

UK - Death and Disability Trends for Diseases of the Nervous System, Ages 15-49

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E.R. Dalby (PhD), Carlos Alegria (PhD)

Summary

In this study we investigate the UK trends in death rates and disabilities for diseases of the nervous system (neurological disease) for individuals aged 15 to 49 by computing excess death rates and excess disability claims, which are the difference between observed deaths/disability rates and a given baseline for expected death rates/disabilities. We measure changes in the behaviour of morbidity and mortality before the COVID-19 pandemic with the post-pandemic period, specifically for diseases of the nervous system.

We show a large increase in morbidity (disabilities) and mortality due diseases of the nervous system that started in 2021 and accelerated substantially in 2022. The increase in disability claims is consistent with the increase in excess deaths in 2022, and both are highly statistically significant (extreme events). The results indicate that from late 2021 a novel phenomenon leading to increased neurological disease deaths and disabilities appears to be present in individuals aged 15 to 49 in the UK.

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1. Introduction

Beginning in early 2020, the world changed due to the emergence of a global pandemic caused by the SARS-Cov2 virus which, in some individuals, manifested in the form of Covid-19 viral disease. The Covid-19 crisis led to alterations in individuals' lifestyles and perceptions of relative and absolute risk, which impacted their day-to-day decision-making. To add to the social changes, governments added to the hysteria with the introduction of unprecedented measures of social engineering such as control of media communications, the introduction of pandemic lockdowns for healthy individuals, and from 2021, mass inoculations based upon experimental mRNA-based vaccine technology. All these factors led to a break in individuals' behaviours from 2020 onwards.

In this context, Phinance Technologies researchers performed several analyses showing excess mortality (all cause) since 2020, from Europe to the US. We published a methodology report to explain our estimates for excess mortality, which is based on measuring excess death rates instead of excess deaths¹. By accurately measuring and then tracking excess mortality trends, we can have a clearer picture of the implications of the different stages of Covid-19 pandemic, as mentioned above.

The purpose of this study is to go into more detail and measure the changes in death rates and morbidity due to diseases of the nervous system. We focus our research on younger individuals, aged 15-49, in which the highest percentage increase in neurological disease deaths was shown to occur. The focus of this study is to provide a statistical analysis at a population level and provide credence to growing anecdotal evidence of neurological disease in younger people.

The relationships that we uncover in our analysis offers a basis for a reality check for health professionals to understand underlying trends in individuals' health.

¹

<https://phinancetechnologies.com/HumanityProjects/Resources/Report%20on%20measuring%20death%20rates%20-%20V4%20-%20UK.pdf>

2. Data

2.1. Cause of Death Data

The data used in this analysis is the number of deaths that occurred in England and Wales between 2010 and 2022, by underlying cause code (ICD-10), sex, and age group (up to 90+). The source is the UK Office for National Statistics (ONS). The direct links to the mortality data by cause for 2010 to 2021 and 2022 are listed below:

Link to the 2022 data source: [Death occurrences by sex, five year age group and underlying cause \(ICD-10 code\) England and Wales: 2022 - Office for National Statistics \(ons.gov.uk\)](#)

Direct link to the source file:

<https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhoc/1050deathoccurrencesbysexfiveyearagegroupandunderlyingcauseicd10codeenglandandwales2022/deathoccsengwal2022final.xlsx>

Link to the 2010-2021 data source: [Death occurrences by sex, five year age group and underlying cause \(ICD-10 code\) England and Wales: 2010 to 2021 - Office for National Statistics \(ons.gov.uk\)](#)

Direct link to the source file:

<https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhoc/1017deathoccurrencesbysexfiveyearagegroupandunderlyingcauseicd10codeenglandandwales2010to2021/deathoccsengwal20102021finalnew.xlsx>

2.2. Registered Deaths (All Deaths)

Registered deaths are all the deaths registered in England and Wales, independently of whether a cause of death has been attributed. The investigation of deaths and attribution of ICD10 codes with a cause of death can take up to 2 years to be performed.

UK Monthly Registered Deaths (All Cause): [Deaths registered monthly in England and Wales - Office for National Statistics \(ons.gov.uk\)](#)

2.3. Disability Claims

For investigating the changes in disability claims, we use data from the Personal Independence Payment (PIP) system of the Department of Work and Pensions (DWP). We analyse changes in PIP clearances for new claims to the system, as explained in our previous analysis, published on our website².

Source for PIP data (from DWP): [Personal Independence Payment statistics](#)

Stat-Xplore system for DWP data: [Stat-Xplore databases](#)

² <https://phinancetechnologies.com/HumanityProjects/PIP%20Analysis-Systems.htm>

3. Methodology

In this study, we investigate the trends in **death rates** and **disability claims** for the selected cause: diseases of the nervous system (or neurological diseases for PIP disability claims). We investigate these trends using yearly data and therefore we do not have to perform a seasonal adjustment to the data.

In general terms, to measure trends in these variables we use a methodology of computing **excess rates**, which is the difference between the actual **observed rates** and a given **baseline** (expected rates). Because we want to measure the impact of the COVID-19 pandemic and post-pandemic periods relative to the prior state of the world, our baselines are based upon the estimation of the trend for a period prior to the pandemic.

In this study we will use method 2C, as described in our report on methodologies for measuring excess deaths³ in the population. Method 2C is based on computing the trends in death rates (deaths adjusted by the population) instead of deaths, as the baseline for estimating excess mortality. This method significantly reduces the noise of the estimation (as it adjusts for population growth or decline) and considers the prior trend in death rates, which tend to decline over time (over the last 100 years) as the population grows healthier and different risk factors are better managed.

3.1. Method 2C for Estimating Excess Death Rates

$$ExcessDeaths_{it}^{AG} = Deaths_{it}^{AG} - Baseline_{it}^{AG} \quad Eq. 1$$

Equation (1) is a general expression for estimating the excess absence rates relative to a given baseline. We use the subscript “AG” to indicate a given population age cohort which could refer to an age range, region, sex, or underlying cause of death.

For estimating the baseline for “normal or expected” death rates we use a simple linear fit:

$$Baseline(t_i) = \hat{b} + \hat{a}(t_i - t_0) \quad Eq. 2$$

Where \hat{a} and \hat{b} are the estimated coefficients of the death rate trendline from 2010 to 2019. It should be noted that for the UK disability data (Personal Independence Payment (PIP) system) the estimation period we use is from 2016 to 2019. The data before 2016 is unreliable due to the transition from a prior system Disability Living Allowance (DLA) to the PIP system in 2013, which only stabilised after 2015.

3.2. ICD10 Code List of Selected Causes of Death for Diseases of the Nervous System

For this analysis we selected all the ICD10 codes from category G, namely G00 to G98 which refer to deaths attributed to diseases of the nervous system.

