

Article

# Disability pay gaps in the UK: 2021

Earnings statistics for disabled and non-disabled employees in the UK, using regression analysis to provide more insight into factors that affect pay.

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# 1 . Main points

- The disability pay gap, the gap between median pay for disabled employees and non-disabled employees, was 13.8% in 2021 and 14.1% in 2019 prior to the coronavirus (COVID-19) pandemic; this gap has widened slightly since 2014 when disabled employees earned 11.7% less than non-disabled employees.
- The disability pay gap has consistently been wider for disabled men than for disabled women; in 2021 median pay for disabled men was 12.4% less than non-disabled men, and median pay for disabled women was 10.5% less than non-disabled women.
- In 2021, median pay for disabled employees living in Wales was 11.6% less than non-disabled employees, which was the narrowest of the four UK nations; Scotland had the widest disability pay gap at 18.5%.
- Disabled employees who were limited a lot in their day-to-day activities consistently had a wider pay gap to non-disabled employees without a long-lasting health condition (19.9% less in 2021) than disabled employees whose day-to-day activities were limited a little (12.1% in 2021).
- Disabled employees with autism as their main impairment had a wider pay gap in 2021 than disabled people with other types of main impairment, having a median pay 33.5% less than non-disabled employees without a long-lasting health condition.
- Adjusting for personal and job characteristics narrows the pay gap seen between most groups of disabled employees and non-disabled employees without a long-lasting health condition - the largest narrowing was seen for disabled employees with autism as their main impairment, where the adjusted pay gap was 9.9% compared with a non-adjusted pay gap of 33.5%.

## 2 . Analysis of disability pay gaps

The data analysed in this article are from the Annual Population Survey (APS) from 2014 (the earliest full year using the [Government Statistical Service \(GSS\) harmonised "core" definition](#)) to 2021. Each year covers January to December. The last two years cover the coronavirus (COVID-19) pandemic and therefore contain its effect on the UK economy.

The coronavirus pandemic also affected [APS data collection in 2020 and 2021](#). APS responses published from 15 July 2021 have been reweighted to new populations using growth rates from HM Revenue and Customs' (HMRC's) Real Time Information (RTI). This reweighting considers different trends during the coronavirus pandemic. Our [Impact of reweighting on Labour Force Survey key indicators, UK: 2020 article](#) explains the reweighting methodology, and why it gives improved estimates of both rates and levels. More information can be found in [Section 10: Data sources and quality](#).

### Definition of disability pay gap

In this article, the headline measure for the disability pay gap uses APS data and is calculated as the difference between the median hourly earnings of non-disabled employees and disabled employees as a proportion of median hourly earnings of non-disabled employees.

Though this analysis makes use of the APS, the primary source of data for earnings analysis in the UK is the Annual Survey of Hours and Earnings (ASHE). As a business survey, ASHE collects information on only a limited range of personal characteristics and does not collect information on employees' disability status.

A positive disability pay gap shows that the median hourly earnings for disabled employees are less than the median hourly earnings of non-disabled employees. Conversely, a negative pay gap shows disabled employees earn more, on average, than non-disabled employees. Using this terminology ensures consistency with existing analysis of different pay gaps.

