

Article

Impact of health conditions requiring hospitalisation on earnings, employment and benefits receipt, England: April 2014 to December 2022

The change in earnings, probability of being a paid employee and probability of benefits receipt attributable to having a major condition requiring hospital admission, compared with a reference period before the hospital admission.

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Release date:
25 June 2025

Next release:
To be announced

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1 . Main points

- There was a consistent loss of earnings, a lower probability of being in paid employment, and a higher probability of receiving benefits for all major health conditions over the five years after first hospital diagnosis, compared with the reference periods before hospital diagnosis.
- The conditions with the highest total loss of earnings for individuals over the five years following hospital diagnosis were stroke (£18,785 in 2023 equivalent prices), chronic kidney disease (£14,721), and heart failure (£10,446).
- The probability of employment reduced most in the fourth year after hospital diagnosis for those diagnosed with stroke (12.1 percentage points), chronic kidney disease (9.4 percentage points) and heart failure (7.7 percentage points).
- The conditions with the greatest increase in probability of benefit receipt in the fourth year after hospital diagnosis were chronic kidney disease (16.3 percentage points), stroke (14.0 percentage points), and heart failure (12.2 percentage points).

The data used for this analysis are de-identified in a secure virtual environment before being combined and analysed. In line with the Code of Practice for Statistics, the de-identified linked data are only used for statistical production and research. Read more in [Section 9: Data sources and quality](#).

2 . Overview

This article presents our analysis of how major health conditions requiring hospital diagnosis affect people's earnings, their ability to work, and the social security benefits they receive. These conditions include:

- cardiovascular diseases
- respiratory diseases
- diabetes
- chronic kidney disease
- cancer
- musculoskeletal conditions

Cardiovascular disease is further broken down into stroke, heart failure, and myocardial infarction.

The hospital diagnosis for our study may not be the first time someone has been diagnosed with that condition. Our data capture primary diagnoses made during both elective and non-elective hospital admissions. They do not include information from primary care.

For further details on the health conditions, see [Section 8: Glossary](#). The full code list can be found in our [accompanying dataset](#).

3 . Methods

We used fixed effects regression modelling to estimate average changes in monthly earnings, employment, and benefits receipt that are attributable to having a major health condition that requires hospitalisation.

For definitions of the model used, see [Section 8: Glossary](#).

We estimate these changes for people who had a first hospital diagnosis for the condition between 1 April 2014 and 31 December 2022 and are of working age (aged 25 to 64 years) at the time of their hospital diagnosis in England. We estimate the impacts at different time periods after first hospital diagnosis compared with a reference period before the first hospital diagnosis. Individuals are followed up from the latest of being 21 years of age or 1 April 2014, to the earliest of being 69 years of age, 31 December 2022, or death. For further details on our methodology, see [Section 9: Data sources and quality](#).

We use different reference periods, depending on the condition requiring hospital diagnosis, to account for how disease progression varies and the labour market impact before the hospital diagnosis. For progressive or chronic conditions, earlier reference periods are required because the impact of the condition can be observed before hospital diagnosis.

The reference periods are defined based on where the pre-hospital diagnosis trends begin to deviate from a plateau. The reference period for:

- cancer, cardiovascular disease, myocardial infarction, respiratory diseases, and stroke is 6 to 12 months before hospital diagnosis
- diabetes, musculoskeletal conditions, and heart failure is 12 to 18 months before hospital diagnosis
- chronic kidney disease is 18 to 24 months before hospital diagnosis

The reference period also includes individuals who had not been hospitalised. To account for different trends between individuals who were hospitalised with a condition and those who were not, we used inverse probability weights to improve comparability. For definitions of terms used in this article, see [Section 8: Glossary](#).

We analysed the effect of health conditions requiring hospital diagnosis on three outcomes:

- monthly earnings
- probability of being a paid employee
- probability of benefits receipt

We calculated the average change in monthly earnings and the probability of receipt of benefits for all individuals in the sample, where earnings are zero for those not in employment, and including only the months in which individuals were in paid employment.

4 . Effects of major health conditions on earnings and employment

Figure 1 shows the main results for effects for all health conditions on individuals' earnings (for all people and for only those in paid employment) and the probability of being a paid employee.

Further analysis, including breakdowns by age at hospital diagnosis group, sex, ethnicity, region, relative level of area deprivation, highest qualification, and National Statistics Socio-economic classification (NS-SEC) can be found in our [accompanying dataset](#).

