Technical appendix: Assessing the impact of COVID-19 on the clinically extremely vulnerable population

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About this technical appendix

- This technical appendix provides supplemental information on the methodology used for the analysis presented in the Health Foundation briefing *Assessing the impact of COVID-19 on the clinically extremely vulnerable population*.

The Health Foundation

Networked Data Lab partners and areas

The Networked Data Lab (NDL) is a collaborative network of five analytical teams across the UK working together using linked datasets on key issues facing health and care services today.

This analysis was on the impact of the COVID-19 pandemic on the clinically extremely vulnerable (CEV) population, those at the highest risk of severe illness and death from COVID-19. Our aim was to understand the impact of COVID-19 on their health and health service use.

The geographical area covered by NDL partners had over 7.5 million residents in 2019 in total. For this analysis, over 390,000 clinically extremely vulnerable (CEV) people from the NDL areas were included in our analysis as detailed below.

Networked Data Lab Partners and populations

Networked Data Lab Partner	Size of CEV cohort in study	Boundaries	Population (2019)
Grampian	16,025	NHS Grampian Health Board	585,700
Leeds	62,851	NHS Leeds CCG	793,139
Liverpool and Wirral	69,293	NHS Liverpool CCG and NHS Wirral CCG	882,053
Wales	128,690	Wales (Country)	3,152,879
North West London	112,134	North West London Health and Care Partnership STP, which includes: NHS Brent CCG, NHS Central London (Westminster) CCG, NHS Ealing CCG, NHS Hammersmith and Fulham CCG, NHS Harrow CCG, NHS Hillingdon CCG, NHS Hounslow CCG, NHS West London CCG	2,103,719

Federated analysis approach

The results presented in our briefing use a federated analytics model whereby analyses were carried out by individual partners using the same analysis plan, before being aggregated into a **central analysis**.[1] Results were then displayed side by side or aggregated into a single value.

In addition to the central analysis described above, this briefing also drew from five independent **satellite analyses** carried out by each of the NDL partners. These five satellite reports partly relied on the methodology for the central analysis, but expanded into the following areas: mental health, social care and a deeper dive into service use statistics. Those satellite reports can be found on the Health Foundation website.[2,3,4,5,6]

Data sources

This central and satellite analyses relied on a mixture of routinely collected administrative data on patients (securely accessed by each of the NDL partners in their local areas) and open publicly available data from the ONS and NHS Digital.

First, partners had to identify people who had been classified as clinically extremely vulnerable (CEV) in their records, which was possible by linking those records with the Shielded Patient List (SPL). The data linkage between the SPL, secondary health care records and mortality data enabled partners to carry out their analyses on the impact of COVID-19 on the health and health service use.

Below we outline the different datasets that were used for both the central and satellite analyses and describe the open data that was used to supplement these.

Health and social care datasets accessed by Networked Data Lab partners
The central analysis relied on the following linked datasets:

- The **Shielded Patient List**, including the reason for shielding and method of addition to the list

- **Patient demographic databases**, with information on age, sex and local deprivation

- **Secondary health records**, with activity data on elective admissions, emergency admissions, outpatient attendances and A&E attendances, including start date and the ICD-10 codes associated with each hospital admission

- **Mortality records**, including the date of death

In addition to the above, the following datasets were also linked to the enable the five satellite analyses done by each of the NDL partners:

- **Grampian** linked data on prescribing and laboratory results.

- **Leeds** linked Adult Social Care data and the electronic Frailty Index (eFI).

- **Liverpool and Wirral** linked primary care prescription data.

- **Wales** linked primary care data on symptoms, diagnoses and prescriptions through the SAIL databank platform.[7]

- **North West London** made use of additional primary care data on diagnoses through the longitudinal Discover dataset, which also includes coded primary care, acute, mental health, community health and social care data.[8]

In addition to patient-level data accessed through our NDL partners, we also accessed the following open data sources:

- **Tracking Healthcare Activity and Outcomes for Shielded Patients, England (NHS Digital).**[9] We used this data to report on emergency admissions, all-cause mortality and positive COVID-19 testing rates among both the CEV cohort and an age-matched general population sample.

- **Coronavirus Shielded Patient List Summary Totals, England (NHS Digital).**[10] We used this data to summarise the number of people added to the Shielded Patient List each week by CCG, before and after the implementation of the QCOVID® algorithm (with the 10/02/2020 and 20/03/2020 extracts acting as the 'before' and 'after' datasets). We stratified this analysis by CCG deprivation level. Each CCG's deprivation quintile was computed using LSOA-level scores from the 2019 Index of Multiple Deprivation, aggregated to the CCG level using 2019 LSOA-level population data.[11,12]

- The **ONS Shielding Behavioural Survey** and the **ONS High Risk Group Insights Survey** to summarise the mental health impacts of being asked to shield among the sample of survey respondents.[13,14]

Cohort definition

CEV cohort

In each of the five locations, the shielding cohort was defined as any person who was on the Shielded Patient List at any point in the period prior to 31 July 2020. However, there may be local variation in how these criteria were applied at each of the five locations.

As detailed below, there is also local variation in the conditions considered for inclusion in the Shielded Patient List. Some of these differences reflect differences in each devolved nation's clinical shielding algorithm. We list below, for each local area included in our analysis, the breakdown of shielding groups. Please note that, in any given area, a patient may be included in more than one category, for example if they had both cancer and a respiratory condition.