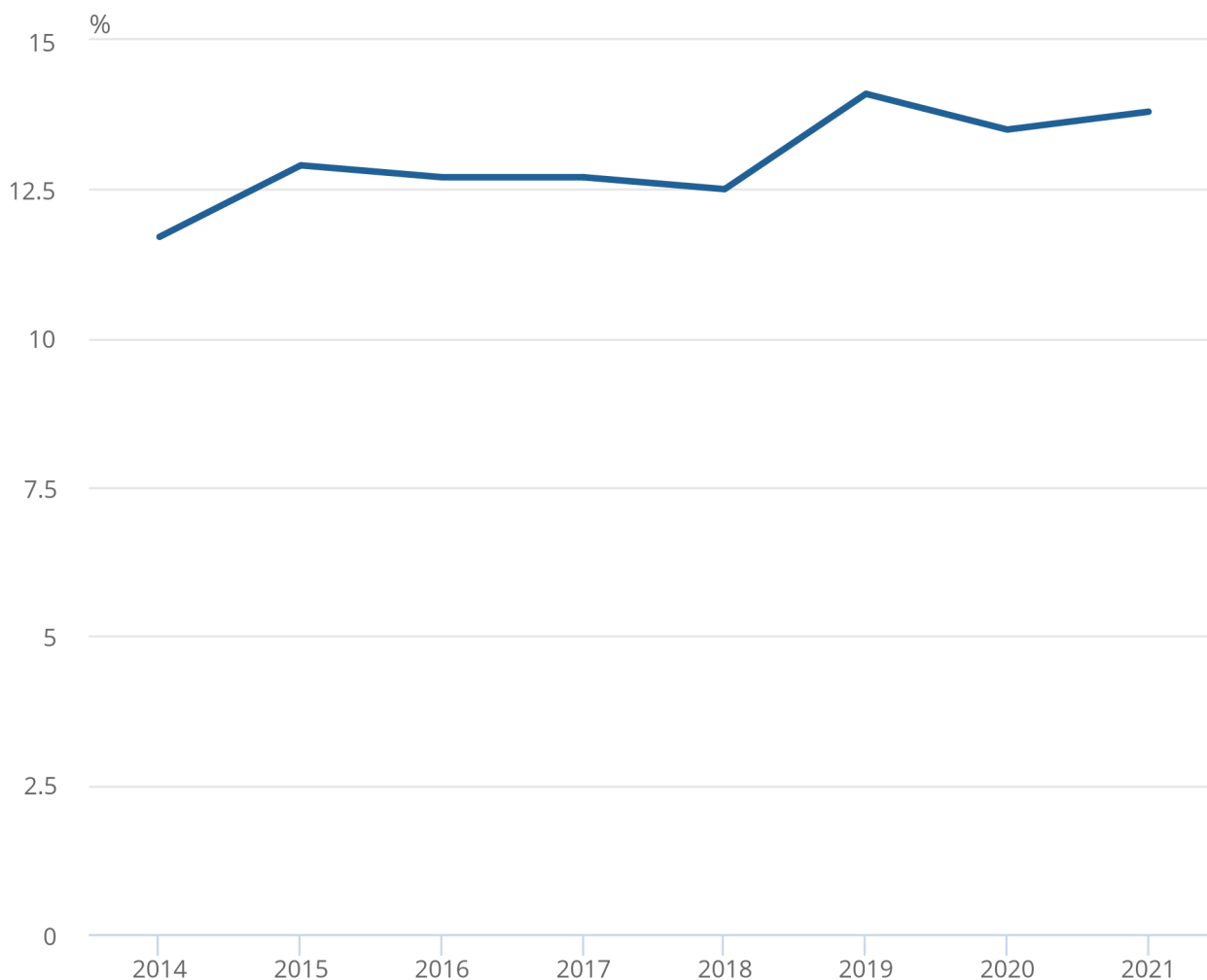
## Disability pay gap over time

Figure 1: The disability pay gap was 13.8% in 2021

Pay gap between disabled and non-disabled employees, UK, 2014 to 2021

Figure 1: The disability pay gap was 13.8% in 2021

Pay gap between disabled and non-disabled employees, UK, 2014 to 2021



Source: Office For National Statistics - Annual Population Survey

In 2021, the disability pay gap was 13.8% with disabled employees earning a median of £12.10 per hour and non-disabled employees a median of £14.03 per hour. In 2019, prior to the coronavirus pandemic, this gap was 14.1% with disabled employees earning a median £10.87 per hour and non-disabled employees £12.66 per hour.

The disability pay gap has widened slightly compared with 2014 when disabled employees' median earnings (£9.71 per hour) were 11.7% less than non-disabled employees' (£11.00 per hour) (Figure 1).

## 3 . Pay gaps by sex

### Figure 2: The disability pay gap was consistently wider for men than for women

Pay gap between disabled and non-disabled employees by sex, UK, 2014 to 2021

**Download the data**

[.xlsx](#)

In 2021, median pay for disabled women (£11.51 per hour) was 10.5% less than non-disabled women (£12.86 per hour). Median pay for disabled men (£13.25 per hour) was 12.4% less than non-disabled men (£15.12 per hour) (Figure 2).