Figure 1: Earnings were consistently lower after hospital diagnosis for all conditions, compared with the pre-admission reference period

Average changes in monthly employee earnings, probability of employment, and average monthly employee earnings among people in paid employment, 1 April 2014 and 31 December 2022, England

Notes:

1. Data include individuals who had a first hospital admission between 1 April 2014 and 31 December 2022, with a primary diagnosis of the health condition, no prior hospital admission with a primary or secondary diagnosis for that condition since 1 April 2009, aged 25 to 64 years at time of hospital admission, and resident in England.
2. Month 0 is the month in which the first hospital admission for the condition occurred.
3. The error bars are 95% [confidence limits](#).
4. Pay is gross [monthly earnings paid to employees](#), in 2023 equivalent values.
5. Being a paid employee is defined as receiving a monthly pay greater than £0.

Average monthly earnings were lower for at least five years after hospital diagnosis than in the pre-admission reference period for all health conditions. The average total loss of earnings over five years for:

- stroke was £18,785
- chronic kidney disease was £14,721
- heart failure was £10,446
- myocardial infarction was £9,139
- cardiovascular disease was £6,962
- diabetes was £5,835
- cancer was £4,996
- musculoskeletal conditions was £4,339
- respiratory conditions was £1,459

Across all individuals in the study population, the initial decrease in monthly earnings in the first six months after hospital diagnosis was greatest for:

- chronic kidney disease, with a reduction of £199 (earnings remained at £223 less than pre-hospital diagnosis in the 54 to 60 months post-hospital diagnosis)
- stroke, with a reduction of £188 (and a reduction of £334 in the 54 to 60 months post-hospital diagnosis)
- myocardial infarction with a reduction of £136 (and a reduction of £168 in the 54 to 60 months post-hospital diagnosis)

The confidence intervals for the later months are often wide. This is because of smaller sample sizes later in the study follow up, resulting from people reaching the end of the study period, ageing out of the study, or dying.

After an initial drop, earnings stabilised at a lower level than before hospital diagnosis for most conditions. We saw a slight recovery in earnings for chronic kidney disease, diabetes, and respiratory disease, though earnings remained lower than before hospital diagnosis.

For those people in work, earnings remain substantially lower five years after hospital diagnosis. The three conditions with the highest loss in earnings were:

- chronic kidney disease (£17,639)
- stroke (£14,656)
- heart failure (£11,996)

There was a substantial average change in monthly pay in the first six months following hospital diagnosis among those in work. This suggests that a decrease in working hours or hourly pay was a factor contributing to the overall average decrease in pay in those first six months. During the first six months after diagnosis, the largest reductions in monthly earnings were for:

- stroke, which reduced earnings by £294 (earnings remained at £237 less than pre-hospital diagnosis after 54 to 60 months post-hospital diagnosis)
- chronic kidney disease, which reduced earnings by £293 (and £259 in the 54 to 60 months post-hospital diagnosis)
- heart failure, which reduced earnings by £264 (and £225 in the 54 to 60 months post-hospital diagnosis)

There was a drop in the probability of employment after hospital diagnosis across all the conditions. This was sustained over the five-year follow-up period and did not recover over time. For some conditions, such as chronic kidney disease, diabetes, musculoskeletal conditions, and heart failure, this decline had already begun gradually, leading up to hospital diagnosis. The largest reductions in the probability of employment in the first six months post-hospital diagnosis were:

- chronic kidney disease by 5.3 percentage points (and remained 8.9 percentage points lower than pre-hospital diagnosis 54 to 60 months post-hospital diagnosis)
- heart failure by 2.8 percentage points (8.2 percentage points 54 to 60 months post-hospital diagnosis)
- stroke by 2.4 percentage points (11.5 percentage points 54 to 60 months post-hospital diagnosis)

In the fourth year after hospital diagnosis, the total reductions in probability of employment were:

- 12.1 percentage points for stroke
- 9.4 percentage points for chronic kidney disease
- 7.7 percentage points for heart failure
- 4.7 percentage points for diabetes
- 4.6 percentage points for myocardial infarction
- 4.5 percentage points for cardiovascular disease
- 3.2 percentage points for cancer and musculoskeletal conditions
- 2.2 percentage points for respiratory conditions

5 . Effects of major health conditions on benefits receipt

Figure 2 shows the main results for the effects of all health conditions on the receipt of benefits for all people and for only those in paid employment.

