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Research and Evaluation

COVID-19 in Wales:

The impact on levels of health care use and mental health of the clinically extremely vulnerable

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Networked Data Lab Wales

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Executive Summary

Introduction

In Wales, and many other countries around the world, those most clinically vulnerable to severe COVID-19 symptoms were advised to self-isolate within their homes and minimise contact with others within and outside their home, known as 'shielding'. The aim of this intervention was to protect the lives of those most at risk of severe illness following contracting the virus, and enable the NHS to respond effectively to the pandemic. In Wales, an estimated 130,000 people were considered to be at high risk, referred to as clinically extremely vulnerable (CEV), and advised to shield.

In March 2020, the World Health Organisation (WHO) further advised that only 'essential services' should be maintained during the pandemic to ensure health systems were able to meet the unprecedented demands due to COVID-19. In Wales, non-essential services were paused from 23rd March 2020, whereas services which were 'life saving or life impacting' continued throughout the pandemic.

As health and care systems continue to respond to a global pandemic and look towards recovery, a more detailed understanding of the CEV population's health needs and changes in patterns of health service use during the COVID-19 pandemic is needed to inform decision making.

The aim of this short report is to describe the characteristics of the CEV population in Wales and examine changes in secondary health care activity and the mental health of this population during the COVID-19 pandemic. Direct comparison of changes in secondary health care activity before and during the COVID-19 pandemic is challenging, but the findings provide timely insight into the extent of the potential unmet need amongst this population with complex health conditions, and considerations for future recovery.

Methodological overview

This study utilised the availability of routinely collected population-scale electronic health record (EHR) and administrative health care data stored in the Secured Anonymised Information Linkage (SAIL) Databank, including hospital admissions (elective, or planned, and emergency), outpatient attendances, emergency department attendances and primary care activity.

Changes in secondary health care activity

After data cleaning and linkage of the CEV patients with secondary health care data in the SAIL Databank, this analysis included 127,787 Welsh CEV patients. Changes in age standardised secondary health care related activity rates were compared across the CEV population and general population from 2019 to 2020, and differences by demographics were examined. The comparison group was the general population living in Wales during the pandemic. The comparison group for primary care was a random sample of Welsh residents registered in primary care during the study period and not instructed to shield. All rates were age

standardised to the Welsh population mid-2019 estimates and presented as per 1,000 population. Changes in rates were determined as the percentage change in annualised rates (2019, 2020), or as the average monthly percentage change. Average monthly percentage change and absolute percentage change from March to August 2020 and August to December 2020 were used to compare secondary health care activity during shielding, and following the pausing of shielding guidance (on 16th August 2020).

Presentation with mental ill health

Linkage with primary care data enabled examination of the proportion of the CEV population and the general population presenting with depression and/or anxiety from 1st March to 30th September 2020. A multivariate Cox proportional hazard regression model, adjusting for demographic characteristics (including sex, age group, deprivation and urban/rural residency) and mental health history (recent or past history of mental ill health), was used to examine differences in risk of mental ill health in the CEV population compared to general population groups.

Key messages

Demographics

- This study included 127,787 CEV individuals, equating to 4.1% of the Welsh population. Women, those aged 65 years and over, and those living in the most deprived quintiles were over-represented in the CEV population.
- The prevalence of the CEV population varied from a high of 49.0 per 1,000 population in Blaenau Gwent to a low of 33.7 per 1,000 population in Newport Local Authorities.
- The most common conditions for shielding were respiratory conditions (36.6%), followed by immunosuppression (27.3%) and cancer (20.7%). 12.5% of the CEV population were identified by a clinician.

Secondary health care activity

Planned care (elective admissions and outpatient attendances)

- Overall, compared to 2019, the declines in planned secondary health care activity in 2020 amongst the CEV population and the general population were similar:
  - » annual elective admissions decreased by 32.2% amongst the CEV population and 32.9% amongst the general population
  - » annual outpatient attendances decreased by 26.9% amongst the CEV population and 30.8% amongst the general population.
- Monthly trends from March to August 2020 showed that the decrease in both elective admissions and outpatient attendances was greater amongst the CEV population (average monthly change: -7.2% and -3.8%, respectively) than the general population (-0.6% and -1.3%, respectively).
- Monthly trends from August to December 2020, showed some recovery amongst planned care activity (elective admissions and outpatient attendances) amongst the general population (average monthly change +3.9% and +4.1%, respectively), and although there was some increase in outpatient attendances amongst the CEV population (average monthly change +1.7%), planned admissions continued to decline amongst this group (average monthly change -3.5%).

Emergency care

- Overall, compared to 2019, the decline in emergency care in 2020 was higher amongst the CEV population compared to the general population:
  - » annual emergency department (ED) attendances decreased by 24.4% amongst the CEV population and 20.2% amongst the general population
  - » annual emergency hospital admissions decreased by 26.2% amongst the CEV population and 13.2% amongst the general population.
- Monthly trends from March to August 2020 showed an increase in emergency activity and that the increase in both ED attendances and emergency hospital admissions was greater amongst the general population (+7.0% and +3.1%, respectively) compared to the CEV population (average monthly change: +4.3% and +0.5%, respectively).
- Monthly trends from August to December 2020, showed ED attendances and emergency hospital admissions declined for both the general population (average monthly change: -6.2% and -2.1%, respectively), and the CEV population (average monthly change: -5.7% and -3.8%, respectively).

Trends in hospital care activity by key demographics

- Annual and monthly changes in planned (elective admissions and outpatient attendances) and emergency care (ED attendances and emergency hospital admissions) were very similar by sex and deprivation within the CEV and general populations.
- The decline in outpatient attendances was greatest in the 45+ age groups and elective admissions greatest amongst the under 15 years and the 15 to 64 year age groups.
- The declines in emergency hospital admissions and ED attendances were markedly higher amongst the younger adult age group (15 to 44 years) in both the CEV and general populations.
- The inverse care law was evident with higher rates of emergency admissions and ED attendances and lowest levels of planned (elective admissions) in the most deprived, in both years amongst the CEV and general population.

Mental health

- Overall 38.8% of the CEV population and 26.1% of the general population comparison group had a history of mental ill health before the pandemic.
- From 1st March to 30th September 2020, 2.2% of the CEV population and 1.9% of the general population comparison group were presenting with depression and/or anxiety in primary care. Of these, 19.5% in the CEV group and 22.2% in the general population comparison group had no history of depression and/or anxiety.
- In a multivariate analysis those at increased risk of experiencing depression and/or anxiety during the pandemic were women (hazard ratio 1.3, 95% confidence interval 1.2-1.4), those of older age (15-44 years (2.1, 1.8-2.5), 45-64 years (1.3, 1.1.-1.6), aged 85+ years (1.4, 1.1-1.8) compared to under 15 years), and those with recent (5.2, 4.9-5.6) or past history of depression and/or anxiety (3.7, 3.5-3.9).
- After adjusting for age, sex, deprivation and recent or past history of mental ill health, the CEV population remained at slightly higher risk of diagnosed depression and/or anxiety compared to the general population (1.2, 1.2-1.3).

Implications

Identifying clinically extremely vulnerable persons

One in ten (12.5%) of the CEV population were identified by a clinician, of which a greater proportion were male, of younger age, and living in the most affluent areas. The CEV population were very diverse, and the algorithm used to define this group may have resulted in over-inclusion of patients who were not CEV. Whilst there is an interest in maintaining clinical vulnerability lists to support the delivery of targeted care, and work is underway to refine the approach to improve precision (i.e. specificity), there is a need to consider ethnicity and socio-economic factors such as density of people living in housing, which contribute to an individual's risk. Furthermore, due consideration to the governance, ownership and legal basis for using the CEV list for other purposes and how to maintain it is needed.

Impact on secondary health care activity

Across all secondary health care, activity rates in 2019 and 2020 were considerably higher in the CEV population compared to the general population, reflecting underlying complex health needs. Trends in age standardised rates during the course of the pandemic show a difference in patterns for planned and emergency secondary health care activity amongst the CEV and general population groups.

In 2020, annual trends in planned secondary health care (outpatient attendances and elective admissions) declined by approximately a third in both the CEV and general populations, compared to 2019. Monthly trends demonstrated that the decline in planned care was greater amongst the CEV than the general population from March to August 2020, and a slower recovery into December 2020. There are many complex factors which are likely to contribute to the declines in planned care for the CEV population. Whilst the CEV population have much greater underlying health needs, COVID-19 resulted in the suspension of the majority of non-essential care for this vulnerable group. But it may also have contributed to patients potentially delaying planned care, if able, to a time when they felt less at risk of COVID-19.

In emergency health care activity (ED attendances and emergency inpatient admissions), annual declines were greater amongst the CEV population, compared to the general population. The CEV population are likely to have more complex underlying health conditions and yet the greatest declines in emergency care was amongst this group. These different patterns may reflect clinical need, but may also reflect differences in thresholds for presentation and clinical management, and health seeking behaviours of the CEV population who were advised to shield during the pandemic.

Exploring demographic differences suggest that the change in activity was similar by sex and deprivation, but there were some differences by age group. The inverse care law was evident with higher rates of emergency admissions and ED attendances amongst the most deprived, in both years amongst the CEV and general population, suggesting that underlying health needs may not be identified or effectively managed thus requiring urgent treatment. There were also higher rates of elective admissions and outpatient attendances amongst the least deprived groups in the CEV population, but no trend by deprivation level for outpatient attendances amongst the general population. Trends in planned and emergency care are difficult to interpret given the diversity of underlying health conditions, comorbidities, and varying levels of need. Given such a significant change in secondary health care activity, and evidence of the inverse care law, a better understanding of the CEV and general populations' unmet needs is required to help inform effective, efficient and equitable delivery of future care.

Impact on mental health

This is the first quantitative study exploring the mental health outcomes amongst the CEV population in Wales. Our findings suggest that from March to September 2020, 1 in 50 of the CEV population had a clinical record of depression and/or anxiety, and of them nearly 1 in 5 had no previous history of mental ill health. Further insights into the impact of the COVID-19 pandemic on both the general population and the CEV population are needed to help inform the support available to those at greatest risk of exacerbation of past mental ill health or new onset. Early identification, support and management is essential to prevent an increasing longer-term burden of poor mental health.

Conclusion

This study has enabled the linkage of the CEV population with health care data within the SAIL Databank to explore the impact on secondary health care activity and mental health outcomes. The findings demonstrate marked declines in planned and emergency care for CEV and general populations in Wales during 2020. This is not unexpected given the marked impact of COVID-19 on the NHS response, and suggests there may be considerable unmet need, in particular in mental ill health amongst the CEV, and evidence of the inverse care law in effect during the pandemic. As health and care systems continue to respond to a global pandemic and look towards recovery, a more detailed understanding of the CEV population's health needs and changes to health seeking behaviour is necessary to effectively and efficiently address the needs of the most vulnerable into recovery.

1. Introduction

On 11th March 2020, the World Health Organisation (WHO) declared a SARS-CoV-2 pandemic, the virus responsible for the disease known as COVID-19. Whilst many individuals contract the virus and remain asymptomatic or report mild symptoms, estimates suggest that approximately 14% of cases can suffer a severe illness, 6% can become critically ill (1), with a 1.4% case fatality rate (2).

In many countries the public health response to COVID-19 included advising those at highest risk of severe illness to self-isolate within their homes and minimise contact with others within and outside of their household, commonly referred to as 'shielding' (3,4). In Wales, an estimated 130,000 people were considered to be at high risk, referred to as clinically extremely vulnerable (CEV), and advised to shield.

In March 2020, the WHO further advised that only 'essential services' should be maintained during the pandemic to ensure health systems were able to meet unprecedented demands due to COVID-19 (5). In Wales, non-essential services were paused from 23rd March 2020, whereas services which were 'life saving or life impacting' continued throughout the pandemic (6). Health care systems across the globe have been tackling the direct impact of COVID-19, alongside the significant indirect effect on planned and emergency services for non-COVID-19 care for large proportions of the population.

The COVID-19 pandemic disrupted routes to health care and services, but also had a wider impact on life for everyone, from changes to work, employment and closures of business, to education, and loss of social connections to friends, family, formal and informal support networks. Understanding the short- and longer-term impact on the mental health of the population has been identified as a key priority globally and in Wales (7,8). The CEV population are one group who may have been more vulnerable to poor mental

health outcomes due to many factors, including managing their increased risk of adverse outcomes from COVID-19, disruptions to their care and the necessity to isolate from family, friends and social networks in unprecedented times.

Some studies amongst shielding persons, or stakeholders representing people affected by shielding, have highlighted the impact of shielding on individuals' mental wellbeing in Wales (9), England and Scotland (10). In England, the Office for National Statistics (ONS) shielding behavioural survey reported worsening of mental health in the early months since being advised to shield (11). Similar results have been reported in smaller studies of CEV individuals with specific conditions, including multiple myeloma (increased levels of anxiety linked to both increased risk of infection and the unpredictable nature of the situation (12)), cancer (13), and cystic fibrosis (rates of anxiety rose from 27% pre-COVID, to 54% during lockdown (14)).

As health and care systems continue to respond to a global pandemic and look towards recovery, a more detailed understanding of the CEV population's health needs and changes in patterns of health service use during the COVID-19 pandemic is needed to inform decision making.

The aim of this short report is to describe the characteristics of the CEV population in Wales and examine changes in secondary health care activity and the mental health of this population during the COVID-19 pandemic. Direct comparison of changes in secondary health care activity before and during the COVID-19 pandemic is challenging, but the findings provide timely insight into the extent of the potential unmet need amongst this population with complex health conditions.

2. Background

About the Networked Data Lab Wales

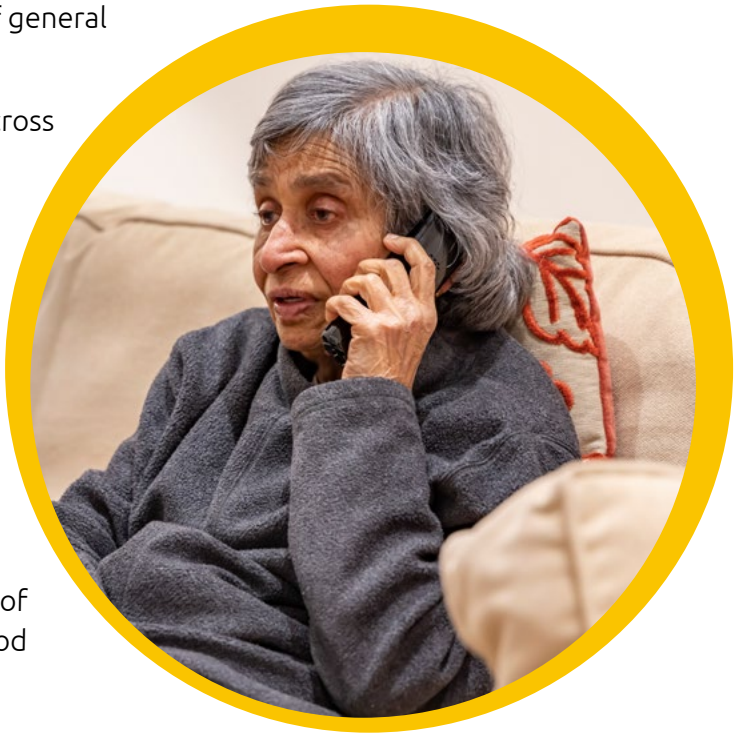
This study has been led by the Networked Data Lab (NDL) Wales, a collaborative programme between Public Health Wales, Digital Health and Care Wales, Swansea University (SAIL Databank) and Social Care Wales.

NDL Wales is one of five national networked data labs funded by the Health Foundation to create a collaborative network of analytical teams working together to use locally available linked datasets to address key issues facing health and care (15). The other NDLs are Grampian (Aberdeen Centre for Health Data Science which includes NHS Grampian and the University of Aberdeen); London (Imperial College Health Partners, Institute of Global Health Innovation, Imperial College London, and North-West London Clinical Commissioning Groups (CCG)); Liverpool (Liverpool CCG, Healthy Wirral Partnership and Citizens Advice Bureau); and Leeds (Leeds CCG and Leeds City Council).

Clinically extremely vulnerable and shielding in Wales

The ability to identify individuals at high risk of severe illness requires a detailed understanding of individuals' health and social care needs and the ways in which they normally interact with services.

At the start of the pandemic there was no mechanism to quickly identify people most vulnerable to severe illness and at highest risk of mortality from COVID-19. Hence the need to rapidly identify patients who, at that *point in time*, were deemed CEV through disease registries, health and care data, or by the clinical judgement of general practitioners (GPs) and other clinicians.



In March 2020, the Chief Medical Officers (CMOs) across the UK commissioned NHS Digital to produce a list of conditions to support the identification of the populations at increased risk. Each devolved nation further refined the methods used to identify those at risk. In Wales, individuals were identified by centralised searches of routine electronic health record (EHR) data using algorithms developed by a collaboration of national bodies in Wales (Digital Health and Care Wales, NHS Delivery Unit, NHS Wales Shared Services Partnership, and Public Health Wales). Several refinements were then made to identify the cohort of individuals notified to shield (Box 1). The final method used is available here(16).

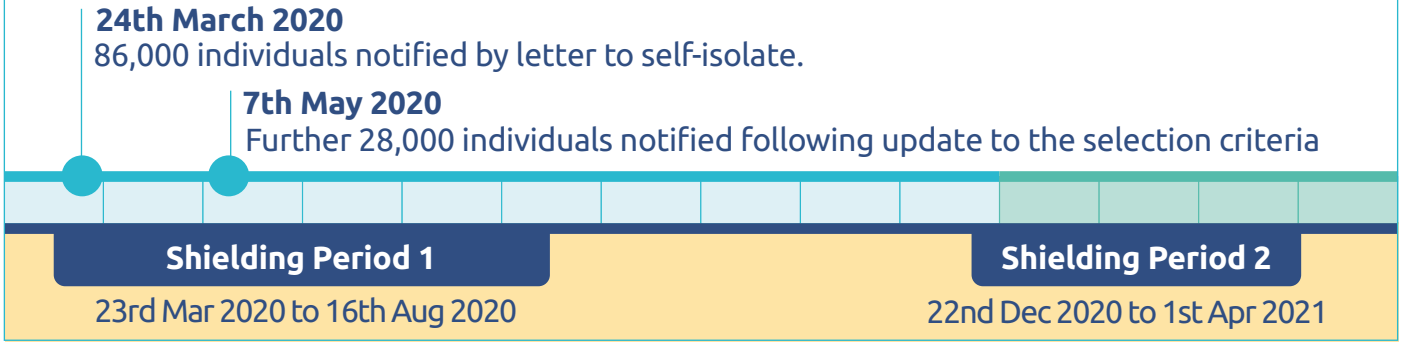
Box 1. The health conditions used to determine the CEV patients through routine health data in Wales up until November 2020 (Source: Joint CMO Criteria, since updated. Recent list available on the Welsh Government website (18).)