The detailed list that was extracted from the ONS cause of death database shows the codes and description that were aggregated for the purpose of our analysis. The list is shown in Appendix 8.1.

Some ICD10 codes, such as G41 with the generic description of “Diseases of the nervous system” refer to ICD10 codes that were not used in the UK from 2010 to 2022.

³

<https://phinancetechnologies.com/HumanityProjects/Resources/Report%20on%20measuring%20death%20rates%20-%20V4%20-%20UK.pdf>

4. Yearly Analysis of Excess Death Rates

In this section we perform a yearly analysis of the death rates for England and Wales, using the ONS cause of death data. In this analysis we use the 2010-2019 trend in death per 100,000 (death rates) as the baseline estimate for excess death rates. Excess death rates for the 2010-2019 period are in-sample while the rates for 2020, 2021, and 2022 are out of sample computations.

The analysis is performed for all the deaths from a particular range of underlying causes of death, as described by the list of ICD10 codes in section 3.2, which refer to all deaths from diseases of the nervous system.

4.1. Deaths from All Causes versus Registered Deaths

When analysing the ONS data for cause of death we noticed that there are discrepancies between the number of deaths which have a cause of death and the number of registered deaths for a year. This is particularly the case for deaths in 2022 (the most recent year) and younger individuals where there are significant discrepancies between both of these datasets.

The reason for the discrepancy is that death certificates for younger individuals take longer, as each death is thoroughly examined and, on many occasions, post-mortems need to be performed. For older individuals, the discrepancies are small. In this report we only investigate deaths for individuals aged from 15 to 49. For this age group, we show the differences between registered deaths and all the causes of deaths in Figure 1.

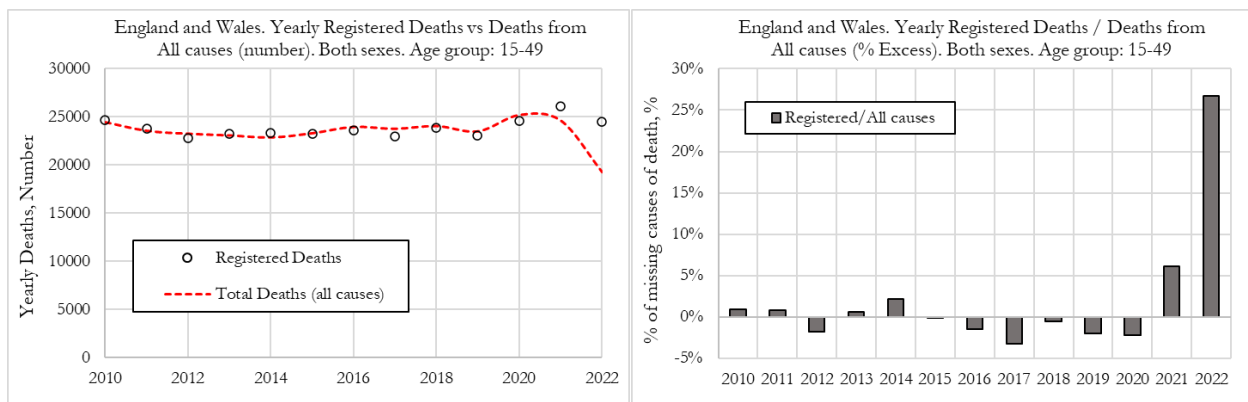


Figure 1- England and Wales, registered deaths versus deaths from all causes in the ONS deaths by cause data table for age group 15 to 49. Left: Yearly numbers. Right: % missing cause of death relative to registered deaths.

We can observe that the discrepancy between registered deaths and the sum of all deaths by cause ranges between -3% to +3% from 2010 to 2020. We consider these normal discrepancies between these databases as there are many factors that could lead to these discrepancies, including if the deaths occurred within England and Wales or abroad, or if they occurred with individuals that were temporary stays in England and Wales.

For 2021, however, we observe about 6% more registered deaths than the sum of the deaths from all causes. In 2022, there are still about 27% of registered deaths without a final cause of death. This is a large discrepancy that needs to be corrected.

To correct for the discrepancies in registered deaths compared to deaths from all causes, we scale the deaths for each ICD10 code by the ratio $R = (\text{registered} / \text{all cause deaths})$. This adjustment is significant for 2022 and assumes that the proportion of deaths from the different ICD10 codes will remain the same after the final

figures are published (in 1 or 2 years). This may not be the case and, therefore, the results need to be taken with a degree of caution, particularly for 2022.

In summary, to estimate the trends in death rates for different causes, we use Adjusted Deaths (Adj-deaths) which refers to the deaths from a particular cause or range of causes adjusted by the ratio defined above. Adjusted death rates are computed based on adjusted deaths.

4.2. Death Rates from Diseases of the Nervous System by Age Group

To determine which age groups were most affected by change in deaths due to diseases of the nervous system, excess deaths were calculated separately by age group for this set of conditions. Although lower in absolute number, the increase in deaths from these causes was higher as a percentage in the younger age groups, as demonstrated in Figure 2.

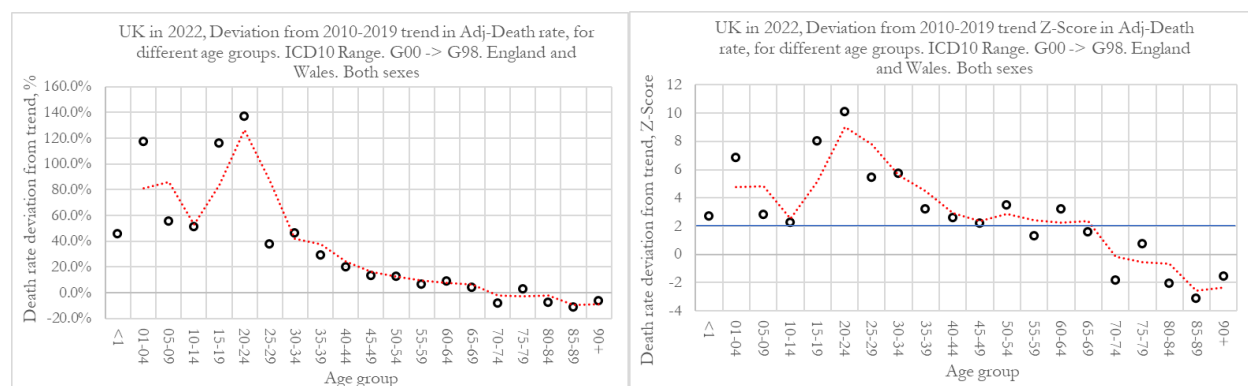


Figure 2 – Excess adjusted nervous system deaths rates in 2022 vs pre-pandemic trend across age groups in England and Wales. Left: Relative deviation from trend, percent. Right: Deviation from trend Z-Score with blue horizontal line marking threshold for statistical significance.