Grampian

Reason for shielding	Number of CEV people
Cancer	2,792
Immunosuppressants	4,497
Other	2,567
Pregnant	11
Rare disease	1,221
Respiratory	6,786
Transplant	607
Total	16,025

Leeds

Reason for shielding	Number of CEV people
Respiratory	10,218
Rare diseases	6,126
Cancer	5,051
Transplants	558
Other	69
Unknown	41,941
Total	62,851

Liverpool

Reason for shielding	Number of CEV people
Chemo and Radiotherapy	1,334
Respiratory	11,763
Rare genetic metabolic and autoimmune diseases	6,285
Cancer (Haematological)	2,851
Pregnant with congenital heart defect	103
Transplants	1,656
Other (BMA asthma)	9,100
Other (BMA COPD)	5,901
Other (BMA diabetes)	16,769
Other (BMA heart failure)	4,053
Other (BMA dementia)	3,058

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Other (BMA learning disabilities)	553
Other (BMA multiple long term conditions)	17,062
Other (BMA and/or local care team/GP)	5,225
Unknown	2,075
Total	54,498

Wirral

Reason for shielding	Number of CEV people
Chemotherapy and radiotherapy	110
Cancer (Haematological)	830
Pregnant with congenital heart defect	12
Rare diseases	1,497
Respiratory	5,060
Transplant	126
Unknown	7,570
Total	14,795

Wales

Reason for shielding	Number of CEV people
Solid organ transplant	2,805
Cancer	23,184
Severe respiratory disease	40,927
Solid organ disease	7,722
Rare diseases	13,647
Immunosuppression therapy	30,550
Pregnancy with congenital heart disease	124
Renal dialysis	609
Other	1,129
GP referred	14,899
Unknown	701
Total	128,690

North West London

Reason for shielding	Number of CEV people
Respiratory	12,085
Rare genetic metabolic and autoimmune diseases	10,716
Cancer (Chemotherapy/Radiotherapy)	2,916
Cancer (Haematological)	4,325
Other (including Pregnancy with congenital heart disease and Transplants)	410
Unknown	84,155
Total	112,134

Non-CEV cohort

North West London carried out additional analysis comparing secondary care activity between the CEV and non-CEV populations. The non-CEV population includes all people over 18 who were not part of the CEV cohort as defined in the study.

Central analysis methods

Here, we summarise key details from the central analysis plan.

- **COVID admissions:** We reported the number of people with a COVID-related hospital admission for each month over the period 1 March 2020 – 31 July 2020. This relies on a lookup of all diagnoses codes related to an admission, not just the primary diagnosis. A diagnosis is considered to be COVID-19 if either of these ICD-10 codes were used: '*U07.1 COVID-19, virus identified*' or '*U07.2 COVID-19, virus not identified*'.

- **Deaths:** We reported the number of any-cause deaths over the period 1 March 2020 – 31 July 2020, regardless of where the death took place (in hospital or elsewhere) and based on the date the person died, rather than when it was reported.

- **Coding of hospital admissions:** Hospital admissions were recorded as being either elective or emergency and those distinctions rely on local coding practices (see NHS Digital Data Dictionary for a methodology on how to code spells in England).[15]

- Each hospital admission is associated with a main diagnosis code, and this is derived from the first diagnosis code from the first episode.

- Using each hospital admission's main diagnosis code, we reported the number of **admissions by ICD-10 chapter** using the mapping provided below. Each ICD-10 code can be mapped to an ICD-10 chapter using the first three characters. A summary of this mapping is provided in the table below.

- The number of admissions by ICD-10 chapter was reported for two different periods: March-July 2019 (all admissions that started between 01/03/2019 and 31/07/2019) and March-July 2020 (all admissions that started between 01/03/2020 and 31/07/2020).

Mapping of main diagnosis to ICD-10 chapter

ICD-10 chapter	Codes included (all those with these first three characters)
1 - Certain infectious and parasitic diseases	A00-A99, B00-B99
2 - Neoplasms	C00-C97, C7A, C7B, C4A, D00-D49, D3A
3 - Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	D50-D89
4 - Endocrine, nutritional and metabolic diseases	E00-E90
5 - Mental, Behavioural and Neurodevelopmental disorders	F00-F99
6 - Diseases of the nervous system	G00-G99
7 - Diseases of the eye and adnexa	H00-H59
8 - Diseases of the ear and mastoid process	H60-H95
9 - Diseases of the circulatory system	I00-I99
10 - Diseases of the respiratory system	J00-J99
11 - Diseases of the digestive system	K00-K95
12 - Diseases of the skin and subcutaneous tissue	L00-L99
13 - Diseases of the musculoskeletal system and connective tissue	M00-M99, M1A
14 - Diseases of the genitourinary system	N00-N99
15 - Pregnancy, childbirth and the puerperium	O00-O99, O9A
16 - Certain conditions originating in the perinatal period	P00-P96
17 - Congenital malformations, deformations and chromosomal abnormalities	Q00-Q99
18 - Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R00-R99
19 - Injury, poisoning and certain other consequences of external causes	S00-S99, T00-T98

20 - External causes of morbidity	V00-V99, W00-W99, X00-X99, Y00-Y99
21 - Factors influencing health status and contact with health services	Z00-Z99, Z3A
22 - Codes for special purposes	U00-U49 (this includes both COVID-19 codes), U82-U85

Satellite analyses methods

Each satellite analysis was published independently and had its own statistical analysis plan, providing more detail on cohort definition, data linkages and outcome definitions. Those analysis plans are hosted on GitHub.[16,17,18,19,20]

Code availability

The codes used for our central analysis are available on GitHub.[21,22,23,24]

Further details, including the code used by our Networked Data Lab partners, can also be found on the GitHub repositories for those individual satellite projects in the Health Foundation Analytics GitHub page.[25]

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When referencing this publication please use the following URL:
https://doi.org/10.37829/HF-2021-NDL01

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