1. Solid organ transplant recipients.
2. People with specific cancers:
    a. People with cancer who are undergoing active chemotherapy or radical radiotherapy for lung cancer.
    b. People with cancers of the blood or bone marrow such as leukaemia, lymphoma or myeloma who are at any stage of treatment.
    c. People having immunotherapy or other continuing antibody treatments for cancer.
    d. People having other targeted cancer treatments which can affect the immune system, such as protein kinase inhibitors or PARP inhibitors.
    e. People who have had bone marrow or stem cell transplants in the last 6 months, or who are still taking immunosuppression drugs.
3. People with severe respiratory conditions including all cystic fibrosis, severe asthma and severe chronic obstructive pulmonary disease (COPD).
4. People with severe single organ disease (e.g. liver, cardio, renal, neurological).
5. People with rare diseases and inborn errors of metabolism that significantly increase the risk of infections (such as severe combined immunodeficiency (SCID), homozygous sickle cell).
6. People on immunosuppression therapies sufficient to significantly increase risk of infection.
7. Pregnant women with significant heart disease, congenital or acquired.
8. Children up to the age of 18 with significant heart disease, congenital or acquired.

The process necessary to identify those at risk of severe illness across the population raised some challenges in comprehensively understanding health needs across primary and secondary care, and approaches needed to best identify those most at risk. In addition to those identified via the algorithm, many others were deemed to be at high risk by GPs and clinicians and manually added to the CEV list.

Shielding was initially in place from 23rd March 2020 to 16th August 2020 (17), and then re-introduced on the 22nd December 2020 after Wales was placed into pandemic alert level four. This second shielding period remained in place until 1st April 2021 (18) (Box 2).

Box 2. Key dates relating to the identification and shielding periods for the clinically extremely vulnerable in Wales.



3. Methods

3.1 Data sources and platform

This report utilises the availability of routinely collected population-scale EHRs and administrative data stored in the SAIL Databank (19). The SAIL Databank is a privacy-protecting trusted research environment (TRE) which enables analytical studies to be carried out across primary and secondary routine health care data, and other data sources, in an anonymised and safe environment (for more information see 3.4).

3.2 Study population

Clinically extremely vulnerable cohort

CEV individuals in this study were identified using the Welsh CEV list within the SAIL Databank (19). The SAIL Databank enables analytical approaches to be adopted using a standardised split file process, where data sources are separated into identifiable (i.e. NHS number, name and address) and non-identifiable parts (i.e. clinical diagnosis).

Following linkage of the Welsh CEV list to the Welsh Demographic Service dataset (WDSD), individuals were excluded from our CEV cohort if they were:

1. not identifiable as a unique patient (through the Anonymised Linkage Field (ALF, see section 3.4) or deterministic or probabilistic match score <0.1 (20))
2. missing the date added to the CEV list (except patients added manually by a clinician, amongst whom date was not provided)
3. added to the CEV list after 31st July 2020 (if addition date was available)
4. not registered with a GP practice in Wales on 1st March 2020 (due to small numbers in the CEV population interfering with disclosure control protocols)
5. had died before the 1st March 2020, or died before date of addition to the list
6. missing demographic information (age and/or sex)

The final CEV cohort included in the analyses in this report was 127,787 patients.

There were nine different conditions within the clinical algorithm for addition to the CEV list (Appendix A). Additional patients could be identified by a GP ('added by GP') or other clinician in secondary care ('other'). For the purposes of this report, these latter two categories have been grouped into a single category 'added by a clinician'.

Comparison population

Changes in age standardised secondary health care activity rates were compared across the CEV population and general population from 2019 to 2020, and differences by demographics examined. The comparison population was the general population living in Wales during the pandemic. The secondary health

care activity (inpatient admissions (elective and emergency), outpatient and emergency department attendances) in this population was calculated using the following exclusion criteria:

1. not identifiable as a unique patient (through ALF or deterministic or probabilistic match score <0.1 (20))
2. had died before the 1st March 2020
3. missing demographic information (age and/or sex).

To examine differences in mental health presentation in primary care amongst the CEV population compared to the general population, a random sample of Welsh residents (of all ages) who were not asked to shield and were registered at one of the general practices with CEV patients was used as a comparison (n=127,787).

Demographics

Age was calculated as of the 1st March 2020. Deprivation quintile (based on the 2014 Welsh Index of Multiple Deprivation (21)), local authority area and urban/rural classification were assigned to the patient based on their 2011 lower-layer super output area (LSOA), as assigned on the 1st March 2020 from the Welsh Demographic Service Dataset (WDSD).

Depression and/or anxiety

Depression or anxiety during the pandemic were defined as any diagnosis, symptoms or treatments recorded in primary care, identified using Read codes (22). Individuals were grouped as those with:

- *Recent history of depression and/or anxiety* at the beginning of the pandemic – defined as those with any diagnosis, symptoms or treatments recorded in primary care for depression and/or anxiety between 1st March 2019 and 29th February 2020.
- *Previous history of depression and/or anxiety* – defined as those with any diagnosis, symptoms or treatments recorded in primary care for depression and/or anxiety before 1st March 2019.
- *Presentation of depression and/or anxiety during shielding period* – defined as those with any diagnosis, symptoms or treatments recorded in primary care for depression and/or anxiety from 1st March 2020 to 30th September 2020, regardless of depression and/or anxiety history.

3.3 Statistical analysis

Changes in secondary health care activity

Secondary health care activity in the CEV population and general population was calculated as annual and monthly estimates, from 1st January 2019 to 31st December 2020. Activities occurring after a date of death were excluded. Inpatient admissions were required to have a valid elective or emergency admission code (23) and outpatient appointments were required to have a valid attendance code (24).

All rates were age standardised to the Welsh population mid-2019 estimates (25) and presented as per 1,000 population. Changes in rates were determined as the percentage change in annualised rates (2019, 2020), or as the average monthly percentage change. Average monthly percentage change and absolute percentage change were considered over two time periods (1) from March to August 2020 – representing the time period when the CEV population was first asked to shield, and (2) from August to December 2020 – representing the time period when shielding was paused (Box 2). We used Chi-squared (Chi^2) and Cochran-Armitage tests to investigate whether the differences in use and patterns of use are statistically significant at a significance level of <0.05.

Presentation with mental ill health

To compare the proportion of the CEV population and the general population presenting with depression and/or anxiety in primary care from 1st March to 30th September 2020 we used Pearson Chi^2 tests. To explore the factors associated with new presentation for depression and/or anxiety in primary care we used a multivariate Cox proportional hazard regression model. The model adjusted for demographical characteristics (including sex, age group, deprivation and urban/rural residency) and mental health history (recent or past history of mental ill health).

3.4 Information governance

This study uses data provided by patients and collected by the NHS as part of their care and support (26). The study is based on anonymised routinely collected EHRs within the SAIL Databank (Figure 1).

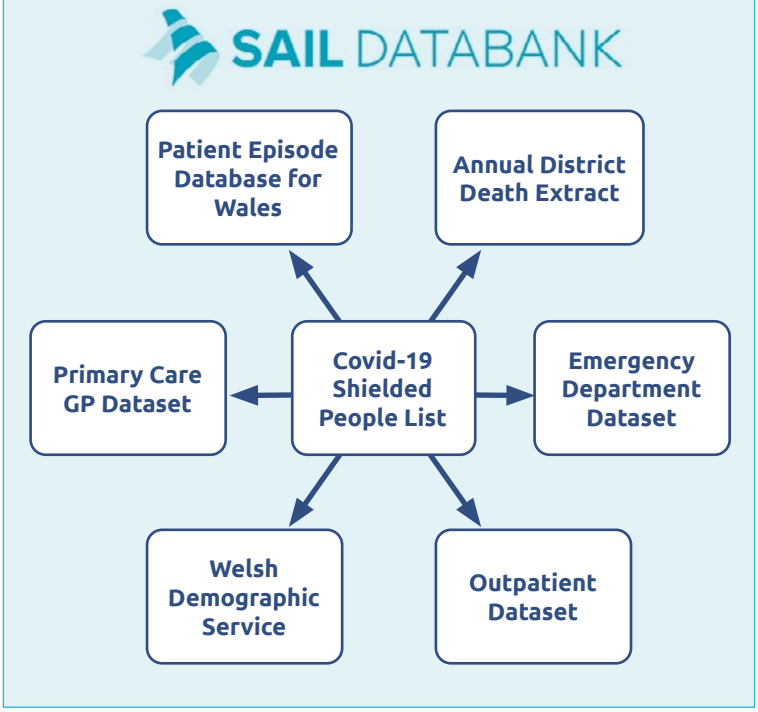
The SAIL TRE uses a standardised split file process to separate data sources into identifiable (i.e. NHS number, name and address) and non-identifiable parts (i.e. clinical diagnosis). The identifiable part is shared with Digital Health and Care Wales (DHCW) and the non-identifiable data is sent directly to the SAIL Databank. DHCW anonymises the identifiable information and assigns an ALF to each individual using a combination of deterministic and probabilistic matching methods, before sending the anonymised individual file to the SAIL Databank (20,27). The Welsh CEV list of people asked to shield underwent the same process so that all data accessed by the research team were anonymised.

All data held in SAIL Databank are exempt from consent due to the anonymised nature of the databank (under section 251, National Research Ethics Committee (NREC)). We were granted approval by the independent Information Governance Review Panel (IGRP) for permission to conduct this study (project number 1224). The IGRP contains independent members from NREC and British Medical Association (BMA), as well as lay members. The review process has checked that the study is useful, not service evaluation, and will not break anonymisation standards.

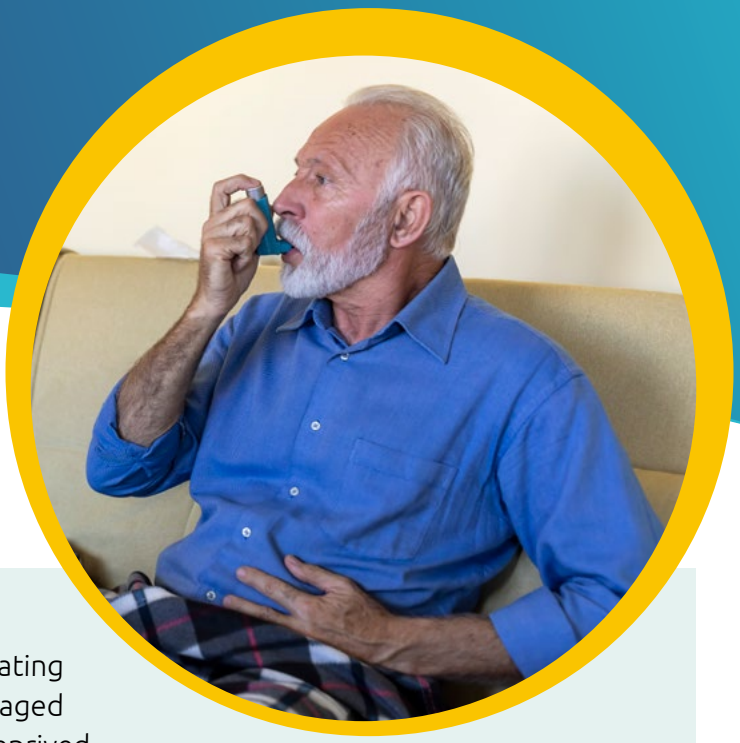
More detail

More details are in the NDL statistical analysis plan (28). The analytical code used to produce the centralised analyses across the NDL programme are available on GitHub (29), along with the data released as open data.

Figure 1: Illustration of data sources in the SAIL Databank



4. Results



4.1 Demographics and underlying health of the clinically extremely vulnerable

Key messages

- This study included 127,787 CEV individuals, equating to 4.1% of the Welsh population. Women, those aged 65 years and over, and those living in the most deprived quintiles were over-represented in the CEV population.
- The prevalence of the CEV population varied from a high of 49.0 per 1,000 population in Blaenau Gwent Local Authority to a low of 33.7 per 1,000 population in Newport Local Authority.
- The most common conditions for shielding were respiratory conditions (36.6%), followed by immunosuppression (27.3%) and cancer (20.7%).
- 12.5% of the CEV population were identified by a clinician. Of whom, a slightly higher proportion were male, of younger age, and in the least deprived quintiles.

The CEV cohort in this study included 127,787 individuals, equating to 4.1% of the Welsh population (30). This cohort included all CEV individuals whose entries were considered valid and linkable to routine health care data in Wales (as defined in the inclusion/exclusion criteria outlined in Section 3.2).

Clinically extremely vulnerable population compared to the general population

Overall, 53.4% of the CEV population were female (compared to 50.1% of the general population (30), Chi^2 p<.001), and 58.6% were aged between 45 to 74 years (compared to 37.8% of the general population (30)).

53.4% of the CEV population were female

When compared to the general population, those aged 65 and over (Chi^2 p<.001), and living in the most deprived quintiles (Chi^2 p <.001) were over-represented in the CEV population (Figures 2 and 3).

Figure 2: Percentage of the CEV population by age group compared to the Welsh population (mid-year estimates 2019). Chi² p<.001. For more information see Appendix B.

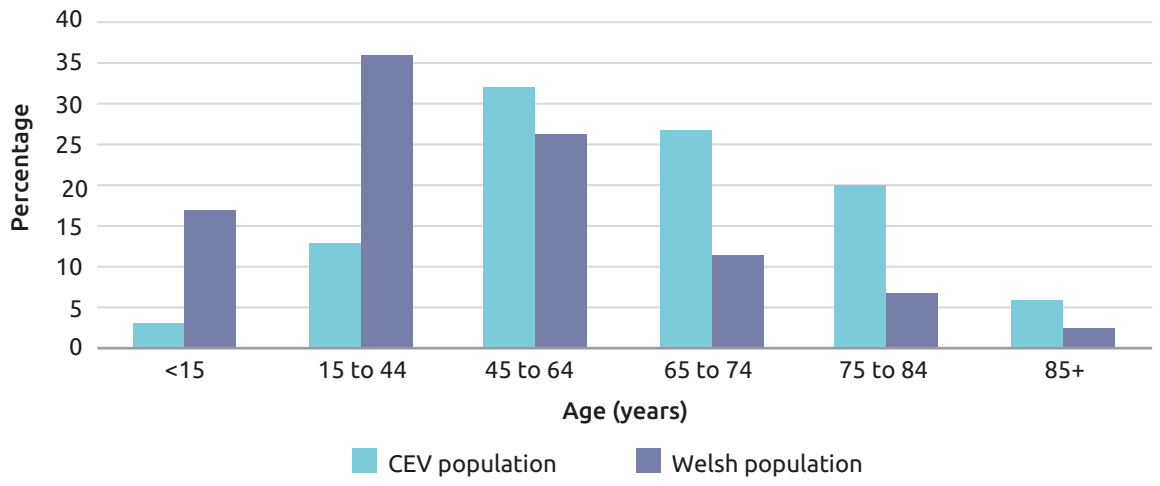
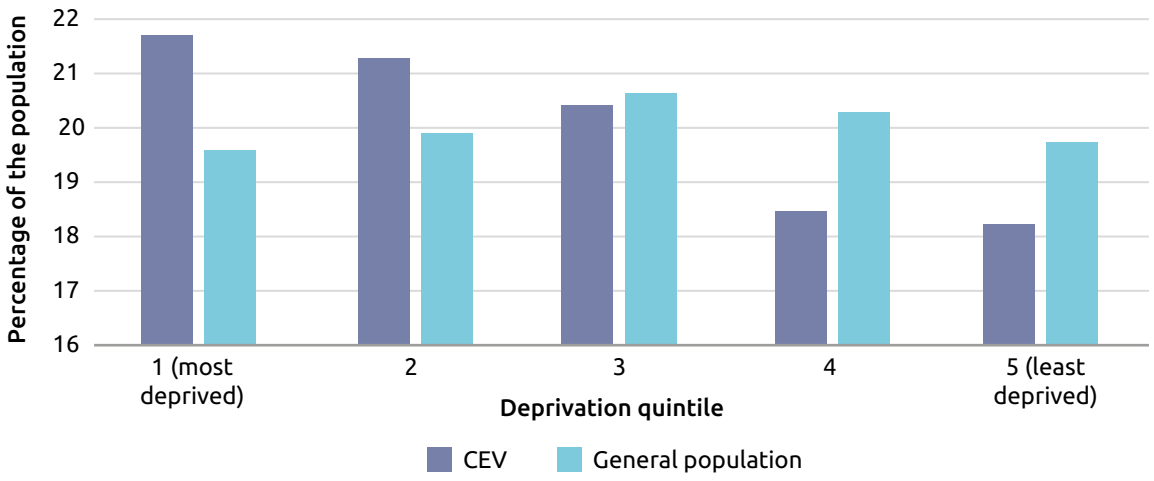
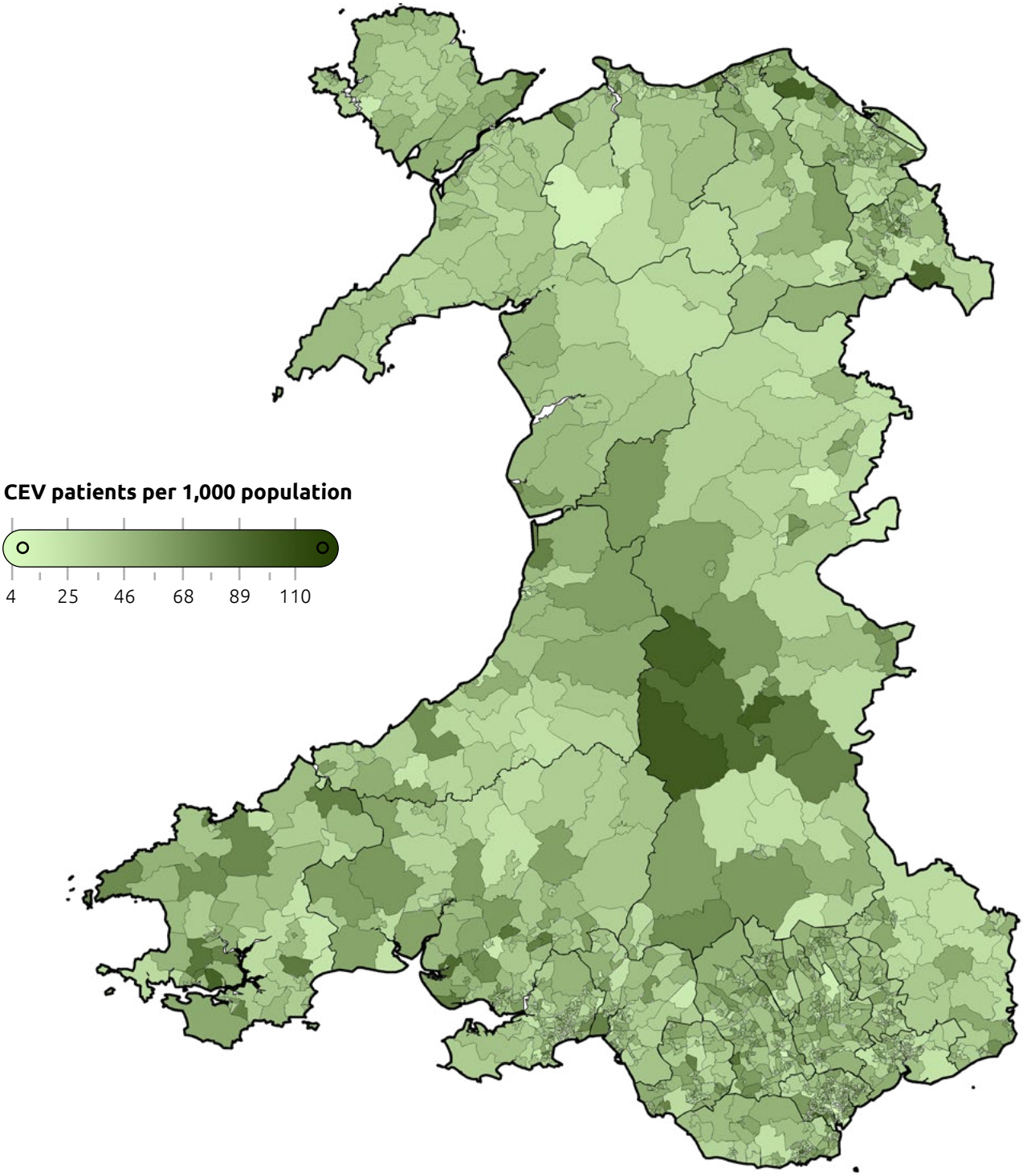


Figure 3: Percentage of the CEV population by deprivation quintile compared to the Welsh population (mid-year estimates 2019). Chi², p<.001. For more information see Appendix B.



