies have reported mortality rates for people with intellectual disabilities compared with the general population. All reported higher rates of COVID-19 mortality, ranging between 2.23 and 8 times higher for people with intellectual disabilities than those in the general population. Studies that report case fatality rates in the intellectual disabilities population have been based on biased samples and have resulted in conflicting findings, with some studies reporting no difference between rates or as much as 2.75 times higher rates in adults with intellectual disabilities compared with other adults.

► In summary studies investigating the impact of COVID-19 on adults with intellectual disabilities may indicate a higher risk of COVID-19 mortality and case fatality than other adults, but the evidence is limited and inconclusive.

What this study adds

► This study analysed COVID-19 mortality, case-fatality, severe infection and infection rates for all adults with intellectual disabilities compared with a 5% sample of the general population. Adults with intellectual disabilities were almost twice as likely to become infected with COVID-19, 2.2 times as likely to have severe infection, 2.2 times as likely to have COVID-19 mortality and had 26% higher COVID-19 case fatality compared with those with no intellectual disabilities. After standardising for age, sex and deprivation, people with intellectual disabilities were 3.2 times more at risk of COVID-19 mortality and 2.6 times more at risk of severe infection relative to those with no intellectual disabilities. We also report that adults with intellectual disabilities had poorer outcomes among non-elderly age-groups particularly those aged 55–65 years, men and those living in less-deprived neighbourhoods compared with people with no intellectual disabilities. Our data indicate that people with intellectual disabilities under the age of 65 are at significantly greater risk of COVID-19 mortality than those in the general population.

Study implications

► The increased risk of COVID-19 infection and mortality suggests that non-pharmaceutical initiatives should be treated as vital interventions to enable carers and care-provider organisations to ameliorate the risk of infection. All adults with intellectual disabilities should be prioritised in the national roll-outs of COVID-19 vaccination programmes, regardless of age, sex or neighbourhood deprivation.

Strengths and limitations

The study is large, including the entire country's adult population with intellectual disabilities, as well as a proportion of adults in the general population. There was a 94%, response rate. Record linkage was successful on 94.9% providing data on a wide range of outcomes.

COVID-19 testing data are likely to be an underestimate of true community incidence of COVID-19 infection rates

due to limited COVID-19 testing during the first wave of the pandemic. However, this approach is preferable to the inclusion of suspected cases that may not be COVID-19. Case fatality rates were high in both groups and are likely to be an overestimate due to lack of testing of less severe infections, particularly in wave one. We did not have information on ability level, Down syndrome or living circumstances, or data on other risk factors for COVID-19 such as comorbidities which are more common in adults with intellectual disabilities than other people. As 97.3% of the intellectual disabilities population in Scotland is white, we were unable to analyse ethnicity due to small cell sizes. In the subgroup calculations of standardised ratios of severe and fatal COVID-19 infections some cells contained less than twenty events. The Office for National Statistics advises that, in such situations derived rates should be interpreted as having low reliability.[24] It is important that COVID-19 outcomes in the second and third waves are investigated as this data becomes available.

Implications for clinicians and policymakers

Non-pharmaceutical interventions are critical in minimising the transmission of COVID-19. Our findings are important for policy-makers, clinicians and public health physicians to make evidence-based decisions about targeting preventive measures such as shielding, surveillance strategies, criteria for testing and prioritisation for vaccination, including those providing care and support to people with intellectual disabilities. These results are relevant for all adults with intellectual disabilities, regardless of age, sex or extent of neighbourhood deprivation. The age cut-offs used in the general population for prioritising COVID-19 vaccination and boosters should not be applied to adults with intellectual disabilities who are a higher risk even at younger ages.

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