Given these trends, we will be focusing this analysis on the age group between 15-49 years old.

4.3. Death Rates for Age Group 15-49

In this section we investigate the trends in death rates in England and Wales for the 15-49 age group. We compare all-cause mortality (registered deaths) with deaths from diseases of the nervous system, with ICD10 codes ranging from G00 to G98. When computing death rates, we chose to show the numbers as deaths per 100,000.

4.3.1. Unadjusted (Raw) Death Rates for Age Group 15-49 from Diseases of the Nervous System (G00-G98)

The first analysis that we perform is the analysis of the unadjusted (raw) deaths from diseases of the nervous system. Before starting the analysis, it needs to be reiterated that as mentioned in section 4.1, there are a significant number of missing records for recorded causes of death relative to registered deaths in 2021 and 2022. This is because younger individuals are not expected to die from natural causes and, consequently, those deaths need to be investigated more thoroughly to understand the underlying causes.

In section 4.1 we observed that for the 15-49 age group, there are about 6% of missing records in 2021 in the ONS cause of death dataset, and 26.7% for 2022. The missing records for 2022 are about a quarter, which

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means that when analysing the raw numbers of deaths (without adjustment) for diseases of the nervous system, they will likely underreport actual deaths by that amount.

With these caveats in mind, Figure 3 shows the deaths (right) and death rate per 100,000 individuals (left) for diseases of the nervous system deaths in England and Wales from 2010 to 2022. Even with a large number of missing records, we can observe a modest signal in above-trend diseases of the nervous system deaths in 2021, but not 2022.

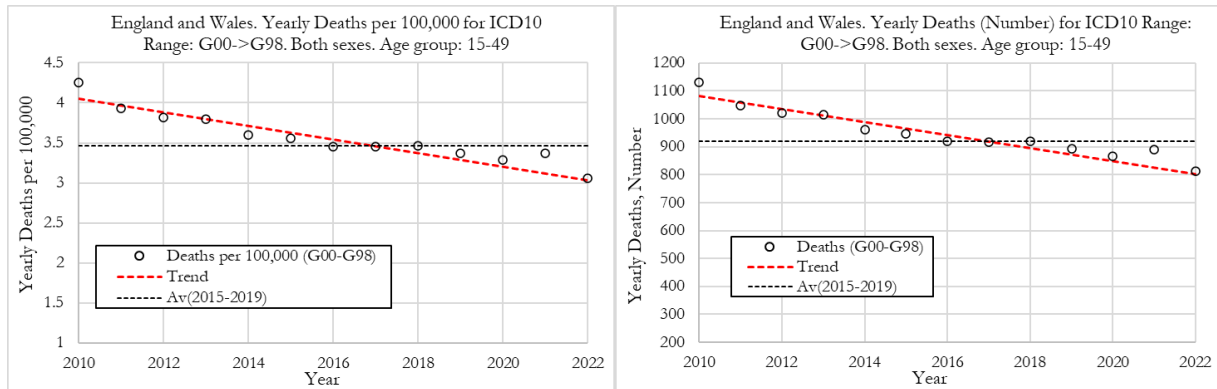


Figure 3 - Yearly unadjusted (raw) deaths from diseases of the nervous system in England and Wales. The red dashed line shows the linear trend from 2010 to 2019. The dotted black line shows the 2015-2019 average death rate. Left: Deaths per 100,000. Right: Deaths (number).

4.3.2. Registered Deaths

The analysis of the registered deaths allows us to have a context by which we can then compare the death rates for diseases of the nervous system. Figure 4 shows the death rate per 100,000 individuals for all registered deaths in England and Wales from 2010 to 2022 in this age group. We can observe that registered deaths per year remained fairly stable from 2010 to 2019, trending slightly downward.

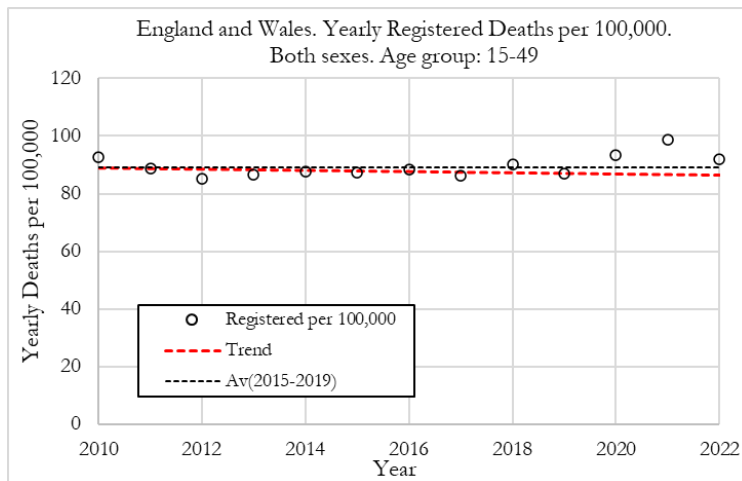


Figure 4 - Yearly registered deaths per 100,000 for England and Wales. The red dashed line shows the linear trend from 2010 to 2019. The dotted line shows the 2015-2019 average death rate.

In 2019, the death rate was about 87 per 100,000 individuals aged 15 to 49. The death rate increased in 2020 to about 93 per 100,000 and then again in 2021 to 99 per 100,000. In 2022 the death rate dropped back to about 92 per 100,000, about the same level as observed in 2020.

4.3.3. Adjusted Deaths from ICD10 Codes G00 to G98 (Diseases of the Nervous System)

We now investigate adjusted⁴ deaths for all diseases of the nervous system (ICD10 codes G00 to G98). Figure 5 (left) shows the death rate per 100,000 individuals for neurological disease deaths (adjusted for under-reporting) in England and Wales from 2010 to 2022. We can observe that deaths per year from neurological disease have been trending lower from 2010 to 2019, with a noticeable downward slope. In 2010 the death rate was ~4.3 per 100,000 and in 2019 it was around 3.3 per 100,000, a roughly 23% drop.