The prevalence of the CEV population varied across Wales within and between local authorities from 49.0 per 1,000 population in Blaenau Gwent to a low of 33.7 per 1,000 population in Newport (Figure 4).

Figure 4: CEV patients per 1,000 population by lower super output area in Wales (Welsh LSOA and Local Authority geographical boundaries (2011) and Welsh population estimates by LSOA provided for reference (31,32)**).** For more information see Appendix C.



Method of identification

Whilst the majority of the CEV population were identified by the central algorithm (87.5%, 111,797/127,787), a further 12.5% (n=15,990) were identified by a clinician alone. A slightly higher proportion of those identified by a clinician were male, of younger age, and in the least deprived quintiles (Chi^2 p<.001) (Table 1).

It was not possible to explore differences in clinical history between the two groups, as underlying health conditions at point of notification to shield were not recorded for those identified by a clinician alone.

Table 1: Comparison of the CEV population by method of identification (NOTE: percentages have been rounded to one decimal place, and so do not total 100)

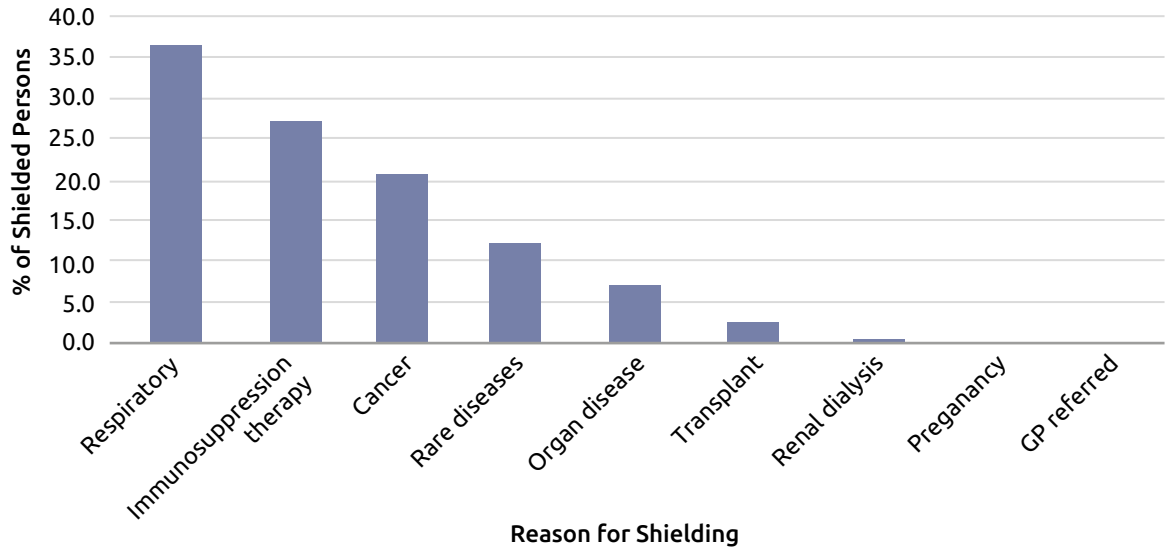
		Identified by the algorithm (n, %)* (Total = 111,797)	Identified by a clinician only (n, %) (Total = 15,990)
Sex	**Male**	51,893 (46.4)	7,641 (47.8)
	Female	59,904 (53.6)	8,349 (52.2)
Age	**<15**	3,146 (2.8)	541 (3.4)
	15-44	13,895 (12.4)	2,493 (15.6)
	45-64	35,630 (31.9)	5,149 (32.2)
	65-74	30,526 (27.3)	3,636 (22.7)
	75-84	22,489 (20.1)	2,997 (18.7)
	85+	6,108 (5.5)	1,174 (7.3)
Deprivation quintile	**1 (most deprived)**	24,836 (22.2)	2,896 (18.1)
	2	23,957 (21.4)	3,207 (20.1)
	3	22,607 (20.2)	3,453 (21.6)
	4	20,277 (18.1)	3,287 (20.6)
	5 (least deprived)	20,120 (18.0)	3,147 (19.7)

*[Note: *33 CEV persons were identified by both the algorithm and a clinician. These individuals are included under 'Algorithm Added' only]*

Underlying health conditions

The conditions leading to individuals being identified as CEV were only available for those identified by the algorithm. Amongst these patients, the majority (93.9%) had one condition identified, with 6.0% having 2-3 conditions, and 0.1% having four or more conditions. The most common conditions were respiratory conditions (36.6%), followed by immunosuppression (27.3%) and cancer (20.7%) (Figure 5).

Figure 5: Percentage of the clinically extremely vulnerable patients with different conditions contributing to underlying reasons to shield (Note: patients have more than one condition, so percentages do not total 100). For more information see Appendix A.



4.2 Changes in secondary health care activity from 2019 to 2020

In this chapter we report changes in annual rates of secondary health care activity in 2020 compared to 2019, and then explore in more detail monthly trends during 2020, over two specific periods: March to August 2020 (when the CEV population was advised to shield), and August to December 2020 (following the pausing of shielding advice).

4.2.1 Changes in planned care (elective admissions and outpatient activity)

Key messages

- Overall, compared to 2019, the decline in planned secondary health care in 2020 amongst the CEV population and the general population were similar:
  - » annual elective admissions decreased by 32.2% amongst the CEV population and 32.9% amongst the general population
  - » annual outpatient attendances decreased by 26.9% amongst the CEV population and 30.8% amongst the general population
- Monthly trends from March to August 2020 showed that the decrease in both planned admissions and outpatient attendances was greater amongst the CEV population (average monthly change: -7.2% and -3.8%, respectively) than the general population (-0.6% and -1.3%, respectively).
- Monthly trends from August to December 2020, showed some recovery amongst planned care activity (elective admissions and outpatient attendances) amongst the general population (average monthly change +3.9% and +4.1%, respectively), and although there was some increase in outpatient attendances amongst the CEV population (average monthly change +1.7%), planned admissions continued to decline amongst this group (average monthly change -3.5%).

Elective admissions

From January 2019 to February 2020, in the year prior to the pandemic in Wales, similar trends of increasing elective admissions in both the CEV population and the general population were evident (Figure 6). Following the pause of non-essential services in March 2020, there was a sharp decline in activity with some recovery in the latter half of the year. For monthly admission rates for the CEV population and general population see Appendix D.

Compared to 2019, the annual age standardised rate of elective admissions in 2020 decreased by 32.2% amongst the CEV population and 32.9% amongst the general population (Table 2). Although the overall decline is similar, the impact would have been much greater amongst the CEV population, amongst whom the rate of elective admissions are approximately 10 times higher than the general population, reflecting their underlying health needs (Figure 6). Figure 7 shows the monthly percentage change in elective admissions for the CEV population and the general population.

During the shielding period, from March to August 2020, elective admissions amongst the CEV population fell from 112.7 to 71.3 admissions per 1,000 population, representing a relative decline of 36.8% over this period. Amongst the general population, the decline in elective admissions was smaller, at 31.8% (from 10.6 to 7.2 admissions per 1,000 population). The average monthly decline in elective admissions over this period was much higher amongst the CEV population compared to the general population (-7.2% and -0.6%, respectively; see Appendix F).

From August to December 2020, elective admissions began to recover for the general population, with an average increase of 3.9% per month (Appendix F), whereas for the CEV population the activity levels continued to decline (average monthly change of -3.5%; see Appendix F).

Figure 6: Monthly age standardised *elective admission* rates amongst the CEV population and the general population from January 2019 to December 2020. For more information, see Appendix D.

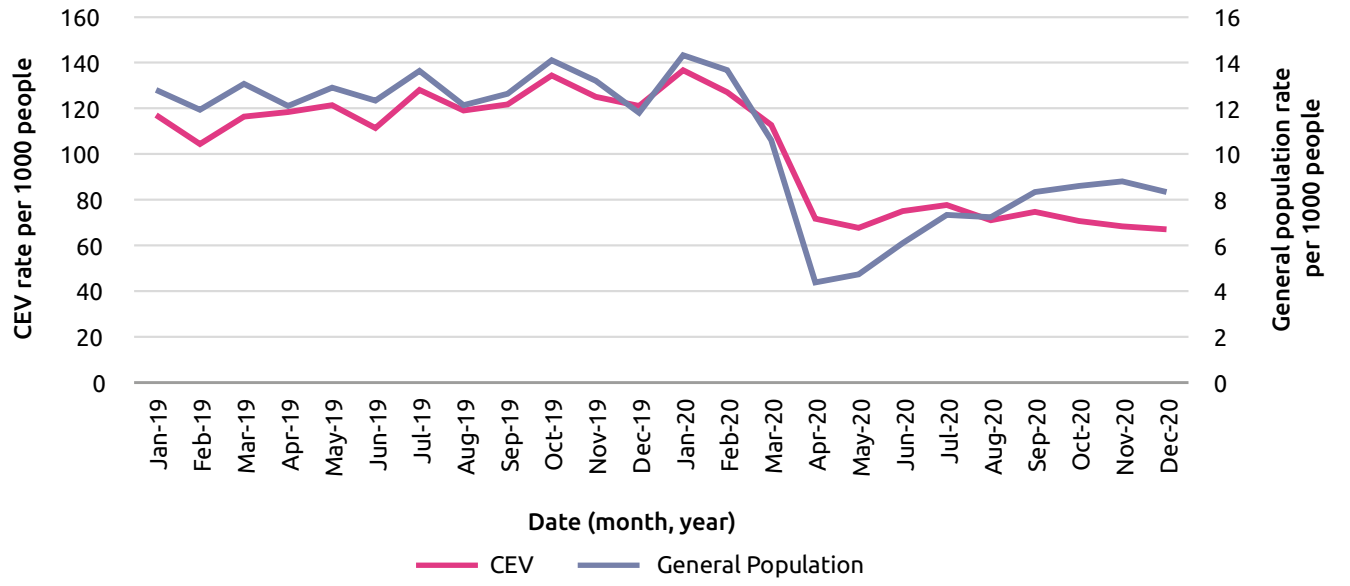
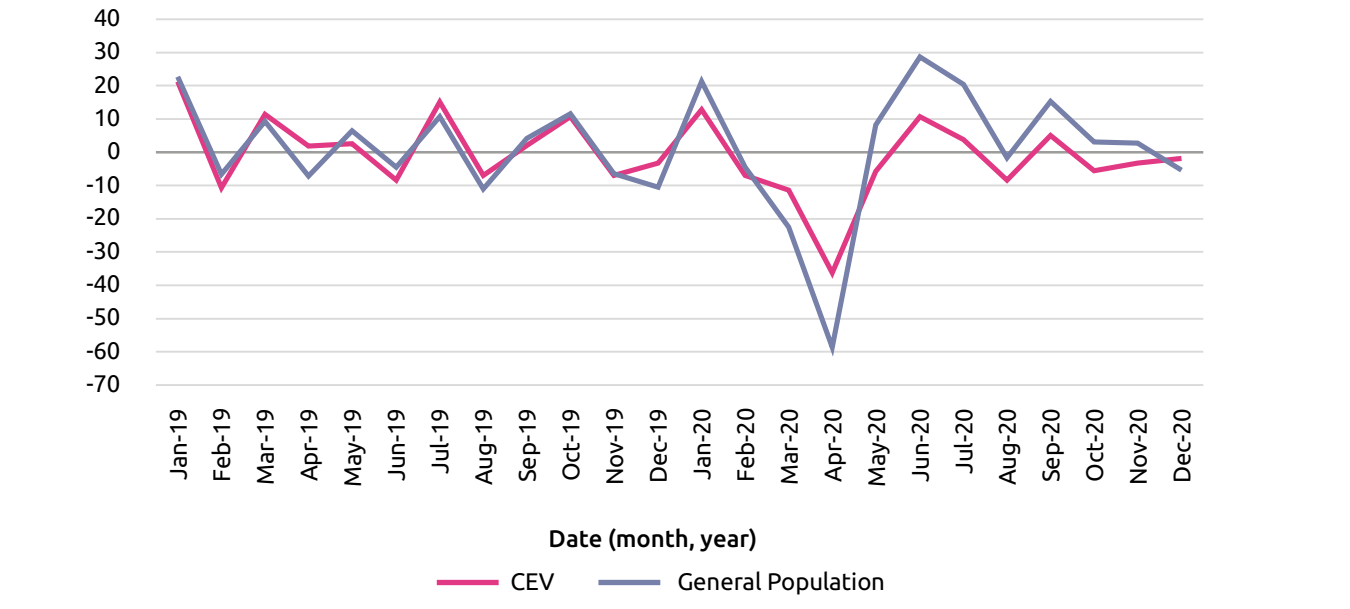


Figure 7: Percentage change in monthly age standardised *elective admission* rates for the CEV population and general population from January 2019 to December 2020. For more information, see Appendix E.



Outpatient attendances

From January 2019 to February 2020, in the year prior to the pandemic in Wales, outpatient attendances increased in both the CEV and general population (Figure 8). The rate of outpatient attendances in the CEV population are consistently, approximately five times higher than the general population, reflecting underlying health needs (for monthly outpatient attendance rates see Appendix D). Compared to 2019, the annual age standardised rate of outpatient activity in 2020 declined by 26.9% in CEV and 30.8% in the general population (Table 2). Figure 9 shows the monthly percentage change in outpatient attendances for the CEV population and the general population.

During shielding, from March to August 2020, outpatient attendances for the CEV population fell from 308.0 to 226.8 attendances per 1,000 population, representing a relative decline of 26.4% over this period. Although rates of outpatient attendances are considerably lower amongst the general population, the decline was similar (25.0%; from 61.8 to 46.3 admissions per 1,000 population). The average monthly decline in outpatient attendances over this period was greater amongst the CEV population compared to the general population (-3.8% and -1.3%, respectively; see Appendix F).

From August to December 2020, the overall trend suggests an increase in outpatient attendances amongst both populations, of 12.7% in the general population (from 46.3 to 52.2 attendances per 1,000 population) and 3.2% in the CEV population (from 226.8 to 234.1 attendances per 1,000 population). The average monthly increase in outpatient attendances over this period was greater amongst the general population compared to the CEV population (4.1% and 1.7% respectively; see Appendix F). This overall trend does mask some differences during this period, of a rise between August and September, plateau in November, and a decline into December.

Figure 8: Age standardised monthly *outpatient attendance* rates amongst the CEV and general populations from January 2019 to December 2020. For more information, see Appendix D.

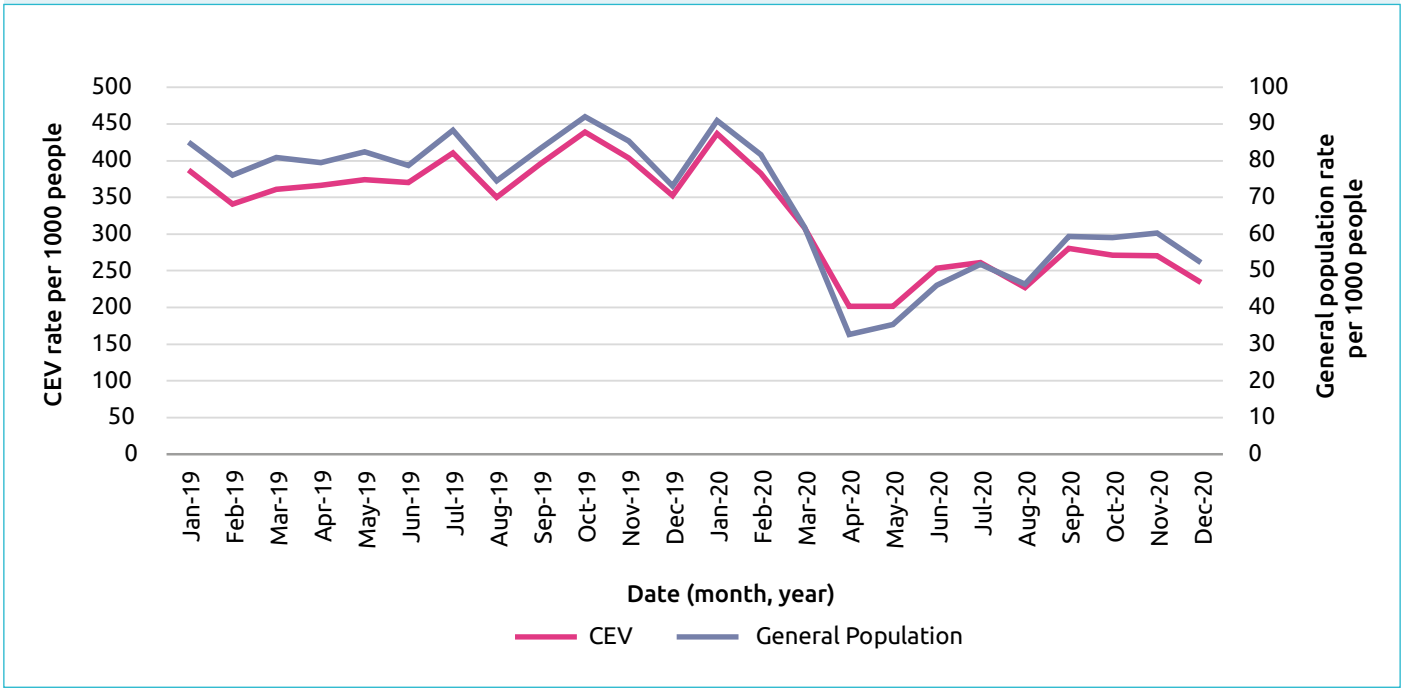


Figure 9: Percentage change in age standardised monthly *outpatient attendance rates* for the CEV and general population from January 2019 to December 2020. For more information, see Appendix E.