The Benefits and Income Dataset from the Department for Work and Pensions is only available up to September 2021, which limits follow-up to 54 months (for more information, see [Section 9: Data sources and quality](#)). Further analysis, including breakdowns by age group, sex, ethnicity, region, relative level of area deprivation, highest qualification, and National Statistics Socio-economic classification (NS-SEC) can be found in our [accompanying dataset](#).

Figure 2: Individuals were more likely to receive benefits after hospital diagnosis for all conditions than in the pre-admission reference period

Change in probability of receiving benefits compared with before hospital diagnosis for a major health condition, England, 1 April 2014 and 31 December 2022

Notes:

1. Data include individuals who had a first hospital admission between 1 April 2014 and 31 December 2022, with a primary diagnosis of the health condition and no prior hospital admission with a primary or secondary diagnosis for that condition since 1 April 2009, aged 25 to 64 years at time of hospital admission, and resident in England.
2. Month 0 is the month in which the first hospital admission for the condition occurred.
3. The error bars are 95% [confidence limits](#).
4. Pay is [gross monthly earnings](#) paid to employees, in 2023 equivalent values.
5. Being a paid employee is defined as receiving a monthly pay greater than £0.
6. Being a recipient of benefits is defined as receiving a benefit in each month.

The probability of receiving benefits increased after hospital diagnosis across all health conditions, compared with the pre-hospital diagnosis reference periods.

For each condition, this probability had already begun to rise gradually over the five years leading up to hospital diagnosis. This potentially reflects the impact of symptoms before the condition becomes severe enough to require hospital diagnosis. These results should be interpreted with caution, because the post-hospital diagnosis results may be affected by these pre-hospital diagnosis trends.

The largest monthly increases in the probability of receiving benefits in the first six months after hospital diagnosis were:

- 10.1 percentage points for chronic kidney disease, rising to 17.2 percentage points higher than pre-hospital diagnosis in the 48 to 54 months post-hospital diagnosis
- 5.6 percentage points for heart failure, rising to 11.9 in the 48 to 54 months post-hospital diagnosis
- 5.1 percentage points for stroke, rising to 13.4 in the 48 to 54 months post-hospital diagnosis

The probability of receiving benefits for those in paid work also increased after hospital diagnosis for all conditions. However, the monthly increases during the first six months after hospital diagnosis were slightly smaller compared with increases for the overall population (including both employed and non-employed individuals). The monthly increases in benefit receipt were smaller in the last 48 to 54 months when compared with the overall population, except for heart failure, which was 0.2 percentage points higher in the employed population.

In the fourth year after hospital diagnosis, the total increases in probability of benefit receipt were:

- 16.3 percentage points for chronic kidney disease
- 14.0 percentage points for stroke
- 12.2 percentage points for heart failure
- 7.3 percentage points for diabetes
- 5.7 percentage points for cardiovascular disease
- 4.0 percentage points for cancer and myocardial infarction
- 2.5 percentage points for musculoskeletal conditions
- 2.3 percentage points for respiratory conditions

6 . Comparison of effects between health conditions

Stroke, chronic kidney disease, and heart failure are the conditions with the highest losses for individuals in annual earnings over the five years after hospital diagnosis and the highest decreases in probability of employment in the fourth year after hospital diagnosis.

Stroke accounts for £18,785 in lost earnings and a 12.1 percentage point decrease in the probability of being a paid employee. Chronic kidney disease accounts for £17,639 in lost earnings and a 9.4 percentage point decrease in the probability of being a paid employee. Heart failure accounts for £11,995 in lost earnings and a 7.7 percentage point decrease in the probability of being a paid employee.

These conditions also had the highest increases in the probability of receipt of benefits in the fourth year after hospital diagnosis. However, the conditions with the highest cost to the economy in England are cardiovascular diseases, cancer, and musculoskeletal conditions among everyone with a first hospital diagnosis for that condition in 2023.

These conditions result in the greatest total lost earnings, reductions in paid employment, and increases in benefit claims. Cardiovascular diseases account for £3,715 million in lost earnings, 23,748 fewer people in paid employment, and 30,152 more people receiving benefits. Cancer accounts for £2,921 million in lost earnings, 18,710 fewer people in employment, and 23,387 more people receiving benefits. Musculoskeletal conditions account for £2,416 million in lost earnings, 17,547 fewer people in employment, and 13,926 more people receiving benefits. For further details see our [accompanying dataset](#).

