Study protocol: Risks of mortality and hospitalisation related to COVID-19 associated with learning disability using the OpenSAFELY platform

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Abstract

On March 11th 2020, the World Health Organization characterised COVID-19 as a pandemic. Various patient groups have been found to have higher risks of severe outcomes from COVID-19, such as death or hospitalisation, including those with chronic heart disease and respiratory disease. As of February 2021, the Learning from Death Reviews (LeDeR) programme reported that more than a thousand people with a learning disability had died from COVID-19 in England since February 2020. Large cohort studies have suggested large increases in risks of poor COVID-19 outcomes among people with learning disabilities. Whether this is restricted to those living in residential care or those with profound learning disability remains unknown.

The aim of this study is to use linked electronic health records within the OpenSAFELY platform to describe the risk of hospitalisation and mortality from COVID-19 in England among adults and children with learning disabilities compared to the general population.

Keywords

Learning disability; COVID-19; risk; mortality; hospitalisation.

Background and aims

On March 11th 2020, the World Health Organization characterised COVID-19 as a pandemic.[1] Various patient groups have been found to have higher risks of severe outcomes from COVID-19, such as death or hospitalisation, including those with chronic heart disease and respiratory disease.[2]

As of February 2021, the Learning from Death Reviews (LeDeR) programme reported that more than a thousand people with a learning disability had died from COVID-19 in England since February 2020.[3] Joy et al found an odds ratio of 1.97 (95% confidence interval (CI) 1.22 to 3.18) for mortality during the first wave of the COVID-19 pandemic, among people with learning disability compared to those without in an analysis of the Oxford RCGP Research and Surveillance Centre (RSC) sentinel network.[4] An analysis of primary care data from 8 million adults found a greatly increased hazard of COVID-19 related death among adults with Down's syndrome (HR after adjustment 10.4 (95% CI 7.1 to 15.2)) and a much smaller increase in those with learning disability other than Down's syndrome (HR 1.26 (95% CI 1.16 to 1.40)).[5] Both of these studies adjusted for variables which might be on the causal pathway, such as socioeconomic status and comorbidities, complicating interpretation of the results. A case series of COVID-19 deaths among individuals with intellectual disability explored risk factors and comorbidities, comparing those with profound to milder disability. They identified differences in risk factors between these groups and concluded that urgent exploration of this topic was needed.[6]

The higher risks of premature death among people with intellectual disabilities in England is well-established. The Confidential Inquiry published in 2013 reviewed deaths of 247 people with intellectual disabilities and reported that deaths occurred on average 13 years younger than the median age of death in males, and 20 years in females.[7] Approximately half (49%) of deaths were deemed to be avoidable, and 37% were from causes amenable to good quality healthcare. As a consequence of the inquiry, a number of changes have been made within the NHS to improve healthcare provision for people with learning disabilities. This includes the establishment of a GP Learning Disability Register to invite people for annual health checks.

The current national recommendations for prioritisation of COVID-19 vaccination include all adults with cerebral palsy, severe or profound learning disabilities, Down's Syndrome, and the whole resident population in care settings where a high proportion of residents would be eligible for vaccination (for example due to learning disabilities).8 Eligible individuals are typically identified through GP records and the Learning Disability Register offers a potential avenue for identifying people with learning disabilities to invite them for vaccination. At present, not everyone on the Learning Disability Register is eligible for COVID-19 vaccination, in particular people with mild-moderate learning disabilities from causes other than Down's Syndrome or cerebral palsy who are not living in residential care. Conversely, not all eligible participants (and specifically not everyone with Down's syndrome or cerebral palsy) will be on the Learning Disability Register.

The aim of this study is to use linked electronic health records within the OpenSAFELY platform to:

1) describe the risk of COVID-19 related hospitalisation and mortality among children and adults in England with learning disabilities compared to the general population;

2) to separate the risk associated with severe-profound learning disability from milder learning disability;
3) to compare risks among people in residential care versus those living in the community; and
4) to establish risk experienced by people with learning disability among the population not yet included in the first 6 priority groups of the Phase 1 vaccination priority list in the UK.

Methods

Study Population, Outcome, Follow-up and Exposure

Study design

Data will be accessed using OpenSAFELY, a data analytics platform created on behalf of NHS England to address urgent COVID-19 research questions (https://opensafely.org).[2] OpenSAFELY includes the electronic health record (EHR) data of 24 million people currently registered with primary care practices using TPP SystmOne software, representing approximately 40% of the English population.