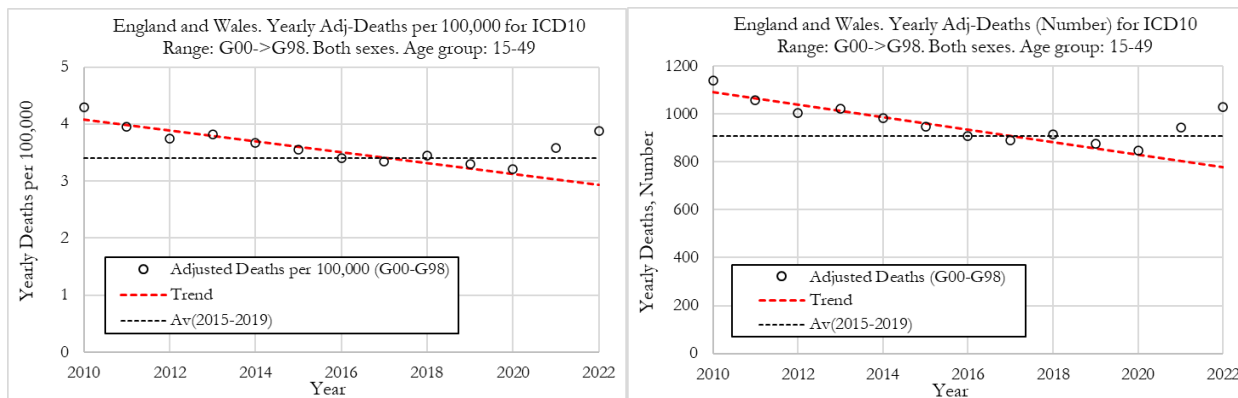


Figure 5 - Yearly adjusted deaths for diseases of the nervous system in England and Wales. The red dashed line shows the average from 2010 to 2019. The dotted line shows the 2015-2019 average death rate. Left: Adj-Deaths per 100,000. Right: Adj-Deaths (Number).

The death rate dropped in 2020 to about 3.2 per 100,000 and then rose to 3.6 per 100,000 in 2021. In 2022 the death rate increased again to about 3.9 per 100,000. The death rate in 2022 was about 0.2 deaths per 100,000 above the 2015-2019 average, and about 0.5 deaths above the rate predicted for 2022.

When translating these numbers into the absolute number of deaths from diseases of the nervous system, shown in Figure 5 (right), we can observe that the 5-year average deaths from 2015 to 2019 was 906 deaths. In 2020, neurological disease deaths were 848, a bit lower than the prior 5-year average. In 2021 there were about 943 deaths, which was about the same as the 2015-2019 average. In 2022, the number increased to 1,028, 122 more than the 2015-2019 average.

4.3.4. Relative Deaths from ICD10 Codes G00 to G98 (Diseases of the Nervous System) Versus All Causes.

In our study we also analyse the trends in the relative incidence of neurological disease deaths relative to all other causes, which provides a different type of information related to breaks in the normal pattern of deaths in this age group.

For this purpose, in Figure 6 we plot the fraction of deaths from all causes that are attributed to diseases of the nervous system. We observe that there was a declining trend in deaths due to neurological disease from 2010 to 2019. In 2010, deaths attributed to neurological disease accounted for 4.6% of total deaths, while in 2019, the fraction had decreased to 3.8%.

⁴ Deaths adjusted for the missing causes of death relative to registered deaths.

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In 2020 the fraction of deaths due to diseases of the nervous system dropped to about 3.4% of total deaths. The fraction then increased to 3.6% in 2021 (just above the 2010-2019 trendline) and then jumped to about 4.2% in 2022, which is where this metric deviates sharply from the trend.

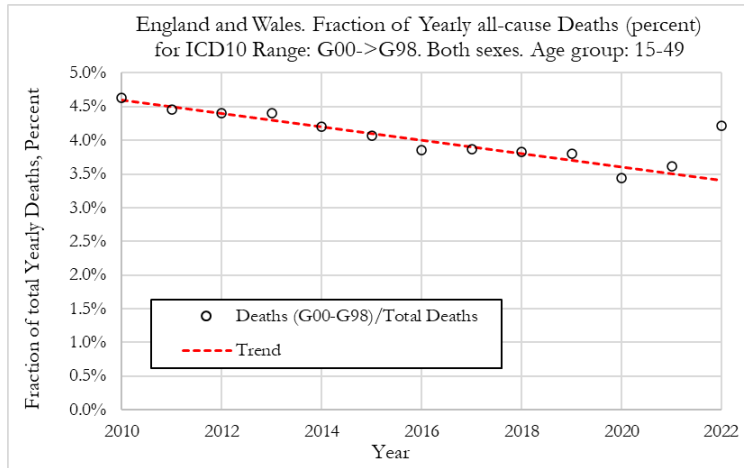


Figure 6 – Fraction of all causes for yearly deaths attributed to diseases of the nervous system, for England and Wales. The red dashed line shows the linear trend from 2010 to 2019.

4.4. Excess Death Rates for Age Group 15-49

In this section we investigate the trends in excess death rates in England and Wales for the 15-49 age group. We compare excess all-cause mortality (registered deaths) with excess deaths from diseases of the nervous system, with ICD10 codes ranging from G00 to G98. We also compare excess deaths for males and females.

4.4.1. Excess Adjusted Deaths from ICD10 Codes G00 to G98 (Diseases of the Nervous System).

Figure 7 compares the excess death rate for diseases of the nervous system (adjusted for under-reporting) and excess registered deaths in England and Wales from 2010 to 2022. The figure on the Figure 7 (left) refers to relative deviations from the 2010-2019 trend, while Figure 7 (right) shows the Z-score (signal strength) for the deviations from trend.

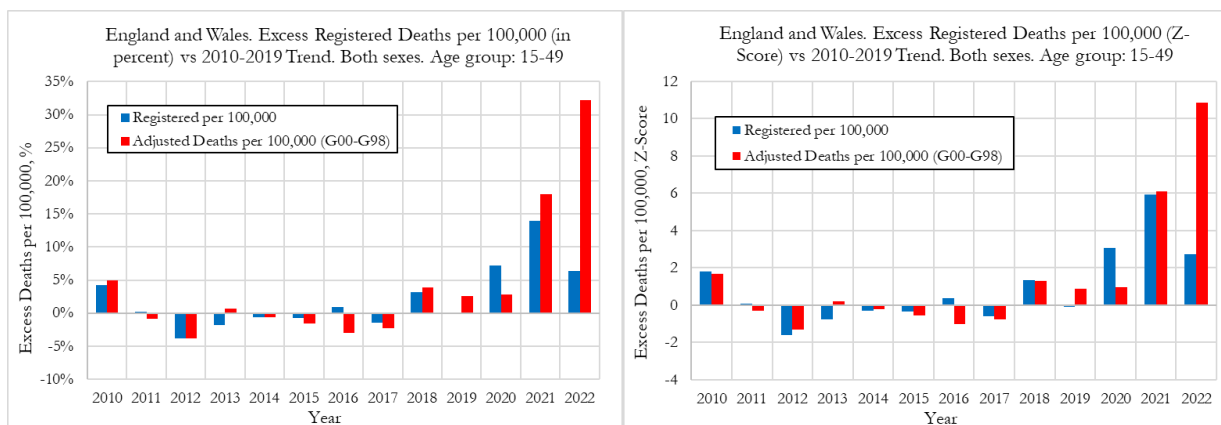


Figure 7 - Excess adjusted deaths rates for diseases by diseases of the nervous system versus excess death rates for all registered deaths in England and Wales. Left: Relative deviation from trend, percent. Right: Deviation from trend Z-Score.