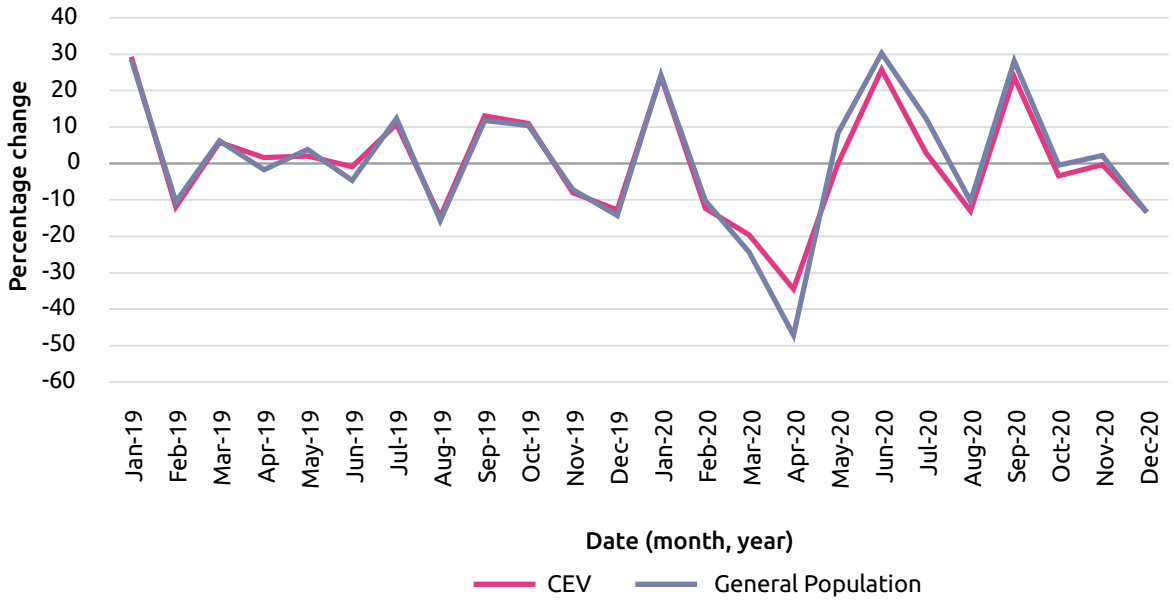


Table 2: Annual age standardised rates of secondary health care activity for the clinically extremely vulnerable (CEV) population and general population and (i) annual percentage change from 2019 to 2020; and (ii) absolute percentage change from March to August 2020 (period of notification to shield) and August to December 2020 (period when shielding was paused)

Secondary health care activity	(i) Annual age standardised rates per 1000 population and annual percentage change from 2019 to 2020						(ii) Absolute percentage change in age-standardised rates from March to August 2020 and August to December 2020[1]			
	CEV			General Population			CEV		General population	
	Jan – Dec 2019	Jan – Dec 2020	% change from 2019 to 2020	Jan – Dec 2019	Jan – Dec 2020	% change from 2019 to 2020	Absolute % change Mar - Aug	Absolute % change Aug-Dec	Absolute % change Mar-Aug	Absolute % change Aug-Dec
Planned care										
Elective admissions	1,439.7	1021.3	-32.2%	152.8	102.6	-32.9%	-36.8	-5.8	-31.8	15.5
Outpatient attendances	4550.8	3327.8	-26.9%	978.9	677.3	-30.8%	-26.4	3.2	-25.0	12.7
Emergency Care										
Emergency admissions	608.3	449.2	-26.2%	104.9	91.0	-13.2%	-5.8	-14.4	4.7	-8.1
ED attendances	593.4	448.5	-24.4%	283.1	225.8	-20.2%	14.0	-21.2	17.9	-23.1

1 Absolute percentage changes between March-August and August-December were calculated by subtracting, for example, the rate in August from the rate in March and dividing by the rate in March

4.2.2 Changes in emergency care (emergency admissions and emergency department attendances)

Key messages

- Overall, compared to 2019, the decline in emergency care in 2020 was higher amongst the CEV population compared to the general population;
  - » annual ED attendances decreased by 24.4% amongst the CEV population and 20.2% amongst the general population
  - » annual emergency admissions decreased by 26.2% amongst the CEV population and 13.2% amongst the general population.
- Monthly trends from March to August 2020 showed an increase in emergency activity and that the increase in both ED attendances and emergency admissions was greater amongst the general population (average monthly change: +7.0% and +3.1%, respectively) compared to the CEV population (average monthly change: +4.3% and +0.5%, respectively).
- Monthly trends from August to December 2020, ED attendances and emergency admissions declined for both the general population (average monthly change: -6.2% and -2.1%, respectively), and the CEV population (average monthly change: -5.7% and -3.8%, respectively).

Emergency admissions

From January 2019 to January 2020, in the year prior to the pandemic in Wales, there was an upward trend in emergency admissions, but this had started to decline from February 2020 onwards (Figure 10). Compared to 2019, the annual age standardised rate of emergency admissions in 2020 overall declined by 26.2% for the CEV population and 13.2% the general population (Table 2). Figure 11 shows the monthly percentage change in emergency admissions for the CEV population and the general population.

From March to August 2020, there was very little variation in the emergency admissions amongst the CEV population, which fluctuated around 30 admissions per 1,000 population, and the general population, which fluctuated around 7 admissions per 1,000 population (Appendix D). Although small, there was some evidence to suggest a slightly higher average monthly increase in emergency admissions over this period amongst the general population compared to the CEV population (+3.1% and +0.5%, respectively, see Appendix F).

From August to December 2020, emergency admissions declined amongst both the CEV population and the general population. Over this period, emergency admissions decreased by 14.4% for the CEV population and 8.1% for the general population (Table 2). The average monthly decrease in emergency admissions was slightly higher amongst the CEV population compared to the general population (-3.8% and -2.1%, respectively; see Appendix F).

Figure 10: Age standardised monthly *emergency admission* rates amongst the CEV population and the general population from January 2019 to December 2020. For more information, see Appendix D.

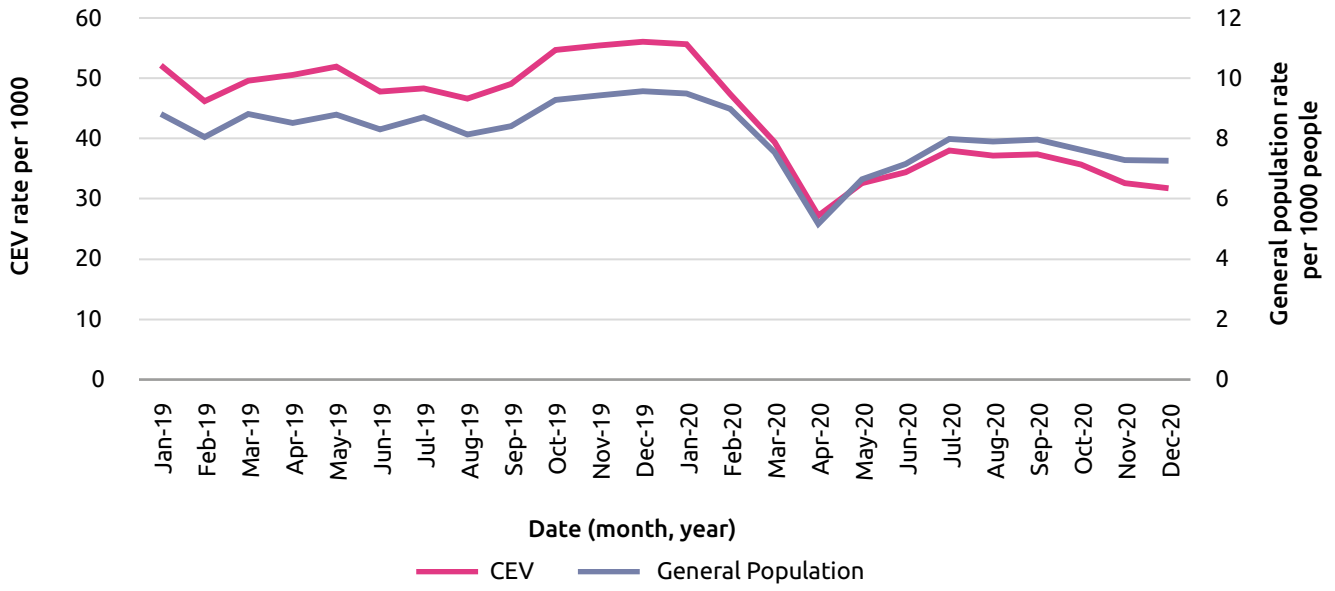
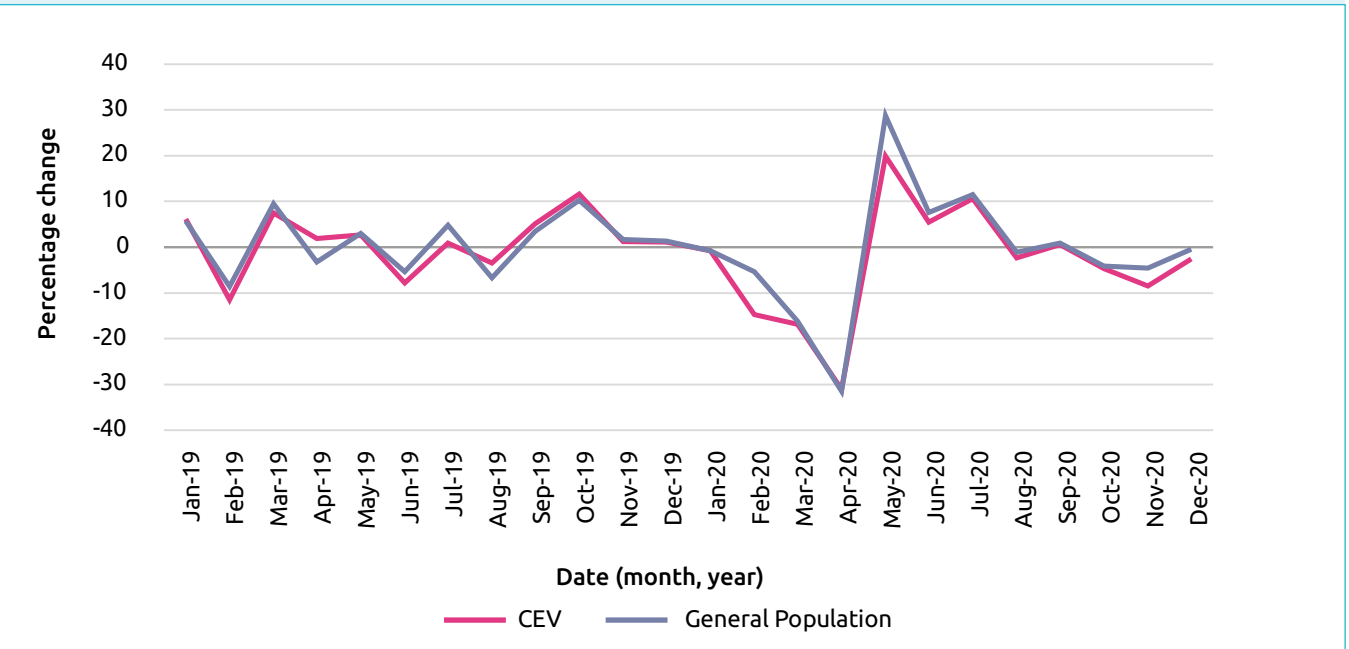


Figure 11: Percentage change in age standardised monthly *emergency admission* rates for the CEV population and general population from January 2019 to December 2020. For more information, see Appendix E.



Emergency department attendances

From January 2019 to January 2020, there was an upward trend in ED attendances in both the CEV population and general population, and the underlying rates were approximately two times higher amongst the CEV population (Figure 12).

Compared to 2019, the decline in annual age standardised rate of ED attendances for both populations was similar, representing a decrease of 24.4% for the CEV population and 20.2% for the general population (Table 2). However, this overall decrease masks changes during the course of the pandemic (Figure 13).

From March to August 2020, ED attendances amongst the CEV population increased from 35.6 to 40.6 admissions per 1,000 population, representing a relative increase of 14% over this period. Amongst the general population, the rise in ED attendances was similar (17.9%, 17.6 to 21.5 admissions per 1,000

population, see Table 2 and Appendix D for reference). The average monthly increase in ED attendances over this period was smaller amongst the CEV compared to the general population (+4.3% and +7.0%, respectively, see Appendix F).

From August to December 2020, ED attendances declined amongst both the CEV population and the general population. ED attendances decreased by 21.2% for the CEV population (from 40.6 to 32.0 attendances per 1,000 population) and by 23.1% in the general population (from 21.5 to 16.5 attendances per 1,000 population), (see Table 2 and Appendix D). The average monthly decrease in ED attendances over this period was similar amongst the CEV population compared to the general population (-5.7% and -6.2%, respectively; see Appendix F).

Figure 12: Age standardised monthly *emergency department* attendance rates amongst the CEV population and the general population from January 2019 to December 2020. For more information, see Appendix D.

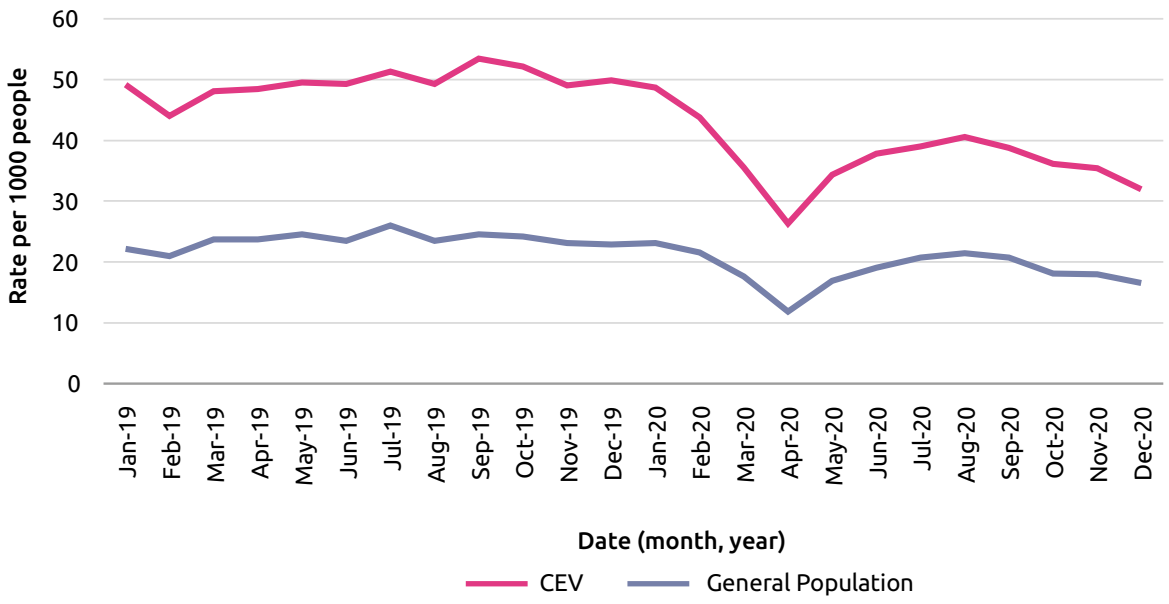
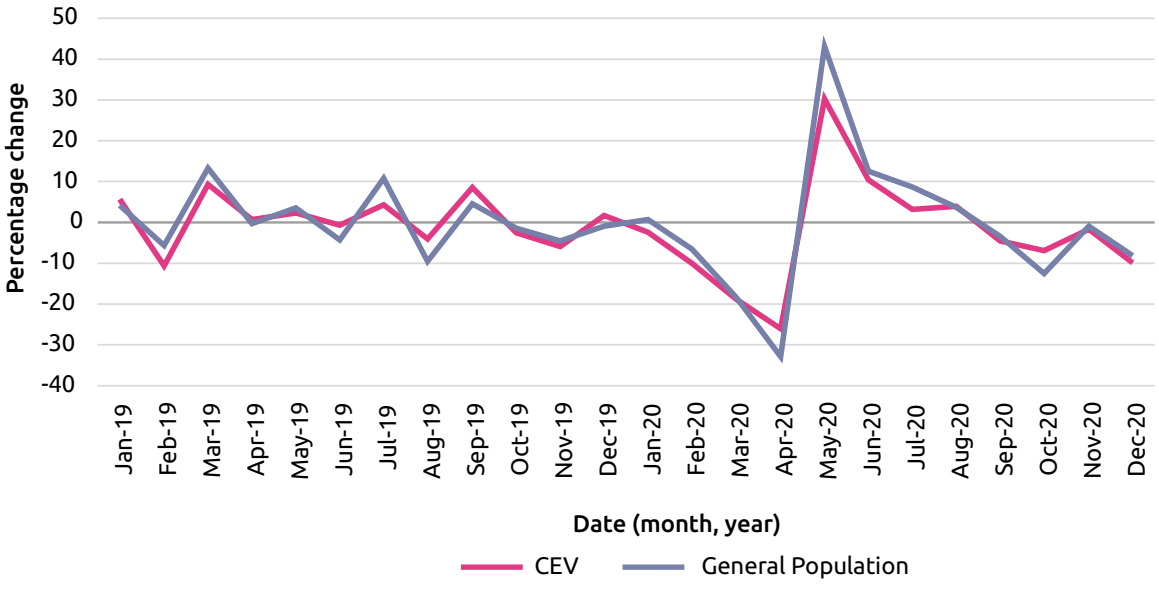


Figure 13: Percentage change in age standardised monthly *emergency department* attendance rates for the CEV population and general population from January 2019 to December 2020. For more information, see Appendix E.