Two population-based observational cohort studies of adult patients in England will be used. The first cohort will comprise adult patients (males and females, aged between 18 and 105 years) registered as of 1st March 2020 in a general practice which employs the TPP system. Patients with missing age or a recorded age over 105 years, missing gender, or missing postcode (from which much of the household and geographic information is calculated) will be excluded. The second cohort will be similarly defined, but will include patients registered as of 1st September 2020 in a general practice which employs the TPP system. Membership of the two cohorts will overlap greatly, but will differ due to patients leaving and joining TPP practices and to patients dying prior to the second cohort. These two time periods correspond to the two main "waves" experienced in England during 2020.

Outcomes

The outcomes for this study are (i) COVID-19 related death and (ii) COVID-19 related hospitalisation.

Primary care data will be linked to mortality data from the Office for National Statistics (ONS) mortality data and to Secondary Uses Services Admitted Patient Care data. COVID-19 related deaths will be defined as deaths with an ICD-10 code of U071 or U072 anywhere on the death certificate. COVID-19 related hospital admissions will be defined as admissions with any ICD-10 admission diagnosis (not restricted to primary diagnosis) of U071 or U072.

Follow-up

The first cohort study will begin on 1st March 2020 and will end on 31st August 2020 (inclusive). The second cohort study will begin on 1st September 2020 and will end on the last date at which outcome data is available.

Exposure

Primary care records will be retrieved from the TPP SystmOne electronic health record system. These data include diagnoses (Read 3 CTV3), prescriptions (dm+d), basic sociodemographics and vital signs. Information on exposure and other covariates will be derived from primary care records retrieved from the TPP SystmOne electronic health record system, including diagnoses (Read 3 CTV3), prescriptions (dm+d) and basic sociodemographics.

Our main exposure group will be individuals on the learning disability register. The codelist used can be found in the Appendix. This approach will identify a subset of individuals with learning disability; it is not a comprehensive list. However, the register provides a simple and practical means of identifying people for vaccine prioritisation or implementation of other public health measures.

A subset of those identified as being on the learning disability register will be classed as having profound or severe learning disability (codelists in Appendix). Codelists will also be used to identify patients with Down's syndrome and Cerebral Palsy, whether or not these individuals are included on the learning disability register. For some analyses, patients with learning disability will be classified according to the presence of these conditions.

Covariates

Codelists used to define the covariates below can be found in the Appendix.

Demographic covariates considered to be potential confounders in the relationship between learning disability and severe outcomes from COVID-19 are: age; sex (male or female); ethnicity (5 category: White, South Asian, Black, Mixed, Other) and geographical region. The last will be measured by the Sustainability and Transformation Partnership (STP). Deprivation is considered to act both as a potential confounder and mediator and will be measured by the quintile of the index of multiple deprivation (IMD) derived from the patient's postcode at lower super output area level. Being in residential care is considered both as a potential effect-modifier and mediator. We do not have a comprehensive indicator of residential care so we will assume that households with 5 or more adults with codes indicating learning disability are residential care homes. Although we use the term "residential care" throughout, we note that this includes a range of settings (care homes, educational settings, sheltered accommodation, etc.). We are only able to group people into households as of 1st February 2020, so this indicator will miss individuals who recently moved into a residential setting for the second cohort.

Obesity and physical comorbidities which may be linked to learning disabilities were considered as potential mediators. To understand the extent to which current vaccine recommendations may mitigate risk among the population with learning disability, we will adjust for obesity and physical comorbidities which are currently separate indications for vaccination.

For consistency with vaccine recommendations, obesity will be defined as class III obesity (a Body Mass Index of 40+ kg/m^2); or no evidence of class III obesity, with BMI ascertained from weight measurements within the last 10 years, restricted to those taken when the patient was over 16 years old (for those 16 years and over, most recent measurement within the last two years for under 16).

Comorbidities will be defined through combinations of clinical measurements, prescriptions, and recorded diagnoses. Physical comorbidities which are current indications for vaccination will be included. Severe asthma will be defined using oral corticosteroids as an indication of severity, with 2 or more prescriptions in the last year taken to indicate severe asthma. We will include cystic fibrosis and associated diseases such as primary ciliary dyskinesia; other chronic respiratory diseases such as chronic obstructive pulmonary disease; chronic cardiac disease including chronic heart failure, ischaemic heart disease, and severe valve or congenital heart disease likely to require lifelong follow up; atrial fibrillation; prior deep vein thrombosis or pulmonary embolism; diabetes mellitus (additionally using HbA1c within last 15 months to determine level of HbA1c control, grouped into <58 mmol/mol (good control), >=58 mmol/mol (poor control) and no recent measure); chronic liver disease; stroke and transient ischaemic attack; and dementia.