Table 1: Total economic impacts of health conditions requiring hospitalisation among working age people following hospital diagnosis in 2023, England

Condition	Total loss of earnings over five years post-hospitalisation (£ millions, 2023 prices)	Decrease in number of people in paid employment four years after hospitalisation	Increase in number of people receiving benefits four years after hospitalisation
Cardiovascular diseases – all	3,715	23,748	30,152
Cardiovascular diseases – stroke	1,782	11,434	13,284
Cardiovascular diseases – myocardial infarction	669	3,368	2,892
Cardiovascular diseases – heart failure	781	5,718	9,081
Diabetes	203	1,635	2,539
Chronic kidney disease	186	1,185	2,055
Respiratory conditions	738	11,130	11,636
Cancer	2,921	18,710	23,387
Musculoskeletal diseases	2,417	17,547	13,926

Source: Death registrations, Census 2011 from the Office for National Statistics; Pay As You Earn Real Time Information from HM Revenue and Customs; Benefits and Income Dataset from the Department for Work and Pensions; Hospital Episode Statistics from NHS England

Notes

1. The number of people identified with a hospital diagnosis of the condition in 2023 includes individuals who had a first hospital admission between 1 January 2023 and 31 December 2023 with a primary diagnosis of the health condition and no prior hospital admission with a primary or secondary diagnosis for that condition since 1 January 2014, aged 25 to 64 years at time of hospital admission, and resident in England.
2. Total loss of earnings was calculated by multiplying the number of individuals diagnosed in hospital with the condition in 2023 (see Note 1) by the overall loss of earnings over five years following diagnosis, compared with the reference period.
3. Decrease in number of people in paid employment and increase in number of people receiving benefits in four years after the hospital diagnosis was calculated by taking the average of the fourth year estimates and multiplying by the number of individuals with hospital diagnoses in 2023.
4. Pay is gross monthly earnings paid to employees in 2023 equivalent values.
5. Being a paid employee is defined as receiving a monthly pay greater than £0.
6. Being a recipient of benefits is defined as receiving a benefit in a given month.

7 . Data on the impact of health conditions requiring hospitalisation on earnings, employment, and benefits receipt

[Impact of health conditions requiring hospitalisation on earnings, employment, and benefits receipt, England](#)

Dataset | Released 25 June 2025

The change in earnings, probability of being a paid employee and probability of benefits receipt attributable to having a major condition requiring hospital admission, compared with a reference period before the hospital admission.

8 . Glossary

Confidence intervals

A confidence interval (CI) is a measure of the uncertainty around a specific estimate. If a CI is calculated at the 95% level, it is expected that the interval will contain the true value on 95 occasions, if repeated 100 times. The level of uncertainty about where the true value lies increases as intervals around estimates widen. More information is available in our [Uncertainty and how we measure it for our surveys page](#).

Fixed effects regression models

A fixed effects regression model is a statistical model that can be applied to panel data, where there are multiple measurements per individual. Within the fixed effects model, an individual's labour market status at any point is compared with their own previous status. This means that the model controls for all factors do not change over time and that influence the likelihood of treatment and labour market status (sources of time-invariant confounding).

Sources of time-varying confounding (such as calendar time and ageing) are accounted for by including them as additional terms in the fixed effects regression model. We calculate [confidence intervals](#) using clustered standard errors to account for correlation between the measurements for each individual.

Our fixed effects models also controlled for a time-varying comorbidity indicator. This is based on a 12-month "look back" period to capture any hospital inpatient contacts, excluding admissions where the primary hospital diagnosis was the condition of interest.

Health conditions

We identified conditions using the International Classification of Diseases 10th Revision (ICD-10) diagnosis codes in NHS England's Hospital Episode Statistics dataset. ICD-10 code lists were developed with input from NHS clinical leads. They define the following conditions as:

- cancer, including all types of cancer
- musculoskeletal conditions, including musculoskeletal pain, immune inflammatory diseases, and osteoporosis, and excludes trauma-related musculoskeletal conditions, such as fractures
- chronic kidney disease, including all stages (1 to 5) of the disease
- diabetes, including types 1 and 2
- respiratory diseases, including asthma, chronic obstructive pulmonary disease, COVID-19, pneumonia, and other respiratory diseases
- cardiovascular diseases, including all types of cardiovascular disease, such as myocardial infarction, stroke, and heart failure (which are also looked at separately); transient ischemic attacks are excluded from stroke and cardiovascular disease

Inverse probability weighting

The type of inverse probability weights we use are described in Section 4: Glossary of our [The impact of NHS Talking Therapies on monthly employee pay and employment status, England article](#).