More information on the overall [Gender pay gap in the UK: 2021](#) is available from the Annual Survey of Hours and Earnings (ASHE). Our [blog examining "Simpson's paradox"](#) shows that results for sub-groups of the population often do not appear to reconcile with results for the total population when considering the gender and other pay gap estimates.

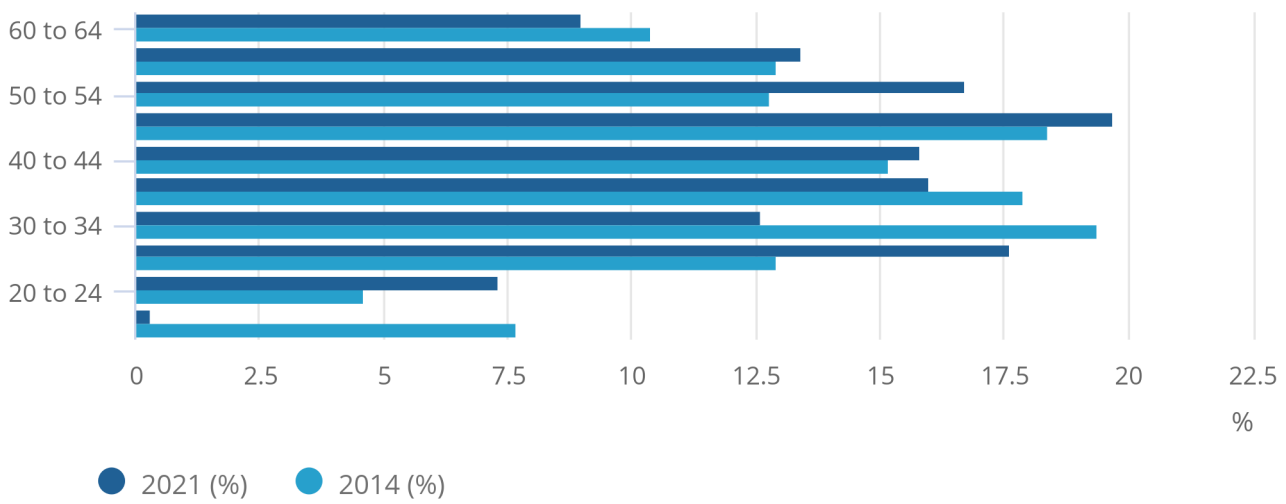
## 4 . Pay gaps by age

Figure 3: How the disability pay gap changed between 2014 and 2021 varied by age group

Pay gap between disabled and non-disabled employees by age group, UK, 2014 and 2021

### Figure 3: How the disability pay gap changed between 2014 and 2021 varied by age group

Pay gap between disabled and non-disabled employees by age group, UK, 2014 and 2021



Source: Office for National Statistics – Annual Population Survey

Disabled employees aged 16 to 19 years have seen their pay gap decrease from earning 7.7% less than non-disabled employees in 2014 to 0.3% less in 2021 (£7.67 per hour for disabled employees compared with £7.69 per hour for non-disabled employees) (Figure 3).

Pay for this age group is more likely to be affected by changes to the minimum wage legalisations than other age groups, which could help explain the reduction in this gap.