In Figure 7 (left) we can observe that the excess death rates attributed to diseases of the nervous system were close to 3% in 2020, rose to around 18% in 2021, and to around 32% in 2022. The excess mortality for all registered deaths was about 7% in 2020, 14% in 2021, and down to 6% in 2022. Interestingly, the drop in excess mortality for all registered deaths from 2021 to 2022 was not mirrored in a drop in neurological disease deaths. In fact, the opposite occurred, with an acceleration in excess deaths due to diseases of the nervous system.

In terms of statistical significance of the excess deaths, we observe from Figure 7 (right) that for all registered deaths, the Z-score in 2020 was about 3, which represents a statistically significant increase. In 2021, the Z-score increased to almost 6, but then decrease in 2022 to a value of 2.7 in this age group.

When looking at excess deaths from diseases of the nervous system, the Z-score in 2020 was within range of normal variation, indicating that the emergence of Covid-19 in the UK was not associated with a significant increase in deaths due to neurological disease in this age group. However, a substantial increase was observed in 2021 and accelerated into 2022 where we observe Z-scores of around 6.1 and 10.9, respectively. This is an alarming increase that, if corroborated, we believe warrants a thorough investigation. Our previous work on measuring excess mortality and disabilities in the UK⁵ points to the COVID-19 vaccines likely playing a role in the rise of mortality and morbidity in younger age groups based on temporal association. However, the pandemic rules, lockdowns, and long-term after-effects of COVID-19 itself could have played a role in the rise of neurological disease deaths.

4.4.2. Excess Relative Deaths from ICD10 Codes G00 to G98 (Diseases of the Nervous System) Versus All Causes.

A different perspective is to analyse the fraction of deaths from all causes that are attributed to diseases of the nervous system and compare them with the absolute changes in death rates due to neurological disease, as shown in Figure 8.

⁵ See our work on excess deaths in the UK:

(<https://phinancetechnologies.com/HumanityProjects/yearly%20Excess%20Death%20Rate%20Analysis%20-%20UK.htm>).

and the analysis of PIP clearances: (<https://phinancetechnologies.com/HumanityProjects/PIP%20Analysis-Systems.htm>)

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We observe that in 2020, there was a slight but significant decrease in the share of neurological disease deaths over other causes, perhaps due to COVID-19 deaths or other pandemic-related deaths such as alcohol abuse. In 2021 however, the fraction of neurological disease deaths relative to all other causes did not deviate significantly from the 2010-2019 trend. For 2022 however, we observe that in excess death rates from neurological disease rose over 32% from trend while the fraction of neurological disease deaths also jumped substantially but to a lesser degree, by about 24%.

When looking at the statistical significance of the signals, in 2022, the fraction of excess deaths due to diseases of the nervous system had a Z-score of almost 13, which was higher in magnitude than that for excess adjusted deaths rates from this group of conditions.

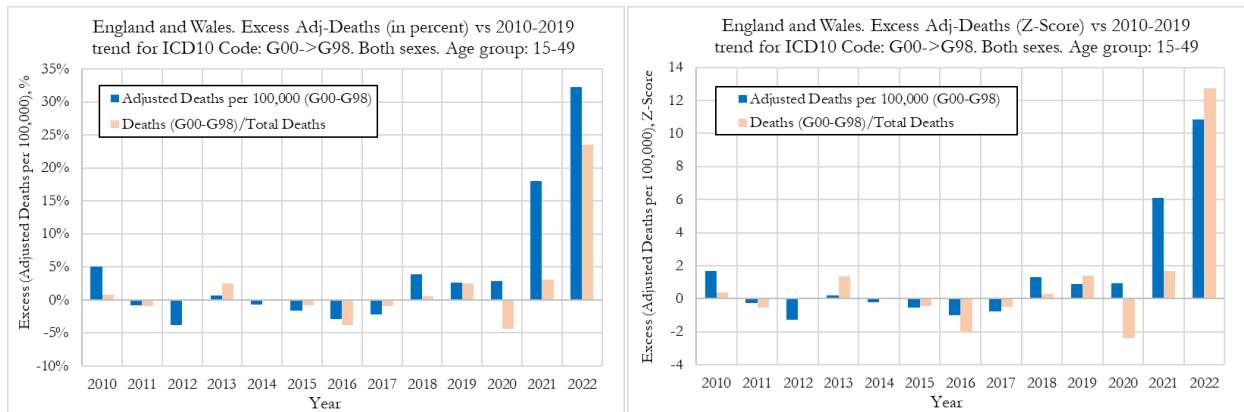


Figure 8 – Excess adjusted deaths rates for diseases of the nervous system versus excess fraction of all deaths that were from diseases of the nervous system, in England and Wales. Left: Relative deviation from trend, percent. Right: Deviation from trend Z-Score.

4.5. Summary of the Analysis of Death Rates

We started our analysis of excess death rates due to diseases of the nervous system by showing that the analysis needs to be performed with caution, as not all deaths had a classified cause up to the time of publication of the ONS dataset. This issue is particularly relevant in younger age groups, which is the case of the present analysis, where we observe that in 2022 about 27% of registered deaths were still not classified with a cause (Figure 1).

We perform a correction to this problem by extrapolating the deaths in each year as if the proportion of each cause of death remained the same when the missing deaths are finally classified. This is an assumption that must be taken with care, as it is likely the case that some of the proportions have changed as well. To make sure that we are identifying an actual trend in the data, we also analyse the deaths from diseases of the nervous system relative to all classified causes of death (Figure 8). The results show that the rise in deaths from diseases of the nervous system in 2022 was higher than the relative rise in neurological disease in relation to all other causes, although the latter was also significantly higher as a proportion in 2022.

Our analysis shows that the excess death rates from diseases of the nervous system were around 3% in 2020, rose by about 18% in 2021, and about 32% in 2022. On the other hand, the excess mortality for all registered deaths in this age group was about 7% in 2020, 14% in 2021, and 6% in 2022. The drop in excess mortality for all registered deaths from 2021 to 2022 was not mirrored in a drop in neurological disease deaths. The opposite occurred, with an acceleration in estimated excess deaths due to diseases of the nervous system.

The excess mortality from neurological disease deaths in 2021 and 2022 are highly statistically significant with Z-scores of 6.1 and 10.9, respectively. These are very strong signals. As mentioned above, these signals are

corroborated by similar findings when measuring rises in the fraction of deaths from diseases of the nervous system relative to all other deaths with classified causes.