We will define chronic kidney disease stages 3-5 based on reduced kidney function ascertained from the most recent serum creatinine measurement taken in the last 5 years excluding the most recent fortnight, where available, converted into estimated glomerular filtration rate (eGFR) using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation), grouped into no evidence of kidney impairment (no creatinine measurement or eGFR>=60 mL/min/1.73m^2), stage 3 (eGFR in range 30-<60 mL/min/1.73m^2) and stage 4-5 (<30 mL/min/1.73m^2). Patients with a history of kidney dialysis or kidney transplant will be included in the category representing stage 4-5.
To capture immunosuppression we will include (as separate variables): asplenia (splenectomy or a spleen dysfunction, including sickle cell disease); solid organ transplant (any); and other immunosuppressive conditions including HIV or other condition inducing permanent immunodeficiency ever diagnosed, or aplastic anaemia or temporary immunodeficiency recorded within the last year. Haematological malignancies will be grouped according to time since diagnosis (<1 year, 2-<5 years, 5+years). We also include common autoimmune diseases including Rheumatoid Arthritis (RA), Systemic Lupus Erythematosus (SLE) or psoriasis since these conditions may require long term immunosuppressive treatments. Although a diagnosis of inflammatory bowel disease is not itself a current indication for vaccination, it typically requires immunosuppressing medication which is, and so is included as a marker for immunosuppression due to medication. Similarly, we include a history of non-haematological cancer diagnosed in the previous year.

Additional comorbidities will be used to identify groups already prioritised for vaccination. These are: serious mental illness (psychosis, schizophrenia or bipolar affective disorder) and other neurological conditions (motor neurone disease, myasthenia gravis, multiple sclerosis, Parkinson's

disease, quadriplegia or hemiplegia, malignant primary brain tumour and progressive cerebellar disease). These conditions will not be adjusted for in the exploration of potential mediation by underlying conditions, due to potential for their differential ascertainment among people with learning disabilities. However, they will be used to exclude individuals eligible for vaccination.

Vaccine priority list

Patients already included in the first 6 priority groups of the Phase 1 vaccination priority list in the UK will be identified, as closely as possible, by applying the criteria as laid out in the Green Book[8] using our existing codelists. These are: residents in a care home for older adults and their carers; 80 years and over and frontline health and social care workers; 75 and over; 70 and over and clinically extremely vulnerable individuals[9]; 65 years and over; 16-64 years with underlying health conditions putting them at higher risk of serious disease and mortality; 60 years and over; 60+; 55+ and 50+.

We will create an indicator of "likely to be among first six priority groups", which will include: individuals 65 years and over and individuals with codes indicating the following conditions: chronic cardiac disease, haematological malignancy, non-hematological cancer diagnosed in the last year, solid organ transplant, respiratory disease, severe asthma, conditions inducing immunosuppression, asplenia, receiving dialysis, reduced kidney function (eGFR <60 mL/min/1.73m^2), liver disease, stroke, dementia, other neurological conditions, diabetes, severe mental illness, BMI of 40 or more (obese III), Down's syndrome, Cerebral Palsy, and profound learning disability.

This indicator will necessarily be imperfect. For example, it is not possible for us to identify carers in care homes or frontline health and social care workers, so our indicator will miss these individuals. Additionally, individuals can be classed as clinically extremely vulnerable based on clinical judgement. We do not have the ability to identify these individuals.

Statistical Analysis

The three analysis steps below will be repeated for the following exposures: being on the learning disability register (LDR, all then divided into severe-profound versus mild-moderate), Down's syndrome (DS), Cerebral Palsy (CP), and then a combined exposure variable. For the combined variable, we will create 5 groups: DS but not LDR, DS and LDR, CP but not LDR, CP and LDR, and LD with no DS or CP.