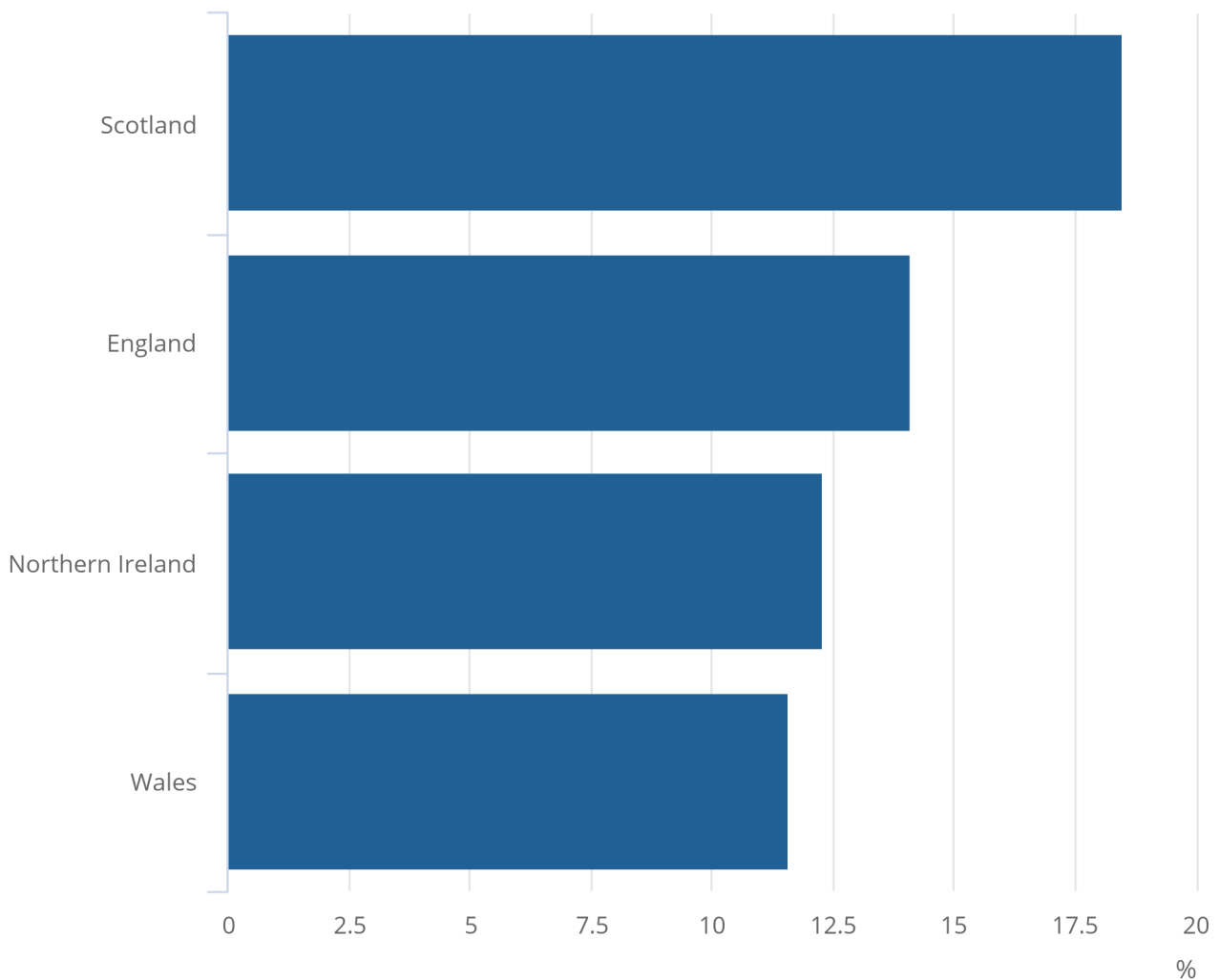
## 5 . Pay gaps by UK country

Figure 4: Scotland had the widest disability pay gap of any UK country in 2021

Pay gap between disabled and non-disabled employees by country, UK, 2021

Figure 4: Scotland had the widest disability pay gap of any UK country in 2021

Pay gap between disabled and non-disabled employees by country, UK, 2021



Source: Office for National Statistics – Annual Population Survey

Analysis in Section 5 refers to area of residence not area of employment. Some employees in our data may work in one area of the country but live in another. This will affect some areas more than others, for example employees living in the South East but working in London.

## Disability pay gap by UK country

In 2021, Scotland had the largest disability pay gap of UK countries, with disabled employees' median pay (£11.54 per hour) 18.5% less than non-disabled employees (£14.16 per hour).

Median earnings for disabled employees living in England (£12.17 per hour) were 14.1% less than non-disabled employees (£14.16 per hour).

In Northern Ireland, disabled employees had a median pay (£11.19 per hour) 12.3% less than non-disabled employees (£12.76 per hour).

Wales had the narrowest pay gap, where disabled employees' median earnings (£11.25 per hour) were 11.6% less than non-disabled employees (£12.73 per hour) (Figure 4).