When translating these numbers into the absolute number of deaths from diseases of the nervous system, shown in Figure 5 (right), we can observe that the 5-year average deaths from 2015 to 2019 was 906 deaths. In 2020, neurological disease deaths were 848, a bit lower than the prior 5-year average. In 2021 there were about 943 deaths, which was about the same as the 2015-2019 average. In 2022, the number increased to 1,028, 122 more than the 2015-2019 average.

We observe that in 2020 and 2021 neurological disease deaths as a proportion of all other causes of death actually decreased slightly (yet significantly) from the 2010-2019 trend, and began to increase in proportion relative to other causes in 2022. Given the nature of the under-reporting adjustment, the 2022 numbers should be considered estimates.

In the future, we plan to expand our analysis to identify the individual causes of death (ICD10 codes) within the diseases of the nervous system (ICD10 codes G00-G98) that were responsible for the acceleration in these deaths.

5. Analysis of UK Disabilities (PIP System)

In this section we investigate the trends in disability claims in the UK's Department of Work and Pension (DWP) Personal Independence Payment (PIP) system that replaced the previous Disability Living Allowance (DLA) system from 2013 onwards.

The analysis we present here refers to clearances from **new claims** to the system. It should be noted that clearances refer to decisions made, which can be positive or negative. The fraction of positive clearances (that lead to a grant allowance) is shown to be stable over time at a rate of about 40% (see PIP report [here](#)).

One must be aware that PIP replaced the UK's previous Disability Living Allowance (DLA) system in 2013 and therefore we observe sharp increase in cases/claims in the few years following the initiation of PIP, which has been explained as "capacity issues" by the DWP. For this reason, only cases after January 2016 are included in this set of analyses.

We perform the analysis for PIP clearances related to neurological causes to compare these trends with the previous chapter on excess mortality due to diseases of the nervous system. On our website, we present the analysis of trends in PIP clearances for the different body systems⁶ which include interactive charts where the user/researcher can change body system, age of the individuals and trend metric.

5.1. Methodology

The methodology we use to estimate excess clearances of new claims in the PIP system is similar to that on measuring excess mortality, described previously in section 3. We compare the 2016 to 2019 trendline in PIP clearances with actual claims and compute the deviation from trend in relative terms (percentage deviation).

⁶ <https://phinancetechnologies.com/HumanityProjects/PIP%20Analysis-Systems.htm>

5.2. Baseline PIP Clearances for New Claims for Neurological Conditions

Figure 9 (top) shows the monthly PIP clearances for neurological diseases from January of 2016 to January of 2023 of the 16-49 age group, with the proportion of the population with at least one COVID-19 vaccine dose over the same time period expressed as a cumulative percentage illustrated in the bottom plot.

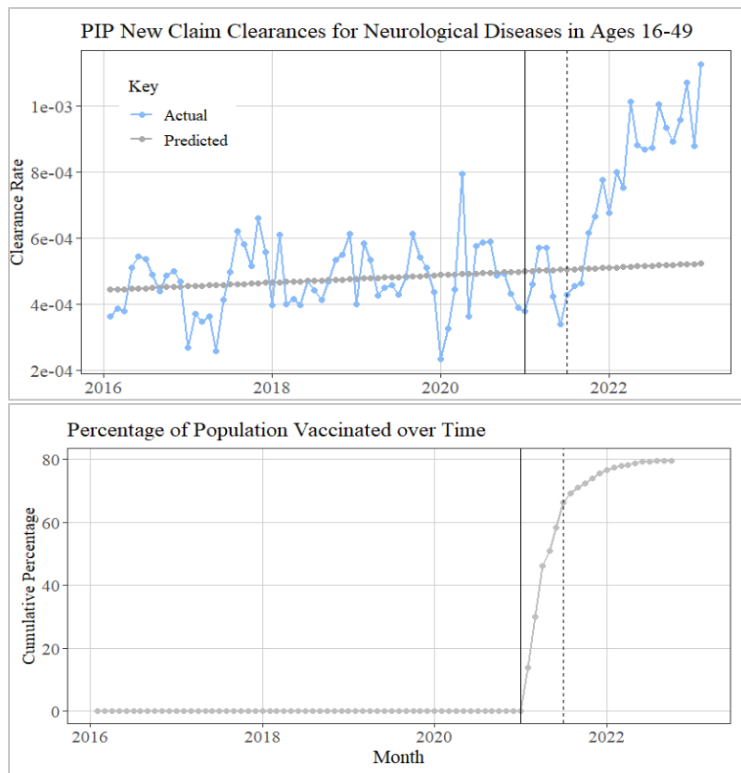


Figure 9 –Top: Monthly clearances (blue line) for new claims to the Personal Independence Payment (PIP) system in the UK for neurological causes for ages 16-49; the grey line shows the 2016-2019 trend. Bottom: the cumulative percentage of the United Kingdom population with at least one dose of COVID-19 vaccine over the same time period.

From 2016 to 2019 we observe that there was a modest upward trend in new PIP clearances per month for this group of conditions in this age group. During 2020, there was some increased variation month to month as pandemic measures were implemented (likely due to processing disruptions), but with no noticeable deviation from trend in new claims overall that year. However, starting after mid-2021, we observe a systematic rise in the PIP clearances which continued until the last data point collected in January 2023. It should be noted that the lockdowns were followed by a sharp increase in rates of alcoholism in this country, which could have contributed at least in part to the increase in disability claims for neuropathy (Jacob 2021). The temporal association is however somewhat unlikely, as development of neuropathy from excessive drinking typically takes years to develop.

The results above seem to corroborate the prior findings of increases deaths attributed to diseases of the nervous system. However, the results can be better compared by performing a yearly analysis of the PIP clearances.

5.3. PIP Clearances for Individual Neurological Conditions

PIP claims were examined separately by individual neurological condition to determine which diseases contributed most to the increase observed in overall neurological disease claims. Rates of the relatively non-

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specific categories of “Neuropathy” and “Other neurological disorders” were the top two conditions that saw the greatest increase after 2020 compared to pre-pandemic levels (Figure 10).