Descriptive

We will describe demographic characteristics and comorbidities by learning disability status, compared with the general population. We will estimate rates of COVID-19 related hospitalisation

and mortality by age-group (ages: 0-15, 16-44, 45-64, 65-69, 70-74, 75-79, 80+) and sex for exposed and unexposed individuals. We will estimate standardised cumulative mortality and hospitalisation curves for individuals with and without learning disabilities by sex and broad age strata.

Exploratory regression modelling

For each cohort study, we will fit a series of Cox proportional hazards models for (i) COVID-19 related mortality and (ii) COVID-19 related hospitalisation, all stratified by STP to account for differing patterns of infection over time in different regions, with days in study as the timescale. Main analyses will target the cause-specific hazard and therefore censor at the competing events of death due to non-COVID-related causes and additionally, for the hospitalisation analyses, at COVID-19 related death. We will use robust standard errors to account for clustering by household. We will adjust for age using a restricted cubic spline with 4 knots. Hazard ratios with 95% confidence intervals will be presented for each exposure considered. We will add interaction terms between an indicator of residential care and exposure, to separately estimate hazard ratios for individuals residing in the community and those in residential care. We will also explore interactions between exposure and broad age strata.

In adults, we will fit a series of sequentially adjusted models. First, we will adjust only for variables considered to be potential confounders, specifically age, sex and ethnicity. Second, we will additionally adjust for deprivation, likely to act both as a mediator and confounder, and separately for living in residential care. These models will explore the extent to which any association found may be mediated through deprivation and living in residential care. Third, we will also adjust for physical comorbidities that are indications for vaccination and also associated with learning disability, Down's syndrome or Cerebral Palsy. This model addresses the question of whether targeting comorbidities identifies those at highest risk, or whether the exposures considered have additional predictive value in identifying high risk groups and therefore, for example, should be added to vaccine prioritisation lists.

In children (0-15 years), we will only explore the outcome of COVID-19 hospitalisation due to few deaths in this age-group. In the third set of models, we will additionally adjust for obesity but not comorbidities. If too few outcome events occur to fit the planned models, we will aggregate groups omit or simplify analyses.

Models will be fitted separately within each cohort (i.e. within each wave).

Risks among those not prioritised for vaccination

We will then exclude all patients identified as being in the first six groups of the Phase 1 vaccine priority list based on age or underlying conditions, as described above. We will not exclude based on institutional residence due to the difficulties in identifying this from our data. In the remaining population, we will refit the multivariable models above to estimate hazard ratios for learning disability in this group. In particular, Down's syndrome, Cerebral Palsy and severe-profound learning disability are in the first six priority groups, so the exposed group will be those on the learning disability register but with none of those three conditions.

Missing data

A large number of the candidate predictors will be fully observed, in the sense that an absence of a diagnosis is taken to indicate the absence of disease, as is typically assumed in electronic health record research. While this may lead to issues with misclassification and subsequent interpretation, this does not manifest itself in a missing data problem. Missing data will arise in some demographic variables and clinical measurements, with the later predominantly used to determine severity of certain conditions. The predictors that are expected to have missing data (with anticipated missing rates in brackets) are: ethnicity (~25%), BMI (~20%), hba1c (~20% of patients with diabetes), and kidney function (missingness likely in serum creatinine measurement). Our previous analyses in these data suggested little evidence against missing at random for ethnicity. Initial models will take a complete case approach to missing ethnicity data. Subsequently, multiple imputation (ten imputations) will be used to account for missing ethnicity. A multinomial logistic imputation model including all covariates from the main modelling and an indicator for each outcome (COVID-19 mortality and hospitalisation) will be used to generate the imputations, and model estimates from the resulting ten imputed datasets will be combined by use of Rubin's rules. Individuals with missing BMI will be assumed to be non-obese; we will not use multiple imputation for this, because it is expected to be missing not at random in UK primary care. Patients with no serum creatinine measurement will be included in the "no evidence of poor kidney function". Patients with diabetes but no Hba1c measurement will be included in a separate "diabetes, no Hba1c" category.