## Disability pay gap by English region

Estimates for the regions of England are available in the [accompanying dataset](#).

## 6 . Pay gaps by impairment severity and type

The pay gap between disabled and non-disabled employees differed by the severity of disabled employees' impairment. Disabled employees whose day-to-day activities were limited a lot experienced a wider pay gap to non-disabled employees than disabled employees whose day-to-day activities were limited a little.

The comparison group for impairments is non-disabled employees without a long-lasting health condition. More information on how we define impairment is available in [Section 9: Glossary](#).

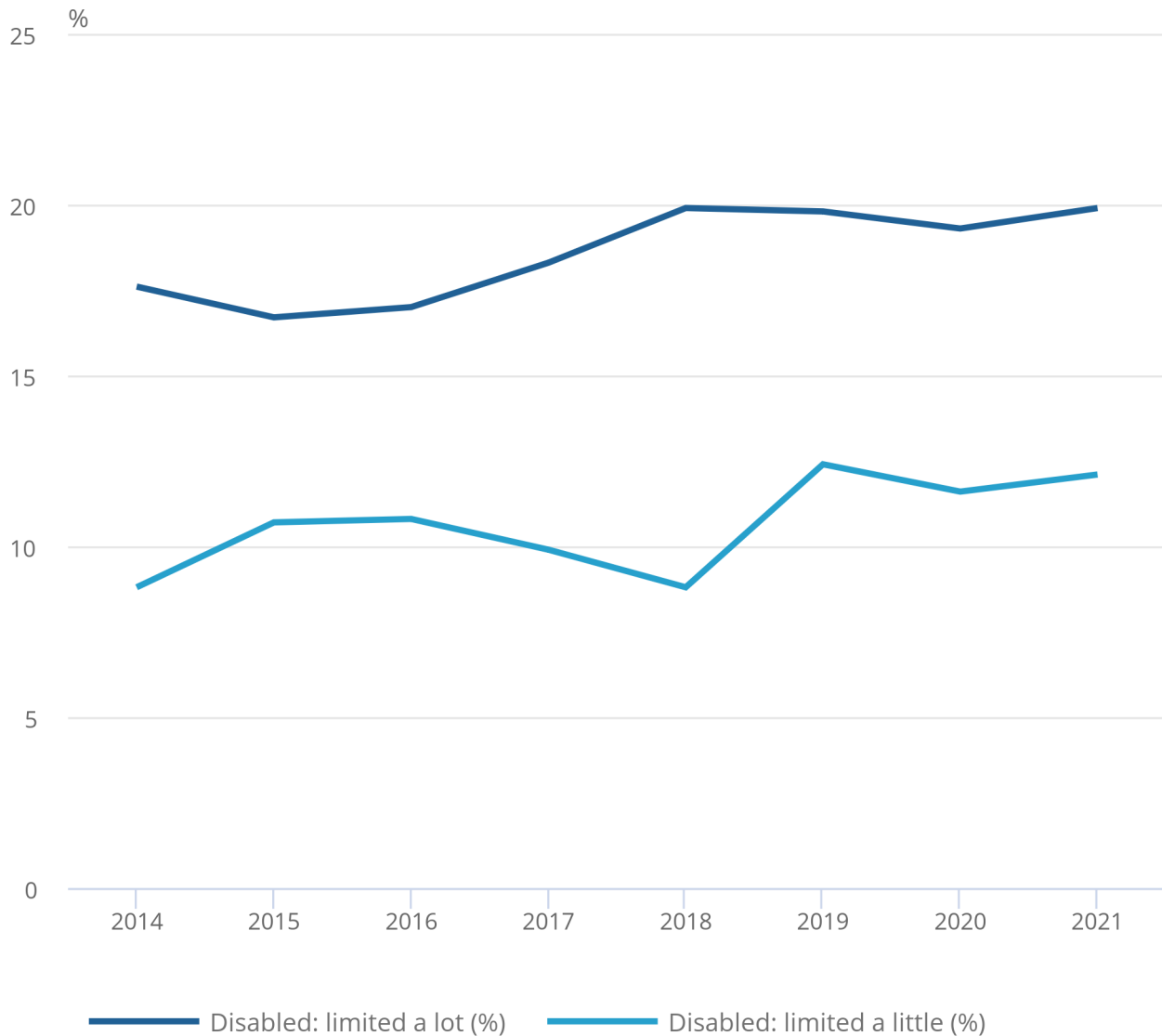


**Figure 5: Disabled employees who were limited a lot in day-to-day activities experienced a wider pay gap to non-disabled employees than those who were limited a little**