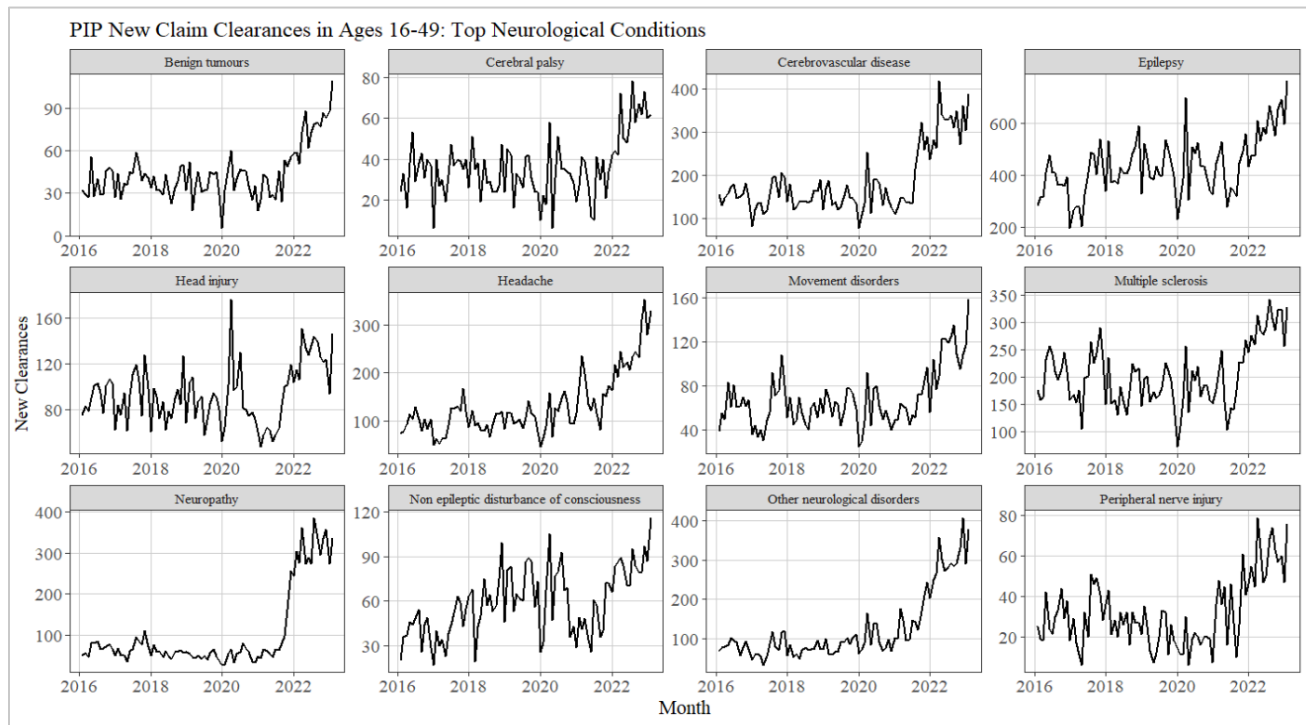


Figure 10. Monthly new claim PIP clearances for 12 neurological conditions that increased in 2021 in ages 16 to 49.

5.4. Excess Yearly PIP Clearances for New Claims Related to Neurological Diseases

When we compute the yearly PIP clearances from new claims due to neurological conditions, shown in Figure 11 (left), we observe that PIP clearances were very stable from 2016-2019, at around 16,211 per year.

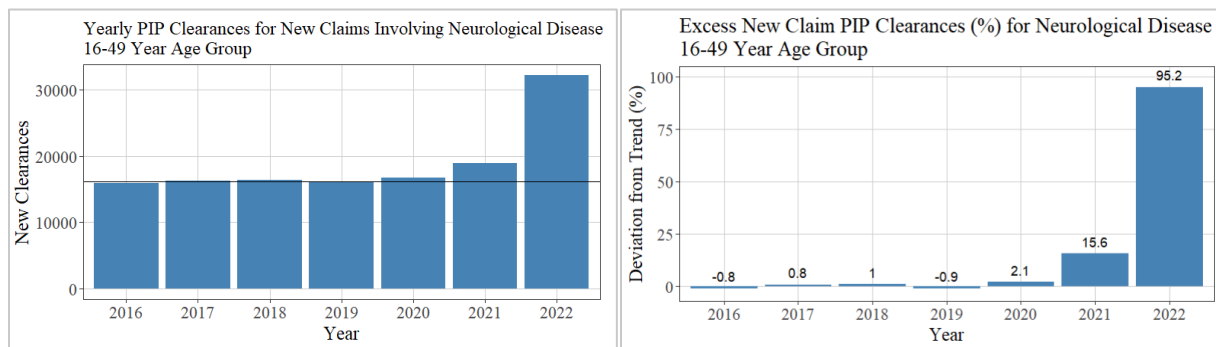


Figure 11 - Yearly excess clearances for new claims to the Personal Independence Payment (PIP) system in the UK for neurological causes for ages 16 to 49. The dotted line refers to the 2016 to 2019 average yearly number of new claims.

In 2020 PIP claims increased by about 2.1%, which was a slight increase from the 2016-2019 trend. In 2021, PIP clearances further increased to 15.6% above trend and further still in 2022 to 95.2% above trend. We may recall that for excess deaths from neurological disease we observed positive deviations from trend of 3% in 2020, 18% in 2021, and 32% (estimated) in 2022 for those between 15 and 49.

We should also note that there was a backlog in PIP clearances peaking in August of 2021 which led to claims taking up to 26 weeks to clear. The DWP mentions that the situation was normalised from early 2022 with PIP claims clearing in about 14 weeks⁷. Consequently, we must observe caution when directly comparing the timing of excess deaths with excess disability claims. However, on a yearly basis, these differences are smoothed out, as observed by the similarity of the trends in both excess deaths and excess disability claims for neurological causes.

5.5. Summary of the Analysis of PIP Clearances for New Claims

The analysis of PIP clearances for new claims where the underlying causes were neurological, is consistent with the analysis of excess deaths. We also show that in 2022 the 95% rise in disability claims for this group of conditions was much greater in magnitude even than the 32% rise in excess adjusted death rates due to neurological disease. By far the most extreme increase in disability claims within this body system was seen in neuropathy, a broad category that refers to diseases that affect the functioning of peripheral nervous system.

6. Concluding Remarks

The results suggest that there is an underlying phenomenon that is causing large rises in mortality and morbidity due to diseases of the nervous system. The explosion in neurological disease disabilities occurred from mid to late 2021 and accelerated in 2022, with a few months lag relative to the rollout of the COVID-19 vaccines. A paper examining vaccine recipients totalling over 99 million showed a clear increase in risk of neurological conditions such as Guillain-Barre syndrome after vaccination, and a 1.5-fold increase in risk in the aforementioned condition after the first dose of the Astra-Zeneca vaccine, which was in widespread use in the United Kingdom (Faksova 2024). This particular vaccine was also associated with a 1.91 increased risk of transverse myelitis, and an alarming 2.23 increased risk of acute disseminated encephalomyelitis in this same study.