Ethics and Information Governance

NHS England is the data controller; TPP is the data processor; and the key researchers on OpenSAFELY are acting on behalf of NHS England. This implementation of OpenSAFELY is hosted within the TPP environment which is accredited to the ISO 27001 information security standard and is NHS IG Toolkit compliant; patient data has been pseudonymised for analysis and linkage using industry standard cryptographic hashing techniques; all pseudonymised datasets transmitted for linkage onto OpenSAFELY are encrypted; access to the platform is via a virtual private network (VPN) connection, restricted to a small group of researchers, their specific machine and IP address; the researchers hold contracts with NHS England and only access the platform to initiate database queries and statistical models; all database activity is logged; only aggregate statistical outputs leave the platform environment following best practice for anonymisation of results such as statistical disclosure control for low cell counts. The OpenSAFELY research platform adheres to the data protection principles of the UK Data Protection Act 2018 and the EU General Data Protection Regulation (GDPR) 2016. In March 2020, the Secretary of State for Health and Social Care used powers under the UK Health Service (Control of Patient Information) Regulations 2002 (COPI) to require organisations to process confidential patient information for the purposes of protecting public health, providing healthcare services to the public and monitoring and managing the COVID-19 outbreak and incidents of exposure. Taken together, these provide the legal bases to link patient datasets on the OpenSAFELY platform. This study was approved by the Health Research Authority (REC reference 20/LO/0651) and by the LSHTM Ethics Board (reference 21863).

Discussion

Results from these analyses will provide a clear description of the risks of COVID-19 hospitalisation and mortality experienced by adults with profound and milder learning disabilities compared with the general population; whether these risks appear to differ for people living in residential care homes compared with those living in the community, and will provide evidence about whether these risks have changed in the first and second large waves experienced in England during 2020. They will also inform future vaccine prioritisation, by providing data regarding risk among people with learning disabilities who are not currently covered by the Phase I vaccination priority groupings.

Data and Software Availability

All data were linked, stored and analysed securely within the OpenSAFELY platform (https://opensafely.org/). Detailed pseudonymized patient data are potentially reidentifiable and therefore not shared. We rapidly delivered the OpenSAFELY data analysis platform without prior funding to deliver timely analyses on urgent research questions in the context of the global COVID-19 health emergency: now that the platform is established we are developing a formal process for external users to request access in collaboration with NHS England. Details of this process will be published shortly on the OpenSAFELY website.

Data management was performed using Python 3.8 and SQL, with analysis carried out using Stata 16.1 and Python. All code is shared openly for review and reuse under an MIT open license. All code for data management and analysis is archived online at https://github.com/opensafely/risk-prediction-research. All clinical and medicines codelists are openly available for inspection and reuse at https://codelists.opensafely.org/.

Author Contributions

B.G. conceived the platform and the approach; B.G. and L.S. led the project overall and are guarantors; S.B. led the software; E.J.W, H.I.M. and H.K. designed and performed the analysis; C.E.M. and A.J.W. led on codelists and implementation; and A.M. led on information governance. Contributions are as follows: data curation, C.B., J.P., J.C., S.H., S.B., D.E., P.I. and C.E.M.; analysis, E.J.W; funding acquisition, B.G. and L.S.; information governance, A.M., B.G., C.B. and J.P.; methodology, E.J.W., K.B., A.J.W., B.G., L.S., C.B., J.P., J.C., S.H., S.B., D.E., P.I. and C.E.M; disease category conceptualization and codelists, C.E.M., A.J.W., P.I., S.B., D.E., C.B., J.C., J.P., S.H., H.J.C., K.B., S.B., A.M., B.M., L.T., I.J.D., H.I.M., R.M. and H.F.; ethics approval, H.J.C., E.J.W., L.S. and B.G.; project administration, C.E.M., H.J.C., C.B., S.B., A.M., L.S. and B.G.; resources, B.G., L.S. and F.H.; software, S.B., D.E., P.I., A.J.W., C.E.M., C.B., F.H., J.C. and S.H.; supervision, B.G., L.S. and S.B.; writing (original draft), E.J.W., H.I.M, H.K. All authors were involved in design and conceptual development and reviewed and approved the final manuscript.

Competing Interests

All authors have completed the International Committee of Medical Journal Editors (ICMJE) uniform disclosure form at www.icmje.org/coi_disclosure.pdf. C.B., J.P., F.H., J.C. and S.H. are employees of TPP. A.M. was interim Chief Medical Officer of NHS Digital April–Sept 2019 (left NHS Digital at the end of January 2020) and Digital Clinical Champion NHS England 2014–2015. All other authors have no competing interests.