Pay gap between disabled and non-disabled employees by impairment severity, UK, 2014 to 2021

Figure 5: Disabled employees who were limited a lot in day-to-day activities experienced a wider pay gap to non-disabled employees than those who were limited a little

Pay gap between disabled and non-disabled employees by impairment severity, UK, 2014 to 2021



Source: Office for National Statistics – Annual Population Survey

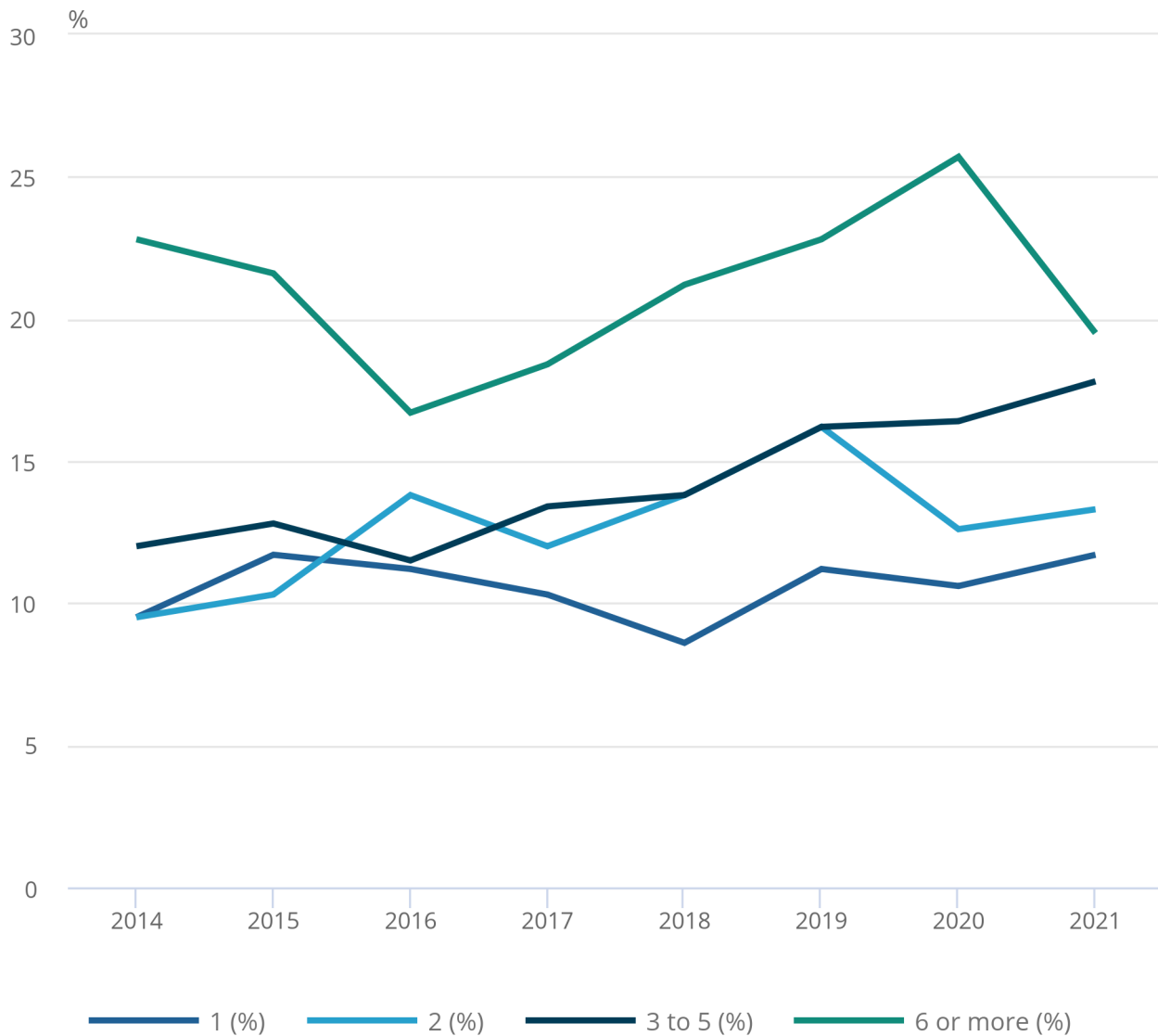
In 2021, non-disabled employees with no long-lasting health conditions had a median pay of £14.03, while disabled employees whose day-to-day activities were limited a little had a median pay of £12.33 (12.1% less) and those who were limited a lot £11.24 (19.9% less) (Figure 5).