4.2.3 Changes in secondary health care activity amongst the clinically extremely vulnerable population compared to the general population – differences by sex, age and deprivation

Key messages

- Annual and monthly changes in planned (elective admissions and outpatient attendances) and emergency care (ED attendances and emergency admissions) were very similar by sex and deprivation within the CEV and general populations.
- Some differences in the magnitude of the change within the CEV population and general populations by age group were evident.
- The decline in outpatient attendances was greatest in the 45+ age groups and decline in elective admissions greatest amongst the age groups under 65 years. Whilst the decline in emergency care was evident in all age groups the decline in emergency admissions and ED attendances were markedly high amongst the younger age group (15 to 44 years) in both the CEV and general populations.
- The inverse care law was evident with higher rates of emergency admissions and ED attendances and lowest levels of planned (elective admissions) in the most deprived, in both years amongst the CEV and general population.

Planned care

Elective admissions

The marked decline in elective admissions was evident across both males and females, and all age groups.

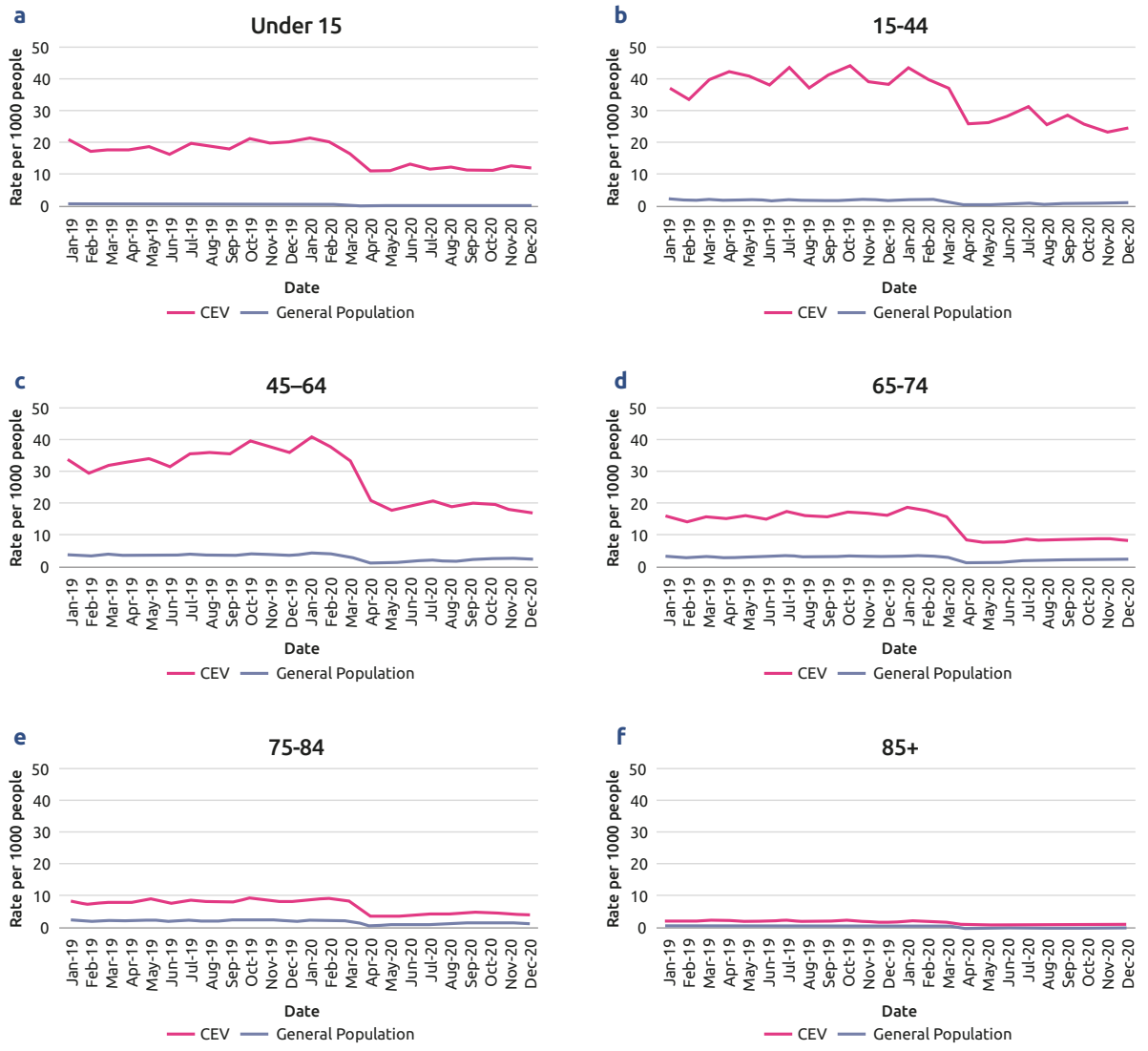
Differences by sex

Within both the CEV population and general population, the change in the rates of elective admissions during 2020 were very similar for males and females (Appendix G). Amongst the CEV population, the absolute change in elective admissions amongst males and females was similar between March and August 2020 (decline by –37.3% and –36.5%, respectively), and from August to December 2020 (decline by –4.4% and –5.9%, respectively). Slightly greater sex differences were seen in the general population, with a slightly greater decrease in elective admissions from March to August 2020 amongst females (-28.3%, compared to –35.1% in males), and a slightly greater increase in average monthly rates of elective admissions from August to December 2020 (18.5%, compared to 12.6% in males, see Table 3).

Differences by age group

There was a sharp decline in elective admissions during the period from February to April 2020, and amongst the CEV population these reduced rates have either remained relatively stable (for children under 15 years and adults over 65 years), or they have continued to decline to January 2021 (15–64 year age groups), see Figure 14 (a-f) and Appendix H for more information.

Figure 14a-f: Age standardised trends in *elective admission* rates amongst the CEV population and the general population from January 2019 to December 2020 by age group. For more information, see Appendix H.



Differences by deprivation

Rates of elective admissions decreased significantly amongst the CEV population and general population within every deprivation quintile from 2019 to 2020 (Chi^2 p<.001). Amongst the CEV population and general population, the pattern in admissions by deprivation remained the same from 2019 to 2020 with admissions increasing incrementally by deprivation level and those in the least deprived areas having the highest number of admissions (see Appendix I). Thus, these findings are consistent with the inverse care law (33).

Outpatient attendances

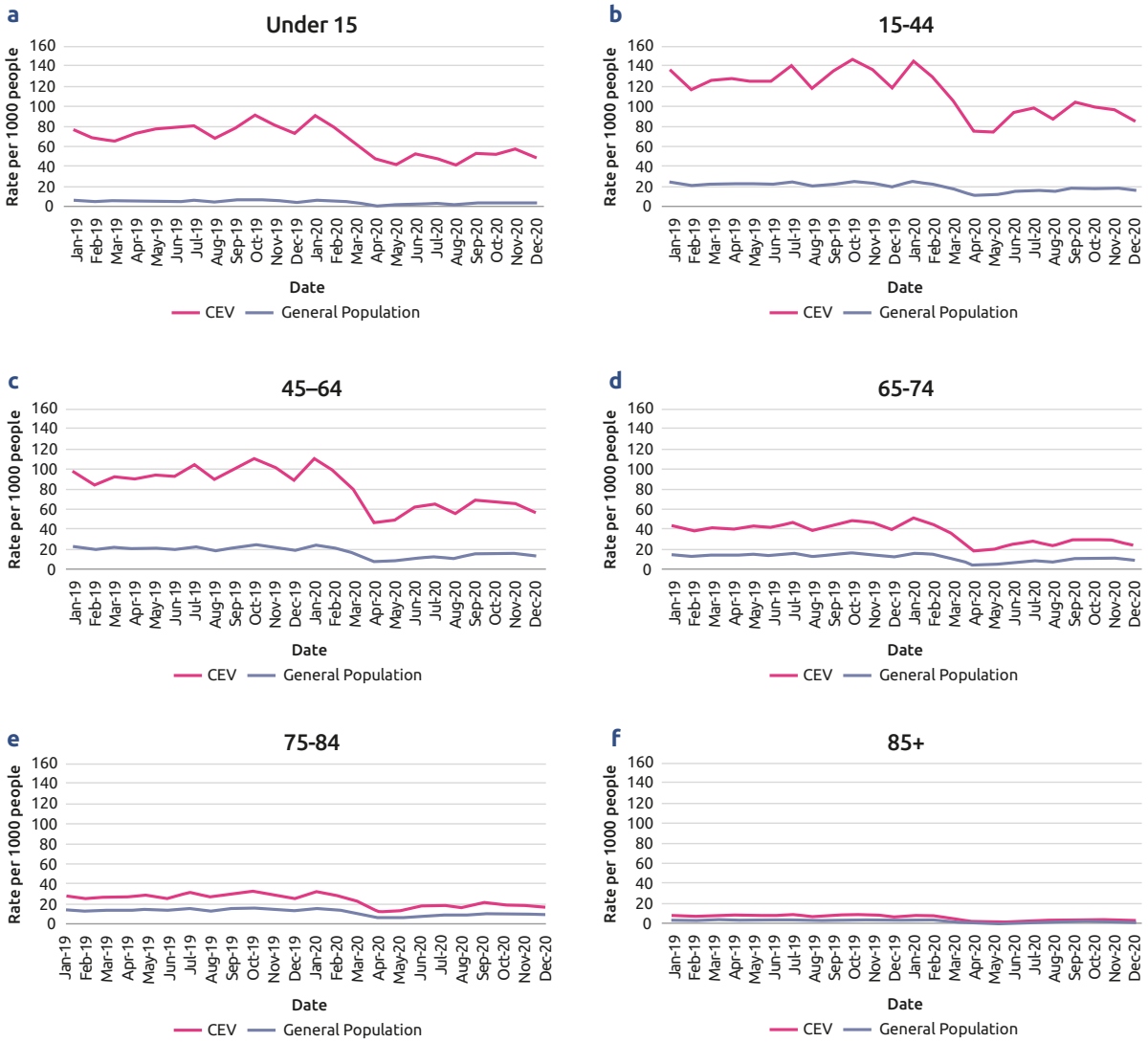
Differences by sex

Females had greater rates of outpatient attendances amongst both the CEV population and general population, throughout 2019 and 2020 (Appendix G). Absolute percentage change in outpatient attendances were similar between sexes, in both the CEV population (-25.7% in males and –27.3% in females from March to August 2020; 4.5% in males and 2.1% in females from August to December 2020) and the general population (Table 3).

Differences by age

Rates of outpatient attendances were greater amongst the CEV population compared to the general population in all age groups (see Figures 15a-f). Rates were highest for the 15–44 year age group in the CEV population and 15–64 year olds in the general population. The greatest decrease in CEV outpatient attendances was between January and April 2020 in those aged 45-64 (57.5%, (46.7-110.5)/110.5; see Appendix H for monthly rates).

Figure 15a-f: Trends in age standardised *outpatient attendance* rates amongst the CEV population and general population from January 2019 to December 2020 by age group. For more information, see Appendix H.



Differences by deprivation

The pattern of increasing rates of elective admissions with decreasing deprivation, was also observed for outpatient attendances in the CEV population but not the general population (Appendix I). Both the CEV population and general population attended significantly fewer appointments in 2020 compared with 2019 regardless of level of deprivation (Chi^2 p<.001).

Emergency Care

Emergency admissions

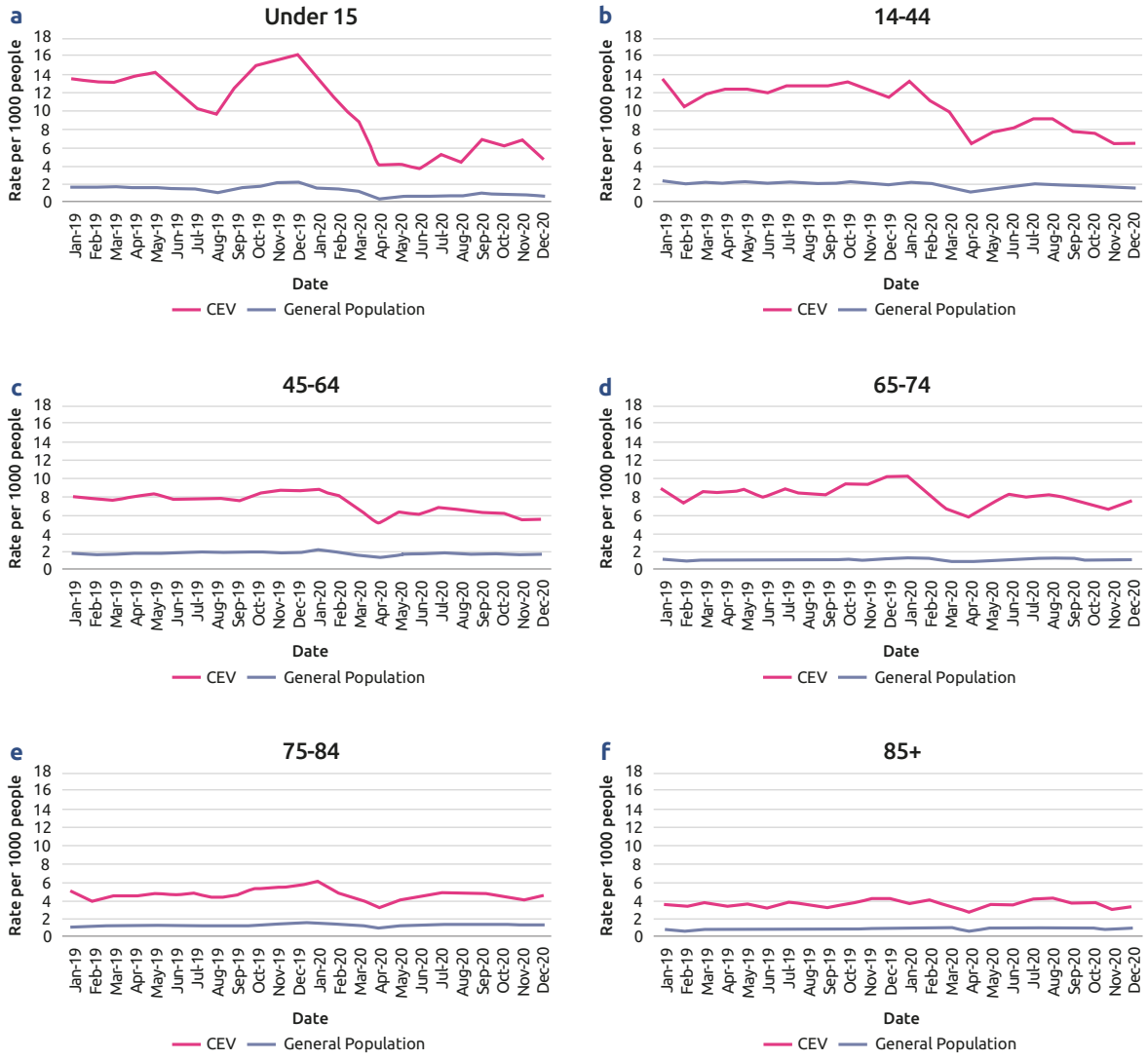
Differences by sex

In the CEV population, males consistently had slightly higher rates of monthly emergency admissions compared to females throughout 2019 and 2020, whereas the opposite was true within the general population (Appendix G). The absolute percentage change in emergency admissions from March 2020 to August 2020 decreased slightly more for CEV females than CEV males (-14.2% compared to -10.4%) but increased more for general population females than general population males (8.5% compared to 0.8%). The difference between sexes remained similar in the CEV population from August to December but reduced to a difference of 2.5% in the general population (-9.3% for females, -6.8% for males; see Table 3).

Differences by age

Rates of emergency admissions were much higher for the CEV population compared to the general population within all age groups (Appendix H). There was a significant decline in emergency admissions overall for the younger age groups from January 2019 to December 2020, particularly among the CEV population. The steady increase in admissions from 2019 to 2020 seen amongst adults was also not observed in children under 15 in either the CEV population or the general population. Emergency admissions for children peaked from September through the winter months, yet the increase was much less marked in 2020 following a huge reduction in admission rates in April 2020 (Figures 16a-f).

Figure 16a-f: Age standardised trends in *emergency admission* rates amongst the CEV population and the general population from January 2019 to December 2020 by age group. For more information, see Appendix H.



Differences by deprivation

The rate of emergency admissions increased with increasing deprivation, in both the CEV and general populations, again suggesting evidence of the inverse care law (see Appendix I). Within both populations, there was a significant reduction in admissions across all levels of deprivation in 2020 compared to 2019 (Chi^2 p<.001).

ED attendances

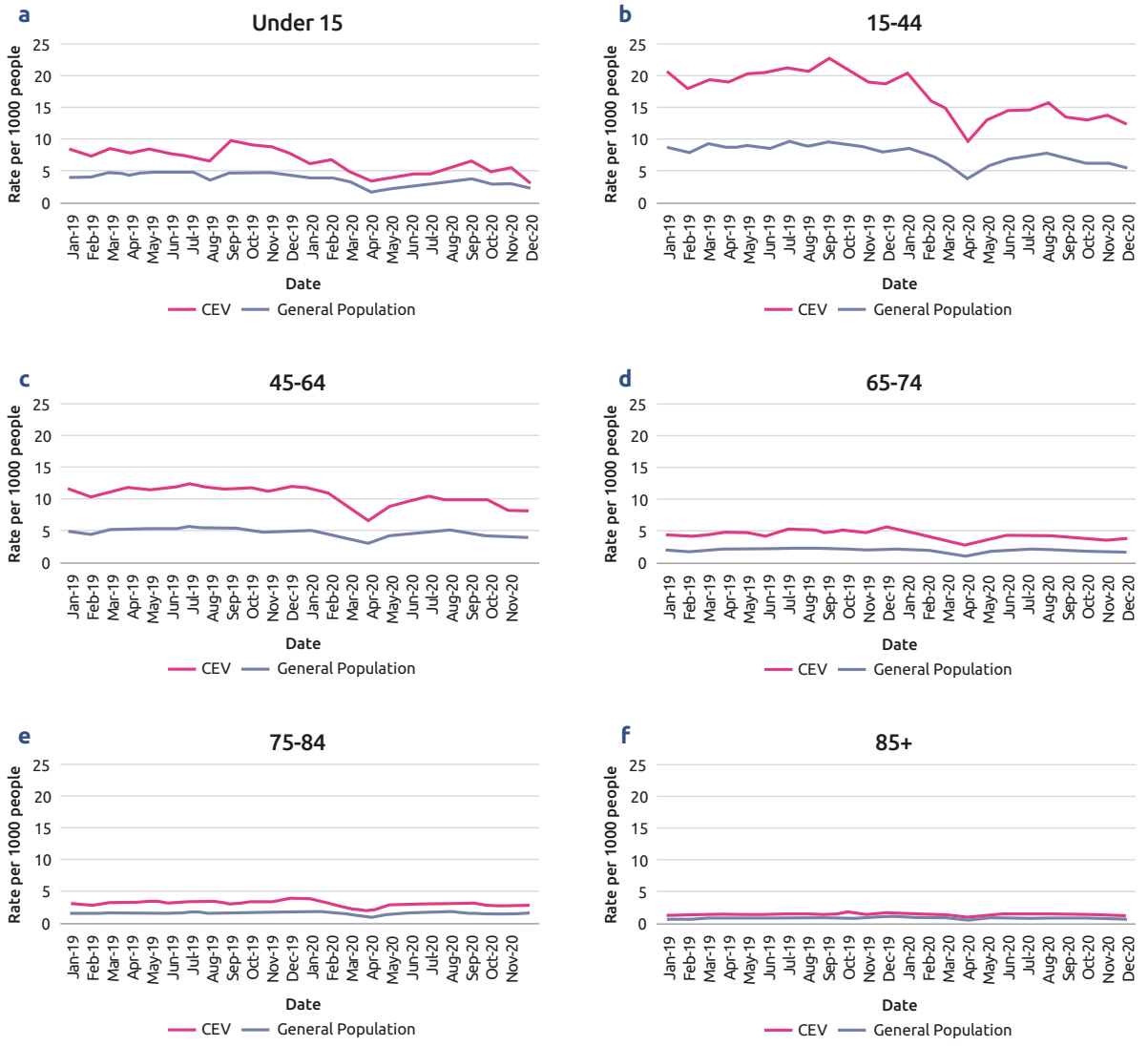
Differences by sex

Male and female ED attendance rates were very similar, within both the CEV population and the general population (Appendix G). The absolute percentage changes in rates of ED attendances from March to August 2020 and August to December 2020 was similar for males and females, in both the CEV population and general population (Table 3).