Some observational data has implicated COVID-19 itself in the development of neurological symptoms, such as what was observed in a study on US Veterans that spanned throughout 2021 (Xu 2022), which reported that the relative risk of any neurological condition after COVID-19 was 1.42. The unfortunate need to rely on observational data to investigate these effects means that doing a risk/benefit analysis can produce wildly varying results depending on the methodology. For example, studies associating risk of a particular condition after COVID compared to after vaccination rarely differentiate between long term conditions vs acute effects that are self-resolving in a short period of time (e.g. Patone 2021). In this case, the researchers for the Veterans study began tracking subjects before the rollout of the vaccine and failed to adjust for exposure to the vaccine during the follow-up period. As such, we cannot properly determine whether these neurological associations were affected by administering COVID-19 vaccination shortly after COVID infection, a practice which has been shown to increase the risk of systemic side effects (Menni 2021, Krammer 2021) but was nevertheless encouraged by public health authorities. Furthermore, because the study uses a population with a significant amount of selection bias (United States veterans), the exact relative risk ratios cannot be easily compared with other studies that calculated these same ratios after exposure to the vaccine. Future research should be aimed

⁷ <https://www.gov.uk/government/statistics/personal-independence-payment-statistics-to-january-2023/personal-independence-payment-statistics-april-2013-to-january-2023#clearance-and-outstanding-times>

at disentangling the effects on each separately or in combination, stratified by age group, to better inform public health decisions in the future and lead the direction toward effective therapeutic strategies for related conditions.

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8. Appendices

8.1. Appendix 1 – ICD10 Code List for Diseases of the Nervous System (G00-G98)

ICD10 Code	Cause
G00	Bacterial meningitis, not elsewhere classified
G01	Meningitis in bacterial diseases classified elsewhere
G02	Meningitis in other infectious and parasitic diseases classified elsewhere
G03	Meningitis due to other and unspecified causes
G04	Encephalitis, myelitis and encephalomyelitis
G05	Encephalitis, myelitis and encephalomyelitis in diseases classified elsewhere
G06	Intracranial and intraspinal abscess and granuloma
G07	Intracranial and intraspinal abscess and granuloma in diseases classified elsewhere
G08	Intracranial and intraspinal phlebitis and thrombophlebitis
G09	Sequelae of inflammatory diseases of central nervous system
G10	Huntington's disease
G11	Hereditary ataxia
G12	Spinal muscular atrophy and related syndromes
G13	Systemic atrophies primarily affecting central nervous system in diseases classified elsewhere
G14	Postpolio syndrome
G15	DISEASES OF THE NERVOUS SYSTEM
G16	DISEASES OF THE NERVOUS SYSTEM
G17	DISEASES OF THE NERVOUS SYSTEM
G18	DISEASES OF THE NERVOUS SYSTEM
G19	DISEASES OF THE NERVOUS SYSTEM
G20	Parkinson's disease
G21	Secondary parkinsonism
G22	DISEASES OF THE NERVOUS SYSTEM
G23	Other degenerative diseases of basal ganglia
G24	Dystonia
G25	Other extrapyramidal and movement disorders
G26	Extrapyramidal and movement disorders in diseases classified elsewhere

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G27	DISEASES OF THE NERVOUS SYSTEM
G28	DISEASES OF THE NERVOUS SYSTEM
G29	DISEASES OF THE NERVOUS SYSTEM
G30	Alzheimer's disease
G31	Other degenerative diseases of nervous system, not elsewhere classified
G32	Other degenerative disorders of nervous system in diseases classified elsewhere
G33	DISEASES OF THE NERVOUS SYSTEM
G34	DISEASES OF THE NERVOUS SYSTEM
G35	Multiple sclerosis
G36	Other acute disseminated demyelination
G37	Other demyelinating diseases of central nervous system
G38	DISEASES OF THE NERVOUS SYSTEM
G39	DISEASES OF THE NERVOUS SYSTEM
G40	Epilepsy and recurrent seizures
G41	DISEASES OF THE NERVOUS SYSTEM
G42	DISEASES OF THE NERVOUS SYSTEM
G43	Migraine
G44	Other headache syndromes
G45	Transient cerebral ischemic attacks and related syndromes
G46	Vascular syndromes of brain in cerebrovascular diseases
G47	Sleep disorders
G48	DISEASES OF THE NERVOUS SYSTEM
G49	DISEASES OF THE NERVOUS SYSTEM
G50	Disorders of trigeminal nerve
G51	Facial nerve disorders
G52	Disorders of other cranial nerves
G53	Cranial nerve disorders in diseases classified elsewhere
G54	Nerve root and plexus disorders
G55	Nerve root and plexus compressions in diseases classified elsewhere
G56	Mononeuropathies of upper limb
G57	Mononeuropathies of lower limb

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G58	Other mononeuropathies
G59	Mononeuropathy in diseases classified elsewhere
G60	Hereditary and idiopathic neuropathy
G61	Inflammatory polyneuropathy
G62	Other and unspecified polyneuropathies
G63	Polyneuropathy in diseases classified elsewhere
G64	Other disorders of peripheral nervous system
G65	Sequelae of inflammatory and toxic polyneuropathies
G66	DISEASES OF THE NERVOUS SYSTEM
G67	DISEASES OF THE NERVOUS SYSTEM
G68	DISEASES OF THE NERVOUS SYSTEM
G69	DISEASES OF THE NERVOUS SYSTEM
G70	Myasthenia gravis and other myoneural disorders
G71	Primary disorders of muscles
G72	Other and unspecified myopathies
G73	Disorders of myoneural junction and muscle in diseases classified elsewhere
G74	DISEASES OF THE NERVOUS SYSTEM
G75	DISEASES OF THE NERVOUS SYSTEM
G76	DISEASES OF THE NERVOUS SYSTEM
G77	DISEASES OF THE NERVOUS SYSTEM
G78	DISEASES OF THE NERVOUS SYSTEM
G79	DISEASES OF THE NERVOUS SYSTEM
G80	Cerebral palsy
G81	Hemiplegia and hemiparesis
G82	Paraplegia (paraparesis) and quadriplegia (quadriparesis)
G83	Other paralytic syndromes
G84	DISEASES OF THE NERVOUS SYSTEM
G85	DISEASES OF THE NERVOUS SYSTEM
G86	DISEASES OF THE NERVOUS SYSTEM
G87	DISEASES OF THE NERVOUS SYSTEM
G88	DISEASES OF THE NERVOUS SYSTEM

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G89	Pain, not elsewhere classified
G90	Disorders of autonomic nervous system
G91	Hydrocephalus
G92	Toxic encephalopathy
G93	Other disorders of brain
G94	Other disorders of brain in diseases classified elsewhere
G95	Other and unspecified diseases of spinal cord
G96	Other disorders of central nervous system
G97	Intraoperative and postprocedural complications and disorders of nervous system, not elsewhere classified
G98	Other disorders of nervous system not elsewhere classified