## Figure 6: Disabled employees who had six or more impairments experienced a wider pay gap

Pay gap between disabled and non-disabled employees by number of impairments, UK, 2014 to 2021

### Figure 6: Disabled employees who had six or more impairments experienced a wider pay gap

Pay gap between disabled and non-disabled employees by number of impairments, UK, 2014 to 2021



Source: Office for National Statistics – Annual Population Survey

#### Notes:

1. In 2020, Autism was added to the list of impairment asked on the Annual Population Survey (APS), therefore it is now possible for some people to be allocated to a different group based on this set of response options, for example, having one impairment on the old question and now having two.

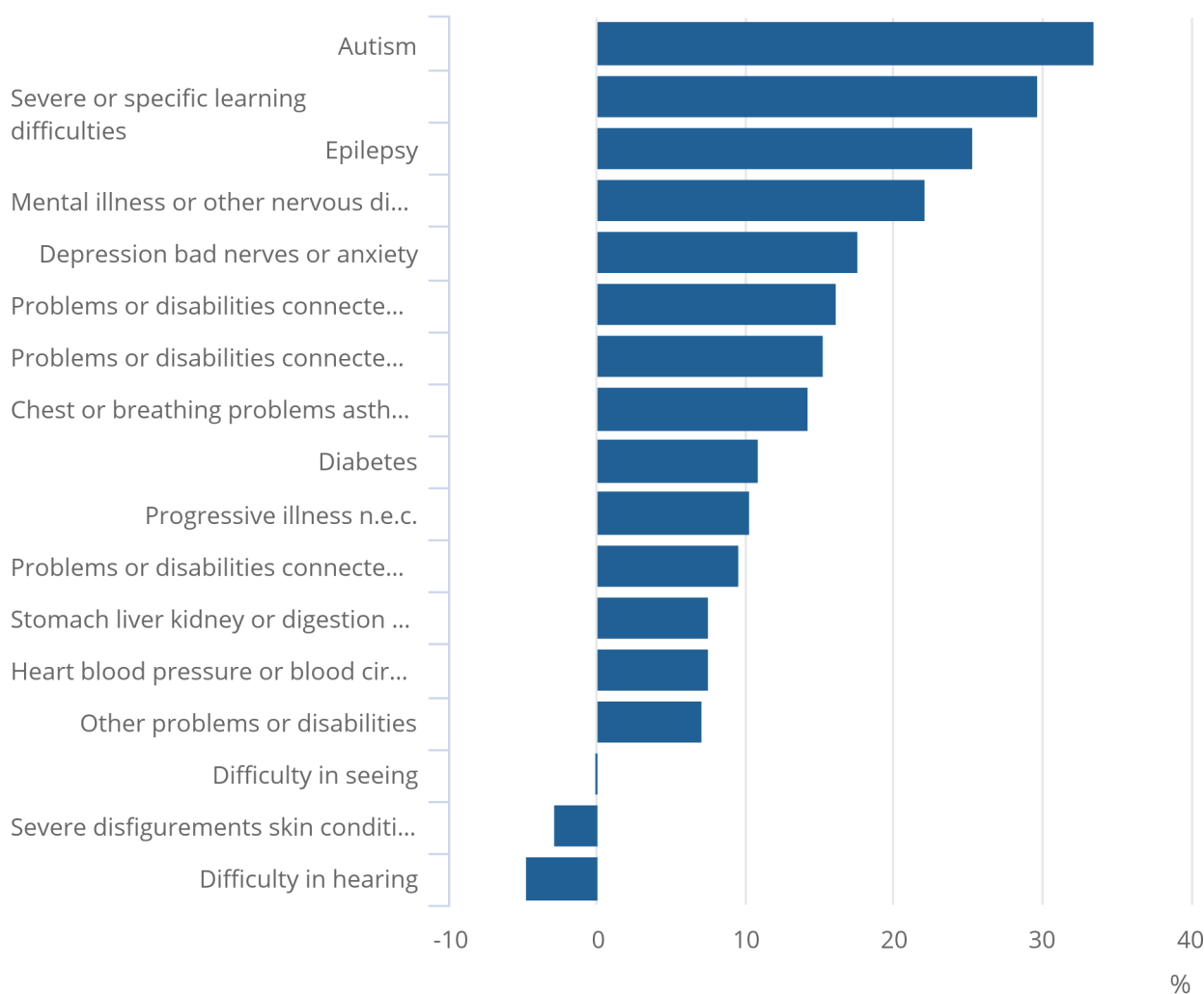
Similarly, median pay for disabled employees decreased with the number of impairments they reported. Those with one impairment had a median pay of £12.39 per hour, those with two impairments at £12.16 per hour, those who have three to five impairments at £11.53 per hour, and those with six or more impairments at £11.30 per hour (Figure 6).