Differences by age

Rates of ED attendances were greater amongst the CEV population in all age groups. Rates were highest for the 15–44 year age group within both populations. Rates of admissions roughly halved between February 2020 and April 2020 for both the CEV population and the general population across all age groups (see Figures 17a-f).

Figure 17a-f: Age standardised trends in *emergency department attendance* rates amongst the CEV population and the general population from January 2019 to December 2020 by age group.



Differences by deprivation

Overall, the rate of ED attendances increased with increasing deprivation, in both the CEV and general populations, again suggesting evidence of the inverse care law. There was a reduction in attendances from 2019 to 2020 across all deprivation quintiles, particularly in the CEV population (Chi^2 p<.001; see Appendix I).

Table 3: Age standardised rates of secondary health care activity for the CEV population and general population by sex and (I) annual percentage change from 2019 to 2020; and (ii) absolute percentage change from March to August 2020 (period of notification to shield) and August to December 2020 (period when shielding was paused).

Sex	Secondary health care activity	Annual age standardised rates per 1000 population and % change from 2019 to 2020						Absolute percentage change: March to August 2020 and August to December 2020.			
		CEV Population			General Population			CEV Population		General Population	
		Jan – Dec 2019	Jan – Dec 2020	% change 2019 to 2020	Jan – Dec 2019	Jan – Dec 2020	% change 2019 to 2020	% change Mar-Aug	% change Aug-Dec	% change Mar-Aug	% change Aug-Dec
Male	Elective admissions	1440.0	1025.0	-28.8%	149.1	103.2	-30.8%	-37.3%	-4.4%	-28.3%	12.6%
	Outpatient attendances	4419.9	3239.7	-26.7%	859.5	587.3	-31.7%	-25.7%	4.5%	-26.8%	13.6%
	Emergency admissions	501.5	342.3	-31.8%	99.7	87.9	-11.9%	-10.4%	-13.2%	0.8%	-6.8%
	ED attendances	581.3	432.0	-25.7%	285.8	227.0	-20.6%	13.1%	-20.7%	20.6%	-24.4%
Female	Elective admissions	1425.8	1014.5	-28.8%	156.4	101.9	-34.8%	-36.5%	-5.9%	-35.1%	18.5%
	Outpatient attendances	4626.1	3370.3	-27.1%	1095.0	764.9	-30.1%	-27.3%	2.1%	-23.6%	12.0%
	Emergency admissions	469.3	330.3	-29.6%	109.9	94.1	-14.4%	-14.2%	-17.6%	8.5%	-9.3%
	ED attendances	599.8	458.9	-23.5%	280.4	224.6	-19.9%	15.2%	-21.5%	23.1%	-21.9%

4.3 Mental health

Key messages

- Overall 38.8% of the CEV population and 26.1% of the general population comparison group had a history of mental ill health before the pandemic.
- From 1st March to 30th September 2020, 2.2% of the CEV population and 1.9% of the general population comparison group presented with depression and/or anxiety in primary care. Of these, 19.5% in the CEV population and 22.2% in the general population comparison group had no history of depression and/or anxiety.
- In a multivariate analysis, females, those of older age, and those with recent or past history of depression and/or anxiety were at increased risk of experiencing depression and/or anxiety during the pandemic.
- After adjusting for age, sex, deprivation and recent or past history of mental ill health, CEV individuals remained at slightly higher risk of diagnosed depression and/or anxiety compared to the general population.

This section explores the impact of shielding on clinical presentation for depression and/or anxiety in primary care between March and September 2020 (for more details see section 3.2 in the methods). Descriptive statistics for the CEV population and general population comparison group for understanding mental health needs are presented in Appendix J.

Within the CEV population, 38.8% (49,641/127,787) had a past history (diagnosed before 1st March 2019) of depression and/or anxiety (symptoms, diagnosis and/or prescriptions), and 5.4% (6,843/127,787) were managing depression and/or anxiety (symptoms, diagnosis and/or prescriptions) in the year before being advised to shield (from 1st March 2019 to 29th February 2020).

During the pandemic, from 1st March to 30th September 2020, 2.2% (2,865/127,787) of the CEV population had a new clinical record for depression and/or anxiety in primary care. Of these, approximately four fifths (80.5%, 2,307/2,865) had a history of mental ill health documented in primary care, whereas one fifth (19.5%, 558/2,865) had no history of mental ill health.

In the general population comparison group, 26.1% (33,415/127,787) had a history of depression and/or anxiety before 1st March 2019, and 4.8% (6,137/127,787) were managing depression and/or anxiety in the year before the pandemic (between 1st March 2019 and 29th February 2020).

During the pandemic, from 1st March to 30th September 2020, 1.9% (2,365/127,787) of the comparison group has a clinical record for depression and/or anxiety in primary care. Of these, the majority (77.8%, 1,826/2,365) had a history of mental ill health documented in primary care, whereas 22.2% (539/2,365) had no history of mental ill health.

In the multivariate analysis examining the risk factors for experiencing depression and/or anxiety during the pandemic, we found that females were at greater risk than males (hazard ratio 1.3, 95% confidence interval 1.2-1.4). Amongst age groups it was those, aged 15-44 years (2.1, 1.8-2.5), aged 45-64 years (1.3, 1.1.-1.6), aged 85+ years (1.4, 1.1-1.8) who were at a significantly greater risk of experiencing depression and/or anxiety during the pandemic, compared to the under 15-year age group. There was no difference found by level of deprivation (Table 4). Individuals with a recent history of depression and/or anxiety in the year leading up to the pandemic were at greater risk of experiencing depression and/or anxiety during the pandemic (5.2, 4.9-5.6), as were those with a past history of depression and/or anxiety (3.7, 3.5-3.9). After adjusting for age, sex, and both recent and past history of mental health, the CEV population remained at slightly higher risk of poor mental health during the pandemic compared to the general population comparison group (1.2, 1.2-1.3).

Table 4: Risk factors for experiencing anxiety and/or depression during the pandemic reported using hazard ratios and 95% confidence intervals.

		Adjusted Hazard Ratio	95% Confidence Interval
General population comparison group		Reference group	
CEV population		1.2	1.2-1.3
Sex	Male	Reference group	
	Female	1.3	1.2-1.4
Age group (years)	< 15	Reference group	
	15-44	2.1	1.8-2.5
	45-64	1.3	1.1-1.6
	65-74	1.0	0.8-1.1
	75-84	1.2	1.0-1.4
	>= 85	1.4	1.1-1.8
Deprivation (WIMD)	Quintile 1 (Most deprived)	Reference group	
	Quintile 2	1.0	0.9-1.1
	Quintile 3	1.0	0.9-1.1
	Quintile 4	1.0	0.9-1.1
	Quintile 5 (Least deprived)	1.0	0.9-1.1
Rurality	Living in urban area	Reference group	
	Living in rural area	1.0	1.0-1.1
Recent history of anxiety/depression (March 2019 – February 2020)	No	Reference group	
	Yes	5.2	4.9-5.6
History of anxiety/depression (before March 2019)	No	Reference group	
	Yes	3.7	3.5-3.9

5. Discussion

Over 127,000 CEV people in Wales, who were identified in this cohort, were advised to shield during the COVID-19 pandemic to protect against the risk of COVID-19, with an impact on the management of underlying conditions and their health and wellbeing. Timely insights into the impact on health service use in the general population and the CEV population over this period can help identify potential unmet health needs, informing the recovery of the health and care system in Wales and further afield.

In this short report, we describe the characteristics of the CEV population in Wales and examine changes in secondary health care activity and the mental health of this population, compared to the general population, during the COVID-19 pandemic.

5.1 Identifying clinically vulnerable persons

There is global interest in the better use of routine data to help understand the numbers, characteristics and conditions of those at risk of severe disease to inform targeted action to protect those at increased risk (34). At the start of the pandemic there was no mechanism to quickly identify people most vulnerable to severe illness and at highest risk of mortality from COVID-19. Hence the need to rapidly identify patients who at that ***point in time*** were deemed CEV through disease registries, health and care data, and clinical opinion.

Those aged 65 years and over, and those living in the most deprived quintiles were over-represented in the CEV population

Our results showed that women, those aged 65 years and over, and those living in the most deprived quintiles were over-represented in the CEV population and there was marked regional variation. One in ten (12.5%) were identified by a clinician, and a greater proportion of whom, were male, of younger age, and living in the least deprived areas. This variation may reflect differences in clinical need or vulnerability not defined by the core algorithm. However, as the underlying health conditions used to identify individuals as CEV were not recorded for patients identified by clinicians, it is not possible to examine such differences in this study. More information is needed to understand if this variation in demographics between those who were added by the algorithm and those who were added by a clinician was unexpected, as has been suggested in England (35).

The need to rapidly identify and protect the most vulnerable meant a blanket approach was necessary. The application of the centralised algorithm of health conditions considered to place individuals at increased clinical risk of severe COVID-19 symptoms did not take into consideration differences within conditions, complexity of co-morbidities, and other factors which may increase an individual's risk. Using a central algorithm reduced specificity (i.e. precision) in the definition of CEV and generated a population with a wide range of clinical needs. The reliance on an algorithm may also have led to overinclusion of patients who were not CEV without further detailed assessment.

Our results demonstrate variation in the demographics and underlying health conditions of those considered to be CEV. There are some recognised patterns, with greater rates of CEV in areas of higher deprivation and in older age groups, indicating underlying poorer health in these populations. The CEV list has been used to prioritise patients who should receive the COVID-19 vaccine. There may also be interest in the use of the CEV list to inform future vaccination programmes for seasonal flu, and to stratify populations to target more integrated and holistic care to different groups based on risk.

This report has demonstrated the value of understanding the demographics and underlying health care needs of the clinically vulnerable. Work is underway to refine the risk assessment tools (36,37) and the potential to integrate data on other social factors important for health, such as ethnicity, BMI and housing density should be considered (for example through linkage of the CEV list to the Survey for Wales (38)), alongside the governance, ownership and legal basis for maintaining and update the CEV list and application for other purposes.

5.2 Changes in secondary health care activity

Across all secondary health care activity, rates in 2019 and 2020 were considerably higher in the CEV population compared to the general population, reflecting their underlying complex health needs. However, trends in age standardised rates during the course of the pandemic show a difference in patterns for planned and emergency health care related activity amongst the CEV population and general population.

All non-essential care was paused on 23rd March 2020, with a marked impact on planned care. Annual trends demonstrated that levels of outpatient attendances and elective admissions declined by approximately a third in both the CEV and general populations in 2020 compared to 2019.

The decline in planned care was much greater amongst the CEV population than the general population

Monthly trends demonstrated that from March to August 2020, the decline in planned care was much greater amongst the CEV population than the general population (average monthly percentage change in outpatient activity: -3.8% in the CEV population and -1.3% in the general population; inpatient admissions -7.2% in the CEV population and -0.6% in the general population). From August to December 2020, planned care amongst the general population started to increase (average monthly percentage change in outpatient activity: +4.1%; inpatient admissions +3.9%). Whilst there was some increase in outpatient attendances amongst the CEV population, inpatient admissions in this population continued to decline (average monthly percentage change in outpatient activity: +1.7%; inpatient admissions -3.5%), and levels of activity remained significantly lower than pre-pandemic levels.

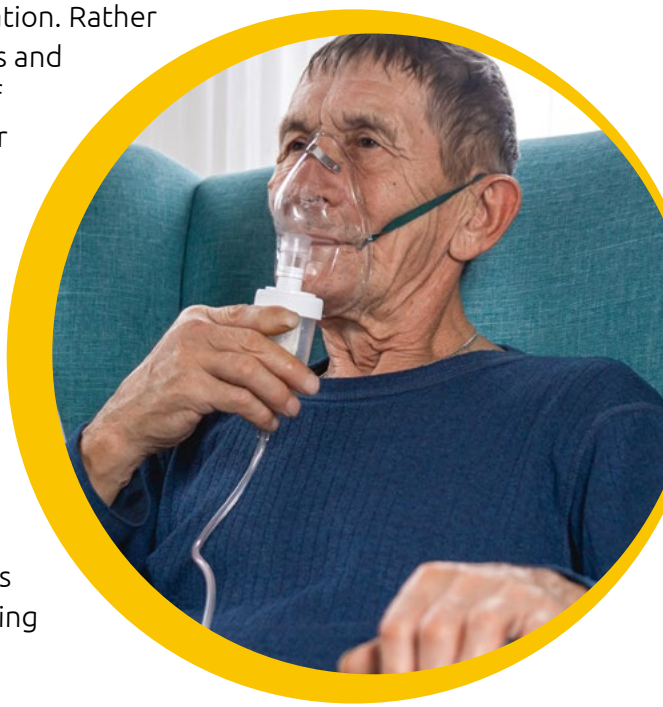
Many complex factors are likely to have contributed to the declines in planned care for the CEV population. Whilst the CEV population have much greater underlying health needs, COVID-19 resulted in the suspension of the majority of non-essential care for this vulnerable group. However, COVID-19 may also have contributed to patients potentially delaying planned care, if able, to a time when they felt less at risk. The slower recovery in the latter half of 2020 was at the time when there was a second wave of COVID-19 infections, resulting in both the need to once again reduce non-essential secondary health care, and a potential hesitancy amongst CEV patients to engage with services (9).

Annual trends in ED attendances and emergency inpatient admissions declined by approximately 25% in the CEV population

In emergency care, annual trends in ED attendances and emergency inpatient admissions declined by approximately 25% in the CEV population, whereas amongst the general population ED attendances declined by 20.2% and emergency admissions by 13.2%. Although the CEV population are likely to have more complex underlying health conditions, greater declines in emergency care were observed amongst

this group. The different patterns between the two populations may reflect clinical need but may also reflect differences in clinical management thresholds for the CEV population and the general population, along with individual differences in willingness to attend emergency care amongst the CEV population.

Previous studies investigating changes in emergency care provide support for our findings. A study examining the changes in care for people with chronic obstructive pulmonary disease (COPD) in Scotland and Wales found that lockdown was associated with a 48% reduction in emergency admissions for COPD in both countries and a 46% reduction in COPD ED attendances in Wales (39). The authors concluded that the reduction in ED attendances was unlikely due to a lack of help-seeking amongst those in need as there was no significant corresponding increase in deaths from COPD, and avoiding hospital is an unlikely behaviour during an acute COPD exacerbation. Rather the observed reductions in COPD related emergency admissions and ED attendances were likely to be the outcome of lower levels of respiratory infection transmission, reduced exposure to outdoor air pollution and/or improved self-management of COPD. This reduction in COPD emergency care may largely account for the decreases in emergency care observed in this study, given we had a large proportion of individuals classified as CEV for respiratory conditions; and COPD is the second largest contributor to emergency admissions in the UK (40). In addition, COPD is more common in older age groups, which corresponds with the overrepresentation of older age groups in the CEV population. The declines in attendances observed in this study were smaller than those observed by Alsallakh and colleagues (39), which may be explained by increased admissions in other specialties, such as radiotherapy for cancers counteracting the declines (41).



ED attendances across the UK were down 29% in March and 57% in April compared to figures in 2019, coinciding with increases in weekly deaths as reported by the ONS, of which COVID-19 only accounted for 44% (42). The increase in deaths for conditions other than COVID-19 raises concern that patients with myocardial infarctions, strokes and cancer may not have been seeking care during the pandemic. Other factors contributing to a reduction in ED attendances were suggested to include reduced trauma, reduced traffic accidents, reduced drug and alcohol related presentations, improved self-care and medication compliance, better care of homeless and less iatrogenic harm due to cancelled elective care (42). Emergency care for the CEV population in particular may have declined as a result of reduced accidents as the CEV population had been advised to stay home. Further studies are needed to better understand the underlying factors contributing to differences in trends in specific conditions through routine data, alongside qualitative insights to understand the impact of the COVID-19 pandemic on health seeking behaviours.

ED attendances across the UK were down 29% in March and 57% in April

Trends in planned and emergency care are difficult to interpret given the diversity of underlying health conditions, comorbidities, and varying levels of need. The findings do suggest that CEV patients, in particular, have significant unmet needs in planned care, but that this did not result in an increase in emergency care. Qualitative studies suggest that, whilst people understood the need to cancel planned acute care, there was frustration over the lack of communication about the continuity of care or the future plan (10). Some services moved to digital provision, but this would not support all individuals to maintain continuity of care, for example some may have been reluctant to move to digital consultation due to difficulties expressing their needs over a phone/online, or due to low levels of digital confidence or access (10). Better understanding of whether the “missing activity” in 2020 translated to a backlog of care needs

will be important, and consideration of mixed models of care may be needed to effectively and efficiently address those needs (43).