9 . Data sources and quality

Linked dataset

We used an extension of the Public Health Data Asset (PHDA) to include data on employee pay and benefits receipt. The de-identified, linked dataset includes:

- Census 2011 and Census 2021
- Hospital Episode Statistics (HES) Admitted Patient Care (APC) records from 1 April 2009 to 31 December 2022
- Office for National Statistics (ONS) death registrations, covering deaths registered from 1 April 2014 to 31 December 2023 and occurring up to 31 December 2022
- Pay As You Earn Real Time information (PAYE RTI) records from HM Revenue and Customs (HMRC), covering 1 April 2014 to 31 December 2022
- Benefits and Income Dataset (BIDs) from the Department for Work and Pensions (DWP), covering 1 April 2014 to 1 September 2021

We previously described the data security processes we use in our [Using the power of linked data to understand factors preventing people from working blog post](#).

All the datasets used for this analysis have been de-identified. This means no individual's attribute information can ever be directly identified from the data held by the ONS. This is because information that can be used to directly identify individuals, such as names, addresses, and NHS numbers, have been removed in a secure virtual environment before the datasets are combined and analysed.

The de-identified linked data will only be used for statistical production and research, in line with the [Code of Practice for Statistics](#). It cannot be used for operational purposes, such as making decisions over individuals' access to healthcare or benefits. More information on our use of data can be found in our [Sources of data page](#). Ethical approval for this work was provided by the [National Statistician's Data Ethics Advisory Committee](#).

Individuals' Census IDs were linked to National Insurance Number (NINo), which is the individual identifier used for HMRC records and to DWP master key, which is the individual identifier used for DWP record. Linkage was carried out using the Demographic Index, as described in our [2011 Census linkage to DWP master key and encrypted NINo methodology](#).

Linkage to the Demographic Index was carried out using NHS number. Census ID was linked to the HES and death registration datasets using the Patient Register 2011 to 2013. The PAYE RTI data were calendarised to derive monthly employee pay ([gross earnings](#)), in line with the methods described in our [Monthly earnings and employment estimates from Pay As You Earn Real Time Information \(PAYE RTI\) data methodology](#). Where an individual had a Census ID linking to multiple monthly PAYE RTI records, pay was summed across all matching records for each month.

Negative monthly pay records were imputed to be zero. Monthly pay above the 99.9% centile was set to the value at the 99.9% centile. Monthly pay was deflated to 2023 prices using the Consumer Price Index including owner occupier's housing costs (CPIH). Being a paid employee was defined as receiving any amount of pay in a month.

We used BIDs to identify people who received any social security benefits each month from April 2014 to September 2021. BIDs contains information on the following benefit types:

- Carer's Allowance
- Disability Living Allowance
- Employment and Support Allowance
- Housing Benefit
- Incapacity Benefit
- Income Support
- Jobseeker's Allowance
- Personal Independence Payment
- Severe Disablement Allowance
- Universal Credit

For some benefits such as Universal Credit, applications can cover two partners living in the same household. In these instances, both partners were assigned as benefit recipients in our analysis.

Data inclusion criteria

Individuals were included if they had a record of hospital admission in HES between 1 April 2014 and 31 December 2022 with a primary diagnosis of cardiovascular diseases, respiratory diseases, diabetes, chronic kidney disease, cancer, or musculoskeletal conditions.

ICD-10 codes used to identify major health conditions are provided in our accompanying dataset. If there were multiple qualifying records for an individual, we took the earliest record. We excluded individuals if they had a record of a past hospital diagnosis of the major condition as a primary or secondary diagnosis code between 1 April 2009 and 31 March 2014.