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Appendix 1

Table A1. Codelists used to define variables used in the analysis

Variable	Notes	Codelist
On learning disability register		https://codelists.opensafely.org/codelist/opensafely/learning-disabilities/2020-07-06/
Severe and profound learning disability		https://codelists.opensafely.org/codelist/opensafely/severe-and-profound-learning-disability-flags/44ef542a/#full-list
Down's syndrome		https://codelists.opensafely.org/codelist/opensafely/down-syndrome/15832db6/#full-list
Cerebral Palsy		https://codelists.opensafely.org/codelist/opensafely/cerebral-palsy/1835edac/#full-list
Ethnicity	5 categories, obtained from 16 (White, South Asian, Black, Mixed, Other)	https://codelists.opensafely.org/codelist/opensafely/ethnicity
Chronic cardiac disease		https://codelists.opensafely.org/codelist/opensafely/chronic-cardiac-disease/
Atrial Fibrillation	This codelist includes both atrial fibrillation and atrial flutter	https://codelists.opensafely.org/codelist/opensafely/atrial-fibrillation-or-flutter/2020-07-30/
Prior deep vein thrombosis / pulmonary embolism		https://codelists.opensafely.org/codelist/opensafely/venous-thromboembolic-disease/2020-09-14/

Diabetes	Combined with Hba1c measure within 18 months to determine level of control	https://codelists.opensafely.org/codelist/opensafely/diabetes/
Stroke and transient ischaemic attack		https://codelists.opensafely.org/codelist/opensafely/stroke-updated/2020-06-02/ https://codelists.opensafely.org/codelist/opensafely/transient-ischaemic-attack/3526e2ac/
Dementia		https://codelists.opensafely.org/codelist/opensafely/dementia-complete/48c76cf8
Other neurological conditions	Will be used only for exclusion of individuals eligible for vaccination in final analysis: will not be adjusted for in models.	https://codelists.opensafely.org/codelist/opensafely/other-neurological-conditions/
Asthma	Combined with OCS prescriptions in past year to determine severity	https://codelists.opensafely.org/codelist/opensafely/asthma-diagnosis/
Cystic Fibrosis and associated conditions		https://codelists.opensafely.org/codelist/opensafely/cystic-fibrosis/2020-07-20/
Respiratory disease other than asthma or cystic fibrosis		https://codelists.opensafely.org/codelist/opensafely/other-chronic-respiratory-disease/2020-07-20/
Non-haematological cancer	Incident diagnosis within the previous year	https://codelists.opensafely.org/codelist/opensafely/cancer-excluding-lung-and-haematological/

Haematological cancer	Grouped by time since diagnosis (<1 year, 2-<5 years, 5+years)	https://codelists.opensafely.org/codelist/opensafely/haematological-cancer/
Lung cancer	Incident diagnosis within the previous year, combined with other non-haematological cancer	https://codelists.opensafely.org/codelist/opensafely/lung-cancer/
Liver disease		https://codelists.opensafely.org/codelist/opensafely/chronic-liver-disease/
Kidney dialysis	Used if no kidney transplant since most recent dialysis	https://codelists.opensafely.org/codelist/opensafely/dialysis/2020-07-16/
Kidney transplant	Combined with non-kidney transplant for transplant indicator. Also used to determine which of dialysis/transplant is most recent.	https://codelists.opensafely.org/codelist/opensafely/kidney-transplant/2020-07-15/
Organ transplant (other than kidney)	Combined with kidney transplant for transplant indicator.	https://codelists.opensafely.org/codelist/opensafely/other-organ-transplant/2020-07-15/
Asplenia		https://codelists.opensafely.org/codelist/opensafely/asplenia/ https://codelists.opensafely.org/codelist/opensafely/sickle-cell-disease/
Rheumatoid arthritis, lupus, psoriasis		https://codelists.opensafely.org/codelist/opensafely/ra-sle-psoriasis/
Other immunosuppressive condition	Temporary and aplastic anaemia within last year; HIV and other permanent immunosuppression ever.	https://codelists.opensafely.org/codelist/opensafely/hiv/2020-07-13/ https://codelists.opensafely.org/codelist/opensafely/permanent-immunosuppresion/ https://codelists.opensafely.org/codelist/opensafely/aplastic-anaemia/

		https://codelists.opensafely.org/codelist/opensafely/temporary-immunosuppresion/
Inflammatory bowel disease		https://codelists.opensafely.org/codelist/opensafely/inflammatory-bowel-disease/2020-04-07/
Serious mental illness	Psychosis, schizophrenia and bipolar affective disease	https://codelists.opensafely.org/codelist/opensafely/psychosis-schizophrenia-bipolar-affective-disease/2020-07-09/