Missing activity should also consider the inverse care law, evident in this report. In 2019 and 2020, there were higher rates of emergency care and lower rates of planned (elective care) amongst the most deprived, in both the CEV and general populations. There is considerable evidence that many populations, particularly those living in areas of high socio-economic deprivation are at increased risk of poor health, disadvantage and face many barriers to accessing care. The patterns reported here suggest that underlying health needs may not be identified or effectively managed thus requiring urgent treatment. Understanding and addressing the factors contributing to the inverse care law are essential to inform the delivery of equitable care for the future.

The response to COVID-19 helps to highlight the need to monitor health care activity in real time to respond and plan services efficiently. In Wales, the pandemic has provided a further push to develop linked data platforms to support rapid access to population health data. Population level cohorts have been developed within the SAIL TRE using demographic and health care data from multiple sources, to enable epidemiological and evaluation studies (44). Linked national population data sources are valuable as they may be used to answer policy and practice relevant questions and aid decisions on the prioritisation of conditions, treatment, longer-term health outcomes, and the demands on the whole health service from primary to emergency care.

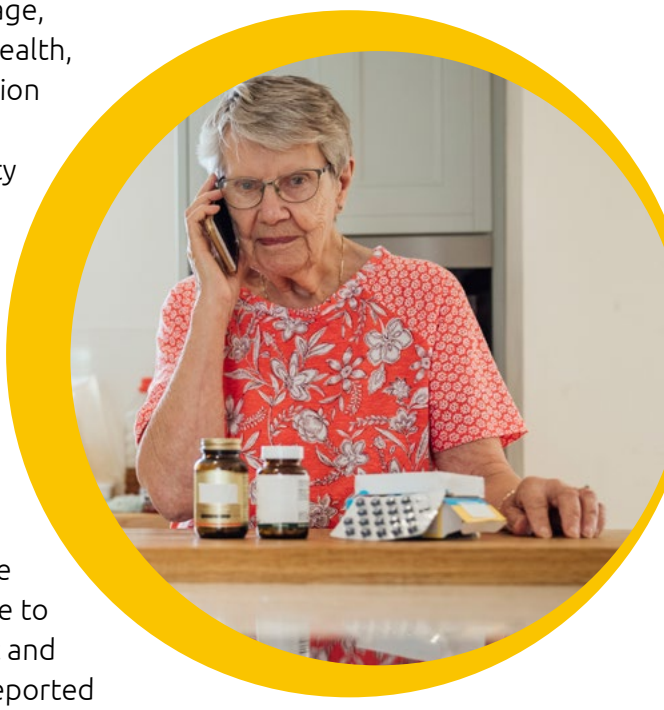
5.3 Impact on mental health

Studies show that the mental health of the overall population in the UK was significantly worse during lockdown periods than pre-COVID, with studies identifying a 25% elevated rate of reports of depression and anxiety (45) and a 50% increase in reports of mental health problems (46).

Amongst the general population, most of the evidence to date on the impact on mental health is from national self-reported surveys, which have highlighted that the mental health of the general population has been negatively impacted during the COVID-19 pandemic (47,48).

There is some evidence examining the impact of the pandemic on the mental health and wellbeing of those who were shielding, through qualitative studies amongst shielding individuals in Wales (9), those with long term physical or mental health conditions in Scotland (10), and the ONS shielding behavioural survey in England (49). The ONS survey found that the majority of CEV individuals (61%, from an estimated 1,369,000 CEV individuals) reported no difference in their mental health and wellbeing since receiving shielding guidance. However, 35% reported their mental health and wellbeing had worsened. Almost half of those under 60 years reported their mental health had worsened compared with roughly a quarter of those aged 70 years and over. More females reported a decline in mental health (40%) compared with males (28%). In addition, amongst the CEV population, those aged 50-59 reported being most affected both mentally and physically by the COVID-19 pandemic whereas, amongst the general population of the UK, 20-29-year-olds reported being most affected (50). Whilst there are only a few studies which have examined presentation rates for mental ill health in health care, those that do, suggest that the increase in self-reported poor mental wellbeing has not translated to increased demand for services during the pandemic. For example, a large population-based study of over 14 million patients in the UK Clinical Practice Research Databank reported reductions in primary care recorded depression (43%) and anxiety disorders (48%) compared to expected rates from January to September 2020, and that by September 2020 incidence had returned to expected levels (51).

1 in 50 of the CEV individuals presented with depression and/or anxiety



This is the first quantitative study exploring the mental health outcomes amongst the CEV population in Wales. Our findings suggest that from March to September 2020, 1 in 50 of the CEV individuals presented with depression and/or anxiety, and of them, nearly 1 in 5 had no previous history of mental ill health. After adjusting for age, sex, deprivation and history (recent and previous) of mental ill health, the CEV population were at increased risk of diagnosed depression and/or anxiety compared to the general population. We did not observe differences in presentation of depression and/or anxiety by deprivation, which was surprising, however this may be due to the limited study period within the primary care from March to September 2020. This means there was little time for conditions to develop or for individuals to seek health care. It is not possible in routine data to understand the factors contributing to poor mental health, but this is essential to inform support. One qualitative study on a small number of shielded patients and stakeholders of charitable and Governmental support for shielded patients, highlighted many different factors contributing to poorer mental wellbeing. These included concerns about the management of their condition due to non-essential services being cancelled, a sense of abandonment and concerns about accessing care if needed. Those shielding also reported anxiety about a lack of information, going out, and personal risk, which also meant that some continued to shield even after termination of the shielding period in August 2020 (9).

Further insights into the impact of the COVID-19 pandemic on both the general population and the CEV population is needed to help inform the support available to those at greatest risk of exacerbation of past mental ill health or new onset (52). Early identification, support and management is essential to prevent an increasing longer-term burden of poor mental health.

5.4 Limitations

A major limitation of this analysis is the challenges of a comparison group over time. The CEV list was a static list captured at one point in time, and does not reflect changes in the population with chronic conditions over time. In this report, we have compared rates in the CEV population with the general population, and underlying differences in patterns of health care activity are likely to reflect differences in age and clinical need. Whilst we have taken into account age variation through age standardisation, we have not been able to address differences in clinical conditions or need. The rates in secondary health care activity were highly variable throughout 2020 and, to enable comparisons, we have described the average monthly change at two specific time points coinciding with the onset and pausing of Welsh shielding advice. Interpretation of changes in routine data is challenging as they are likely to reflect many factors, including patients' own thresholds for seeking care, disrupted care pathways and care delivery, and the direct and indirect impact of COVID-19 on individual health. Lastly, as this study uses routine health data it will not capture self-reported health, which is likely to result in an underestimate of health needs, particularly for mental health.

5.5 Conclusion

The CEV population has been identified as being at significant risk of being negatively affected by the COVID-19 pandemic. This study has enabled the linkage of the CEV list with routinely collected health care data within the SAIL Databank to explore the impact on secondary health care activity and mental health outcomes. The findings demonstrate marked declines in planned and emergency care for the CEV population and general population in Wales during 2020. This is expected given the marked impact of COVID-19 on the NHS response, and suggests there may be considerable unmet need, in particular in mental ill health amongst the CEV population, and evidence of the inverse care law in effect during the pandemic. This unmet need is likely to cause a considerable backlog in demand for mental health (and physical health) services, and translate to increased service use over time. As health and care systems continue to respond to a global pandemic and look towards recovery, a more detailed understanding of the CEV population's health needs and changes to health seeking behaviour is necessary to effectively and efficiently address the needs of the most vulnerable during recovery.

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Appendices

Appendix A.

List of conditions considered as clinically extremely vulnerable to COVID-19, and number of CEV patients where condition known (individuals may have multiple conditions so figures do not sum to 100% (Total=111,797 CEV patients)).

Condition	Number and % of CEV patients
Severe respiratory disease	40,863 (36.6%)
Immunosuppression therapy	30,490 (27.3%)
Cancer	23,143 (12.2%)
Rare diseases	13,632 (12.2%)
Solid organ disease	7,702 (6.9%)
Solid organ transplant	2,794 (2.5%)
Renal dialysis	609 (0.5%)
Pregnancy with congenital heart disease	121 (0.1%)
GP Referred	33 (<0.1%)

Appendix B.

Demographics of the CEV population.

Demographics		Number	Percentage of CEV population
Sex	Male	59,534	46.6%
	Female	68,253	53.4%
Age Group (years)	<15	3,687	2.9%
	15 to 44	16,388	12.8%
	45 to 64	40,779	31.9%
	65 to 74	34,165	26.7%
	75 to 84	25,486	19.9%
	85+	7,282	5.7%
Deprivation (WIMD Quintile)	1 (most deprived)	27,732	21.7%
	2	27,164	21.3%
	3	26,060	20.4%
	4	23,564	18.4%
	5 (least deprived)	23,267	18.2%

Appendix C.

CEV rates per 1,000 population by Local Authority in Wales.

Local Authority	CEV rate per 1,000 population
Blaenau Gwent	49.0
Merthyr Tydfil	47.7
Denbighshire	46.3
Rhondda Cynon Taf	46.3
Isle of Anglesey	44.0
Carmarthenshire	43.4
Wrexham	43.1
Torfaen	42.8
Pembrokeshire	42.7
Vale of Glamorgan	41.8
Flintshire	41.3
Bridgend	40.9
Conwy	40.7
Powys	40.1
Neath Port Talbot	40.0
Caerphilly	39.7
Ceredigion	38.7
Gwynedd	37.6
Cardiff	36.6
Swansea	36.1
Monmouthshire	34.6
Newport	33.7

Appendix D.

Age standardised monthly rates of secondary health care activity for CEV and general population (gen pop) from 2019 to 2020, per 1,000 population.

Month, year	Elective admission		Outpatient attendance		Emergency admission		Emergency Department attendance	
	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop
Jan-19	117.1	12.8	387.2	85.0	52.1	8.8	49.2	22.2
Feb-19	104.5	12.0	340.8	76.0	46.1	8.0	44.0	21.0
Mar-19	116.4	13.1	360.6	80.8	49.6	8.8	48.1	23.8
Apr-19	118.5	12.1	366.7	79.4	50.5	8.5	48.4	23.7
May-19	121.5	12.9	374.1	82.5	51.9	8.8	49.5	24.5
Jun-19	111.4	12.3	370.5	78.6	47.8	8.3	49.2	23.5
Jul-19	128.2	13.7	410.5	88.4	48.3	8.7	51.3	26.0
Aug-19	119.3	12.1	349.9	74.5	46.6	8.1	49.3	23.5
Sep-19	121.7	12.7	395.8	83.3	49.0	8.4	53.4	24.6
Oct-19	134.6	14.1	438.9	92.0	54.7	9.3	52.1	24.2
Nov-19	125.3	13.2	403.6	85.3	55.4	9.4	49.0	23.1
Dec-19	121.2	11.8	352.3	73.2	56.1	9.6	49.9	22.9
Jan-20	136.8	14.3	436.5	90.9	55.6	9.5	48.7	23.1
Feb-20	127.1	13.7	382.9	81.7	47.4	9.0	43.8	21.6
Mar-20	112.7	10.6	308.0	61.8	39.4	7.5	35.6	17.6
Apr-20	71.8	4.4	201.8	32.6	27.2	5.2	26.3	11.8
May-20	67.8	4.7	201.6	35.3	32.6	6.7	34.3	16.9
Jun-20	75.0	6.1	253.6	46.0	34.4	7.2	37.9	19.1
Jul-20	77.8	7.4	260.8	51.7	38.0	8.0	39.1	20.7
Aug-20	71.3	7.2	226.8	46.3	37.2	7.9	40.6	21.5
Sep-20	74.9	8.3	280.5	59.3	37.4	8.0	38.8	20.8
Oct-20	70.7	8.6	271.1	59.1	35.6	7.6	36.1	18.1
Nov-20	68.4	8.8	270.2	60.3	32.6	7.3	35.5	18.0
Dec-20	67.1	8.4	234.1	52.2	31.8	7.3	32.0	16.5

Appendix E.

Monthly percentage change in age standardised monthly rates of secondary health care activity for CEV and general population (gen pop) from 2019 to 2020.

	Elective admission		Outpatient attendance		Emergency admission		Emergency Department attendance	
Month, year	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop
Jan-19	21.3%	22.6%	29.3%	28.6%	6.1%	5.7%	5.7%	4.2%
Feb-19	-10.8%	-6.7%	-12.0%	-10.5%	-11.5%	-8.6%	-10.6%	-5.6%
Mar-19	11.4%	9.3%	5.8%	6.3%	7.5%	9.5%	9.3%	13.3%
Apr-19	1.8%	-7.2%	1.7%	-1.7%	1.9%	-3.3%	0.7%	-0.3%
May-19	2.6%	6.5%	2.0%	3.9%	2.6%	3.0%	2.4%	3.6%
Jun-19	-8.3%	-4.4%	-0.9%	-4.6%	-7.8%	-5.4%	-0.6%	-4.3%
Jul-19	15.0%	10.6%	10.8%	12.4%	1.0%	4.8%	4.3%	10.8%
Aug-19	-6.9%	-11.1%	-14.8%	-15.7%	-3.4%	-6.6%	-4.0%	-9.6%
Sep-19	2.0%	4.2%	13.1%	11.8%	5.1%	3.4%	8.5%	4.6%
Oct-19	10.6%	11.6%	10.9%	10.4%	11.6%	10.3%	-2.5%	-1.4%
Nov-19	-6.9%	-6.5%	-8.1%	-7.2%	1.3%	1.6%	-5.9%	-4.5%
Dec-19	-3.3%	-10.6%	-12.7%	-14.2%	1.1%	1.4%	1.7%	-0.9%
Jan-20	12.9%	21.3%	23.9%	24.2%	-0.8%	-0.7%	-2.4%	0.7%
Feb-20	-7.1%	-4.6%	-12.3%	-10.2%	-14.8%	-5.4%	-10.0%	-6.5%
Mar-20	-11.4%	-22.5%	-19.6%	-24.4%	-16.8%	-16.1%	-18.7%	-18.3%
Apr-20	-36.2%	-58.6%	-34.5%	-47.2%	-31.0%	-31.5%	-26.0%	-32.9%
May-20	-5.7%	8.2%	-0.1%	8.3%	19.9%	28.8%	30.3%	43.1%
Jun-20	10.6%	28.7%	25.8%	30.3%	5.4%	7.6%	10.4%	12.5%
Jul-20	3.8%	20.4%	2.8%	12.4%	10.6%	11.6%	3.2%	8.7%
Aug-20	-8.4%	-1.7%	-13.0%	-10.4%	-2.3%	-1.1%	3.9%	3.7%
Sep-20	5.1%	15.2%	23.7%	28.1%	0.6%	0.9%	-4.5%	-3.4%
Oct-20	-5.6%	3.1%	-3.4%	-0.4%	-4.7%	-4.1%	-6.9%	-12.5%
Nov-20	-3.3%	2.7%	-0.3%	2.1%	-8.5%	-4.6%	-1.7%	-0.9%
Dec-20	-1.8%	-5.4%	-13.4%	-13.5%	-2.5%	-0.4%	-9.9%	-8.1%

Appendix F.

Average monthly percentage change in age standardised in secondary health care activity for the CEV population and the general population between March 2020 and December 2020.

Secondary Health Care Activity	CEV		General population	
	Average mthly % change Mar - Aug	Average mthly % change Aug-Dec	Average mthly % change Mar-Aug	Average mthly % change Aug-Dec
Planned care				
Elective admissions	-7.2	-3.5	-0.6	3.9
Outpatient attendances	-3.8	1.7	-1.3	4.1
Emergency care				
Emergency admissions	0.5	-3.8	3.1	-2.1
ED attendances	4.3	-5.7	7.0	-6.2

Appendix G.

Age standardised monthly rates of secondary health care activity for CEV and general population (gen pop) from 2019 to 2020, per 1,000 population, by sex.

Month, year	Sex	Elective admission		Outpatient attendance		Emergency admission		Emergency Department attendance	
		CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop
Jan-19	Male	122.2	12.6	375.6	74.1	43.6	8.3	47.5	22.3
	Female	111.0	13.0	395.4	95.5	39.7	9.3	50.0	22.2
Feb-19	Male	109.0	11.9	332.8	66.6	39.9	7.6	43.9	21.1
	Female	99.1	12.1	343.5	85.2	34.4	8.5	44.0	20.8
Mar-19	Male	118.6	12.8	354.5	71.2	40.6	8.3	46.2	23.9
	Female	112.6	13.4	362.9	90.1	38.4	9.3	49.5	23.6
Apr-19	Male	117.8	11.7	360.0	69.3	42.4	8.1	46.4	24.1
	Female	117.1	12.5	367.6	89.2	39.2	8.9	49.7	23.3
May-19	Male	121.1	12.5	361.8	72.1	44.1	8.3	51.0	24.8
	Female	121.9	13.3	383.5	92.6	39.4	9.3	47.6	24.3
Jun-19	Male	110.9	11.9	356.6	68.8	39.5	7.8	49.3	23.5
	Female	110.5	12.7	381.4	88.2	37.3	8.8	48.7	23.5
Jul-19	Male	127.9	13.3	397.2	77.5	38.3	8.3	50.2	26.4
	Female	127.5	14.0	416.9	98.9	37.4	9.1	52.1	25.6
Aug-19	Male	119.5	12.0	335.9	65.1	37.4	7.7	47.7	23.8
	Female	118.3	12.3	358.0	83.6	36.5	8.5	50.0	23.2
Sep-19	Male	116.2	12.2	385.8	73.7	39.5	8.0	51.2	25.3
	Female	125.2	13.1	400.7	92.6	39.2	8.8	55.1	23.9
Oct-19	Male	131.9	13.8	418.1	80.7	46.3	8.9	50.9	24.5
	Female	136.3	14.5	454.2	102.9	41.0	9.6	52.3	24.0
Nov-19	Male	120.1	12.8	397.3	75.4	44.8	9.0	47.2	23.2
	Female	129.1	13.6	405.8	95.0	43.4	9.9	50.9	23.1
Dec-19	Male	124.7	11.8	344.1	64.9	45.1	9.3	49.8	22.9
	Female	117.1	11.9	356.2	81.2	43.4	9.8	49.8	22.9
Jan-20	Male	137.5	14.2	419.4	80.2	44.7	9.1	48.3	23.1
	Female	134.8	14.4	449.1	101.3	42.9	9.8	48.8	23.0
Feb-20	Male	129.2	13.8	371.9	72.6	37.6	8.6	40.9	21.5
	Female	124.9	13.5	390.3	90.5	36.8	9.4	46.5	21.6
Mar-20	Male	112.8	10.5	297.6	54.2	30.7	7.5	34.3	18.0
	Female	111.5	10.7	314.4	69.1	30.8	7.6	36.2	17.3
Apr-20	Male	70.2	4.3	195.3	27.2	22.2	5.1	26.0	11.9
	Female	73.1	4.5	205.0	37.9	18.2	5.3	26.2	11.8
May-20	Male	64.9	4.6	198.9	29.7	24.2	6.5	32.3	17.0
	Female	70.4	4.9	201.6	40.8	23.2	6.8	35.9	16.9
Jun-20	Male	74.1	6.1	250.6	39.3	25.7	6.9	36.7	19.2
	Female	76.1	6.1	252.4	52.6	23.5	7.4	38.3	18.9
Jul-20	Male	79.7	7.6	256.7	44.4	29.1	7.6	37.8	20.8
	Female	77.4	7.2	261.1	58.8	26.3	8.3	39.5	20.7
Aug-20	Male	70.7	7.5	221.2	39.7	27.5	7.6	38.8	21.7
	Female	70.7	6.9	228.6	52.8	26.4	8.2	41.7	21.3
Sep-20	Male	74.5	8.5	272.4	51.4	27.1	7.6	37.4	21.1
	Female	74.9	8.1	284.2	67.0	28.4	8.3	39.6	20.4
Oct-20	Male	74.6	8.7	264.2	51.2	24.5	7.3	33.6	18.2
	Female	66.4	8.5	274.5	66.7	28.1	8.0	38.0	18.1
Nov-20	Male	69.3	9.0	260.4	52.3	24.9	6.9	35.2	18.1
	Female	67.5	8.7	275.7	68.1	23.7	7.6	35.6	17.9
Dec-20	Male	67.6	8.5	231.1	45.1	23.9	7.1	30.8	16.4
	Female	66.6	8.2	233.4	59.1	21.8	7.4	32.7	16.6

Appendix H.