Sociodemographic information was linked to these individuals from the 2011 Census. The sample was restricted to individuals that live in England (as recorded in HES, if available, and census data if not) and aged 25 to 64 years on the date of hospital diagnosis. Individuals must have at least three years of follow up before their hospital admission event to be included in the sample. Sociodemographic information on the cohorts of individuals hospitalised for specific conditions are provided in our [accompanying dataset](#).

We created a sample of unexposed individuals, comprising individuals counted in the 2011 Census, who did not have a record for the specific condition between 1 April 2009 and 31 December 2022. These individuals were sampled using stratified sampling by sex and five-year age band to match the age-sex distribution in the cohort with the condition.

The purpose of this sample was to more accurately adjust for time-varying confounders, which would be partially collinear with the within-individual treatment effect in the exposed cohort. To account for different trends between individuals who were hospitalised with a condition and those who were not, we used inverse probability weights to improve comparability. For definitions of terms used in this article, see [Section 8: Glossary](#).

Follow up

Individuals were followed up in our de-identified dataset for a maximum of five years before and after hospital diagnosis, between 1 April 2014 and 31 December 2022.

When analysing the probability of benefit receipt, we limited follow up to September 2021. This is because data quality issues after that date resulted in a maximum follow-up time of 4.5 years after hospital diagnosis.

We followed individuals from the latest of either:

- the start of the study period
- five years pre-hospital diagnosis
- aged 21 years

We followed individuals to the earliest of either:

- the end of the study period
- five years post-hospital diagnosis
- turning 69 years of age
- death

To account for earnings and employment lost due to death, we conducted a separate sensitivity analysis (available in our accompanying dataset). We calculated average monthly earnings and employment without ending follow up at death for individuals who died from a health condition. Instead, we recorded their earnings and employment status as zero from the time of death onwards.

Strengths and limitations

The PHDA is a population-level dataset for England. There are 49,781,938 individuals with a non-imputed record in the 2011 Census and who were resident in England at the time of the 2011 Census. Of these individuals, 92.4% (45,975,018) could be linked to both NHS and HMRC information.

The PAYE RTI data cover employees only. Self-employed people are recorded as receiving £0 in pay and categorised as not a paid employee for the purposes of this analysis. Approximately 13% of working people are self-employed rather than employees, as recorded in our [Employees and self-employed by industry dataset](#). People who are employed, but not currently receiving pay (for example, on maternity leave and not receiving maternity pay) are also categorised as not a paid employee.

We did not have reliable data on hours worked, so we were unable to distinguish changes in hours worked from hourly pay changes. We were also not able to distinguish pay given during short- or long-term absence, such as sick pay or maternity pay, from regular pay.

We have only included those benefits that can be related to illness or employment. This most accurately reflects the economic impact of hospital diagnosis. We have excluded benefits not directly linked to these factors or those that are not applicable to the working age population, such as Attendance Allowance, Bereavement Support Payment, Pension Credit, State Pension Retirement, or Widow's Benefit.

Acknowledgements

This analysis was produced in collaboration with the Department of Health and Social Care and the Department for Work and Pensions Joint Work and Health Directorate. The project was funded by HM Treasury's [Shared Outcomes Fund](#).

10 . Related links

[Likelihood of benefit receipt among people who are economically inactive because of long-term ill health, England and Wales: April 2020 to March 2021](#)

Statistical bulletin | Released 26 February 2025

Exploration of the socio-demographic characteristics of people who were economically inactive because of long-term ill-health at Census 2021, classified by whether they were receiving social security benefits.

[2011 Census linkage to DWP master key and encrypted NINo](#)

Methodology | Released 6 December 2024

Linkage methodology and quality information for 2011 Census linkage to DWP (Department for Work and Pensions) master key and encrypted NINo (National Insurance number).

[Benefit recipients during the coronavirus \(COVID-19\) pandemic, England: November 2019 to March 2021](#)

Statistical bulletin | Released 6 December 2023

Age-standardised percentages of people who received a social security benefit by health conditions and sociodemographic characteristics, using linked 2011 Census, primary care and benefits data.

[Using the power of linked data to understand factors preventing people from working](#)

Blog | Released 5 December 2023

Emma Rourke explains how linked, population-level data can improve our understanding of the interplay between health and work, with the goal of improving the well-being of individuals and the economy.

11 . Cite this article

Office for National Statistics (ONS), released 25 June 2025, ONS website, article, [Impact of health conditions requiring hospitalisation on earnings, employee status and benefits receipt, England: April 2014 to December 2022](#)