Age standardised monthly rates of secondary health care activity for CEV and general population (gen pop) from 2019 to 2020, per 1,000 population, by age group.

Month, year	Age group (years)	Elective admission		Outpatient attendance		Emergency admission		Emergency Department attendance	
		CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop	CEV	Gen Pop
Jan-19	<15	20.3	0.5	76.0	6.2	13.5	1.8	8.3	3.9
	15-44	37.3	2.1	136.1	22.9	13.5	2.2	20.3	8.7
	45-64	33.3	4.1	96.9	23.0	7.9	1.8	11.3	4.8
	65-74	15.6	3.2	43.2	15.6	8.9	1.1	4.5	2.0
	75-84	8.1	2.3	26.5	12.7	4.9	1.2	3.2	1.8
	85+	2.3	0.7	8.6	4.4	3.5	0.7	1.5	1.0
Feb-19	<15	17.2	0.4	68.3	5.6	13.2	1.7	7.2	4.0
	15-44	33.7	2.0	116.8	20.4	10.5	2.0	17.9	8.1
	45-64	29.4	3.8	84.8	20.6	7.6	1.6	10.1	4.4
	65-74	14.2	2.9	38.7	14.0	7.6	1.0	4.3	1.9
	75-84	7.6	2.2	24.4	11.4	4.0	1.1	3.0	1.7
	85+	2.4	0.6	7.8	4.0	3.3	0.6	1.5	0.9
Mar-19	<15	17.8	0.5	66.6	6.1	13.1	1.8	8.4	4.7
	15-44	40.4	2.2	125.8	21.6	11.9	2.2	19.1	9.2
	45-64	32.0	4.1	92.5	21.8	7.6	1.7	10.9	4.9
	65-74	15.8	3.2	41.7	15.0	8.7	1.1	4.7	2.1
	75-84	8.0	2.4	25.6	12.1	4.6	1.2	3.4	1.8
	85+	2.5	0.7	8.5	4.3	3.7	0.8	1.6	1.0
Apr-19	<15	17.7	0.5	73.0	6.0	13.8	1.7	7.8	4.5
	15-44	42.3	2.1	127.0	21.4	12.4	2.1	18.9	8.9
	45-64	33.2	3.9	90.8	21.3	8.0	1.7	11.6	5.0
	65-74	14.9	2.9	41.5	14.6	8.5	1.1	5.0	2.3
	75-84	8.0	2.2	25.7	11.8	4.5	1.2	3.4	2.0
	85+	2.4	0.6	8.7	4.3	3.3	0.7	1.7	1.1
May-19	<15	18.7	0.5	77.2	6.3	14.2	1.6	8.3	4.9
	15-44	41.1	2.1	123.6	21.7	12.4	2.2	20.1	9.1
	45-64	34.2	4.0	94.6	22.1	8.1	1.8	11.2	5.1
	65-74	16.3	3.2	43.1	15.3	8.8	1.2	4.8	2.3
	75-84	8.9	2.4	27.0	12.6	4.7	1.3	3.6	2.0
	85+	2.2	0.6	8.6	4.4	3.6	0.8	1.6	1.1
Jun-19	<15	16.5	0.4	78.3	6.2	12.4	1.5	7.7	4.7
	15-44	38.2	2.1	123.6	20.7	12.1	2.1	20.5	8.6
	45-64	31.9	3.9	93.0	21.2	7.6	1.7	11.7	5.1
	65-74	14.9	3.0	42.4	14.5	8.0	1.1	4.4	2.2
	75-84	7.7	2.2	25.2	11.8	4.6	1.2	3.4	1.9
	85+	2.1	0.6	7.9	4.1	3.1	0.7	1.5	1.0
Jul-19	<15	19.7	0.5	79.9	7.0	10.4	1.5	7.2	4.9
	15-44	43.8	2.2	139.8	23.3	12.8	2.2	21.2	9.7
	45-64	35.7	4.3	105.0	23.7	7.7	1.8	12.2	5.6
	65-74	17.8	3.4	47.3	16.3	8.8	1.2	5.2	2.5
	75-84	8.8	2.5	29.1	13.4	4.8	1.3	3.7	2.2
	85+	2.5	0.7	9.5	4.7	3.8	0.8	1.8	1.2
Aug-19	<15	19.0	0.4	68.1	5.6	9.7	1.2	6.5	3.6
	15-44	37.5	2.0	117.9	19.9	12.8	2.1	20.5	9.1
	45-64	36.2	4.0	90.0	19.8	7.9	1.8	11.7	5.2
	65-74	16.2	3.0	40.6	13.8	8.4	1.2	5.1	2.4
	75-84	8.4	2.2	25.5	11.4	4.4	1.2	3.6	2.0
	85+	2.0	0.6	7.8	4.0	3.5	0.8	1.8	1.1

Sep-19	<15	18.0	0.4	78.3	6.6	12.7	1.5	9.7	4.7
	15-44	41.7	2.1	134.6	21.9	12.8	2.1	22.7	9.4
	45-64	35.6	4.1	100.7	22.4	7.6	1.7	11.4	5.1
	65-74	15.9	3.1	45.6	15.4	8.3	1.1	4.9	2.2
	75-84	8.4	2.3	27.9	12.7	4.6	1.2	3.3	2.0
	85+	2.2	0.6	8.8	4.4	3.1	0.8	1.5	1.1
Oct-19	<15	21.4	0.5	91.4	7.2	15.0	1.9	9.1	4.7
	15-44	44.3	2.3	146.9	24.0	13.2	2.2	20.8	9.1
	45-64	39.6	4.6	110.8	24.9	8.2	1.8	11.6	5.0
	65-74	17.3	3.4	49.6	17.1	9.5	1.2	5.1	2.3
	75-84	9.6	2.6	30.7	14.0	5.3	1.3	3.6	2.0
	85+	2.5	0.7	9.5	4.8	3.6	0.8	1.8	1.2
Nov-19	<15	20.0	0.5	81.4	6.7	15.5	2.2	8.8	4.6
	15-44	39.8	2.2	136.8	22.5	12.4	2.1	19.1	8.6
	45-64	37.9	4.3	102.4	23.0	8.6	1.8	11.0	4.7
	65-74	16.7	3.3	46.1	15.9	9.5	1.2	4.7	2.1
	75-84	8.8	2.4	28.2	12.9	5.4	1.4	3.7	2.0
	85+	2.1	0.6	8.7	4.4	4.0	0.8	1.8	1.2
Dec-19	<15	20.4	0.4	73.5	5.5	16.1	2.2	7.7	4.2
	15-44	38.6	1.9	117.8	19.4	11.6	1.9	18.7	8.1
	45-64	36.1	3.9	88.8	19.9	8.5	1.8	11.8	4.8
	65-74	16.1	3.0	40.2	13.7	10.2	1.3	5.5	2.3
	75-84	8.1	2.1	24.4	11.0	5.7	1.5	4.2	2.2
	85+	2.0	0.5	7.6	3.7	4.0	1.0	2.0	1.3
Jan-20	<15	21.6	0.5	91.5	7.1	13.5	1.7	6.2	3.9
	15-44	43.8	2.3	144.8	23.7	13.4	2.1	20.1	8.6
	45-64	40.9	4.7	110.5	24.8	8.6	1.9	11.7	4.9
	65-74	18.9	3.6	50.4	17.1	10.3	1.4	5.0	2.2
	75-84	9.2	2.5	29.9	13.7	6.1	1.5	3.9	2.1
	85+	2.4	0.7	9.3	4.6	3.7	1.0	1.8	1.2
Feb-20	<15	20.3	0.5	78.1	6.3	10.9	1.6	6.8	3.9
	15-44	39.9	2.2	128.7	21.3	11.2	2.0	16.6	7.8
	45-64	37.9	4.4	98.0	22.3	8.0	1.8	10.9	4.6
	65-74	17.5	3.4	43.9	15.4	8.7	1.3	4.4	2.1
	75-84	9.3	2.5	26.3	12.2	4.8	1.4	3.3	1.9
	85+	2.2	0.6	7.9	4.1	3.9	0.9	1.8	1.2
Mar-20	<15	16.4	0.3	63.4	4.8	8.7	1.3	4.7	3.2
	15-44	37.0	1.6	105.1	17.0	10.0	1.6	14.7	6.3
	45-64	33.4	3.5	78.6	16.8	6.6	1.5	8.6	3.8
	65-74	15.7	2.8	35.0	11.4	6.8	1.1	3.4	1.7
	75-84	8.1	2.0	20.3	8.9	4.1	1.3	2.6	1.7
	85+	2.0	0.5	5.7	2.9	3.3	0.9	1.4	1.0
Apr-20	<15	10.9	0.1	47.3	2.3	4.2	0.5	3.5	1.6
	15-44	26.3	0.6	74.3	10.5	6.4	1.1	10.1	3.9
	45-64	21.2	1.6	46.7	8.6	4.9	1.1	6.6	2.9
	65-74	8.4	1.1	19.9	5.7	5.9	0.8	2.9	1.3
	75-84	4.0	0.7	10.7	4.3	3.3	1.0	2.2	1.3
	85+	1.0	0.2	3.0	1.3	2.5	0.6	1.1	0.8
May-20	<15	11.1	0.1	42.6	2.5	4.1	0.7	3.9	2.2
	15-44	26.5	0.7	73.4	11.1	7.7	1.4	13.3	5.9
	45-64	18.2	1.7	50.2	9.4	6.1	1.5	8.8	4.2
	65-74	7.5	1.2	20.8	6.1	7.1	1.1	3.8	1.9
	75-84	3.5	0.8	11.4	4.7	4.2	1.2	3.1	1.8
	85+	0.9	0.2	3.2	1.5	3.5	0.9	1.5	1.0

Jun-20	<15	13.4	0.2	52.8	3.5	3.7	0.7	4.5	2.6
	15-44	28.8	0.9	93.1	14.0	8.1	1.6	14.5	6.9
	45-64	19.7	2.1	62.5	12.4	6.1	1.5	9.6	4.5
	65-74	8.2	1.6	26.4	8.0	8.2	1.2	4.3	2.1
	75-84	4.0	1.1	14.8	6.2	4.5	1.3	3.3	1.9
	85+	0.9	0.2	4.0	1.9	3.7	0.8	1.7	1.1
Jul-20	<15	11.6	0.2	48.1	3.9	5.2	0.8	4.6	3.0
	15-44	31.4	1.1	97.7	15.2	9.1	1.8	14.6	7.6
	45-64	20.6	2.4	65.7	13.8	6.7	1.7	10.3	4.8
	65-74	8.6	2.0	28.3	9.2	8.0	1.3	4.4	2.2
	75-84	4.4	1.3	16.3	7.3	4.9	1.4	3.4	2.1
	85+	1.2	0.3	4.6	2.4	4.0	1.0	1.8	1.1
Aug-20	<15	12.3	0.2	42.1	3.6	4.4	0.8	5.6	3.3
	15-44	25.9	1.0	85.2	13.8	9.1	1.8	15.7	8.0
	45-64	19.1	2.3	56.5	12.0	6.5	1.7	9.7	4.8
	65-74	8.4	2.0	24.4	8.2	8.2	1.2	4.4	2.2
	75-84	4.4	1.4	14.5	6.6	4.8	1.4	3.5	2.1
	85+	1.1	0.3	4.1	2.1	4.1	1.0	1.7	1.1
Sep-20	<15	11.4	0.2	53.3	4.7	6.8	1.1	6.5	3.8
	15-44	28.9	1.2	102.6	16.9	7.8	1.7	13.4	7.2
	45-64	19.9	2.7	70.2	15.7	6.3	1.6	9.8	4.5
	65-74	8.9	2.3	30.7	10.7	7.9	1.2	4.2	2.1
	75-84	4.7	1.6	18.6	8.6	4.8	1.4	3.3	2.0
	85+	1.1	0.4	5.2	2.7	3.7	0.9	1.5	1.1
Oct-20	<15	11.1	0.3	53.1	4.9	6.2	0.9	4.9	3.0
	15-44	25.5	1.3	98.1	16.5	7.5	1.6	12.9	6.3
	45-64	19.6	2.8	67.5	16.0	6.2	1.7	9.7	4.1
	65-74	8.8	2.3	29.8	10.8	7.4	1.2	4.0	1.9
	75-84	4.7	1.6	17.6	8.4	4.5	1.4	3.1	1.8
	85+	1.1	0.4	4.9	2.6	3.8	0.9	1.6	1.0
Nov-20	<15	12.6	0.3	57.7	5.0	6.8	0.9	5.5	3.0
	15-44	23.7	1.3	95.6	16.8	6.3	1.6	13.8	6.4
	45-64	18.0	2.9	66.1	16.5	5.5	1.6	8.3	4.0
	65-74	8.8	2.4	29.5	11.0	6.8	1.1	3.6	1.8
	75-84	4.2	1.6	16.7	8.5	4.1	1.3	2.9	1.8
	85+	1.1	0.3	4.6	2.6	3.0	0.8	1.3	1.0
Dec-20	<15	11.9	0.3	49.2	4.1	4.7	0.7	3.0	2.2
	15-44	24.9	1.2	84.1	14.9	6.3	1.5	12.4	5.7
	45-64	17.2	2.8	57.2	14.1	5.4	1.6	8.1	3.9
	65-74	8.2	2.3	25.0	9.6	7.6	1.2	4.0	1.9
	75-84	4.0	1.5	14.9	7.4	4.5	1.4	3.2	1.8
	85+	1.0	0.3	3.8	2.2	3.3	0.9	1.3	1.0

Appendix I.

Age standardised annual rates of secondary health care activity for CEV and general population in 2019 and 2020, per 1,000 population, by deprivation

Health care activity	Deprivation Quintile (WIMD)	CEV		General population	
		2019	2020	2019	2020
Elective admissions	1 (most deprived)	255.6	185.4	147.0	91.2
	2	269.8	189.0	154.3	93.5
	3	290.1	209.7	152.7	92.6
	4	307.2	216.3	155.3	96.8
	5 (least deprived)	336.7	235.1	164.2	106.1
Outpatient attendances	1 (most deprived)	860.5	634.2	199.5	144.1
	2	867.3	617.9	200.4	141.0
	3	886.9	628.4	189.4	132.2
	4	982.9	740.5	189.4	136.1
	5 (least deprived)	983.6	735.8	195.0	142.5
Emergency admissions	1 (most deprived)	114.9	77.1	25.9	21.3
	2	107.2	72.8	23.9	19.9
	3	97.5	69.7	20.4	17.6
	4	91.5	67.2	18.0	15.9
	5 (least deprived)	82.4	58.1	16.7	14.9
Emergency department attendances	1 (most deprived)	136.6	107.9	2.3	2.3
	2	123.1	95.1	1.6	1.6
	3	123.5	89.6	1.8	1.4
	4	105.8	78.2	1.5	1.1
	5 (least deprived)	95.2	68.5	1.4	1.1

Appendix J.

Demographics and mental health outcomes for CEV individuals and population comparison group.

		CEV population			Population comparison group		
		No recorded depression or anxiety	Depression or anxiety during pandemic	Chi² P value	No recorded depression or anxiety	Depression or anxiety during pandemic	Chi² P value
N		124,922	2,865		125,422	2,365	
Sex	Male	58,553 (46.9)	981 (34.2)	<.001	63,115 (50.3)	823 (34.8)	<.001
	Female	66369 (53.1)	1884 (65.8)		62307 (49.7)	1542 (65.2)	
Age group (years)	<15	3629 (2.9)	58 (2.0)	<.001	21325 (17.0)	86 (3.6)	<.001
	15-44	15712 (12.6)	676 (23.6)		45276 (36.1)	1425 (60.3)	
	45-64	39694 (31.8)	1085 (37.9)		33676 (26.9)	605 (25.6)	
	65-74	33654 (26.9)	511 (17.8)		13715 (10.9)	117 (4.9)	
	75-84	25078 (20.1)	408 (14.2)		8258 (6.6)	89 (3.8)	
	>=85	7155 (5.7)	127 (4.4)		3172 (2.5)	43 (1.8)	
Deprivation quintile (WIMD)	1 (most deprived)	27039 (21.6)	693 (24.2)	<.001	25634 (20.4)	638 (27.0)	<.001
	2	26497 (21.2)	667 (23.3)		25195 (20.1)	509 (21.5)	
	3	25511 (20.4)	549 (19.2)		25136 (20.0)	456 (19.3)	
	4	23110 (18.5)	454 (15.8)		24475 (19.5)	409 (17.3)	
	5 (least deprived)	22765 (18.2)	502 (17.5)		24982 (19.9)	353 (14.9)	
Rural/urban area	Rural	40040 (32.1)	822 (28.7)	<.001	38000 (30.3)	632 (26.7)	<.001
	Urban	84882 (67.9)	2043 (71.3)		87422 (69.7)	1733 (73.3)	
Recent history of depression or anxiety	No	119007 (95.3)	1937 (67.6)	<.001	120110 (95.8)	1540 (65.1)	<.001
	Yes	5915 (4.7)	928 (32.4)		5312 (4.2)	825 (34.9)	
Previous history of depression or anxiety	No	77437 (62.0)	709 (24.7)	<.001	93654 (74.7)	718 (30.4)	<.001
	Yes	47485 (38.0)	2156 (75.3)		31768 (25.3)	1647 (69.6)	

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