**Figure 7: Disabled employees whose main impairment was autism had the widest pay gap to non-disabled employees in 2021**

Pay gap between disabled and non-disabled employees by main impairment, UK, 2021

Figure 7: Disabled employees whose main impairment was autism had the widest pay gap to non-disabled employees in 2021

Pay gap between disabled and non-disabled employees by main impairment, UK, 2021



Source: Office for National Statistics – Annual Population Survey

Notes:

1. Sample sizes the estimates presented in this figure are based on are available in the [accompanying dataset](#)

The disability pay gap varied depending on the type of main impairment the disabled employee reported having.

In 2021, disabled employees with autism had the largest pay gap to non-disabled people with no long-lasting health conditions, with their median pay being 33.5% less. Those with severe or specific learning difficulties (29.7% less), epilepsy (25.4% less), or mental illness or other nervous disorders (22.1%), also had a large pay gap to non-disabled employees with no long-lasting health conditions. (Figure 7).

Respondents to the Annual Population Survey (APS) could select multiple impairments and were asked to identify their main impairment. However, not all respondents were able to isolate a single main impairment, so the base population is slightly different to the other impairment questions.

## 7 . Modelling the factors that affect pay

The pay someone earns depends on multiple factors, such as their occupation or where their job is in the UK. For example, those living in London sometimes have higher pay to compensate for the higher cost of living in London.

If these factors vary by disability status and by impairment type for disabled employees, then the disability pay gaps observed in the previous sections might result from differences in these characteristics. More information on how these characteristics vary between disabled and non-disabled people can be found in [our Outcomes for disabled people in the UK: 2021 article](#).

For example, earlier sections showed that the disability pay gap differed by age and sex. Therefore, it is helpful to try and isolate the effect that disability has on pay, after controlling for potentially pay-determining characteristics such as occupation, qualification level or age.

Regression is a statistical technique that allows us to examine this by modelling the relationship between the dependent variable (for example, hourly pay) and such potential explanatory variables (for example, disability, occupation and so on).

Using a regression model in this way allows us to estimate the effect of disability, if all other characteristics were the same between different groups of people.

The model used to analyse pay on 2021 data is different from the model used to analyse pay on data in [our Disability pay gaps in the UK: 2018 article](#). For more information on the model used in 2021, see [Section 10: Data sources and quality](#).

## **Controlling for factors that influence the disability pay gap**

Accounting for pay-determining characteristics using a regression model influences the pay gaps observed, with a narrowing of pay gaps between disabled employees with most main impairment types and non-disabled employees with no long-lasting health conditions.

This suggests that differences in the average characteristics of disabled people with different main impairment types were influencing the raw disability pay gap.

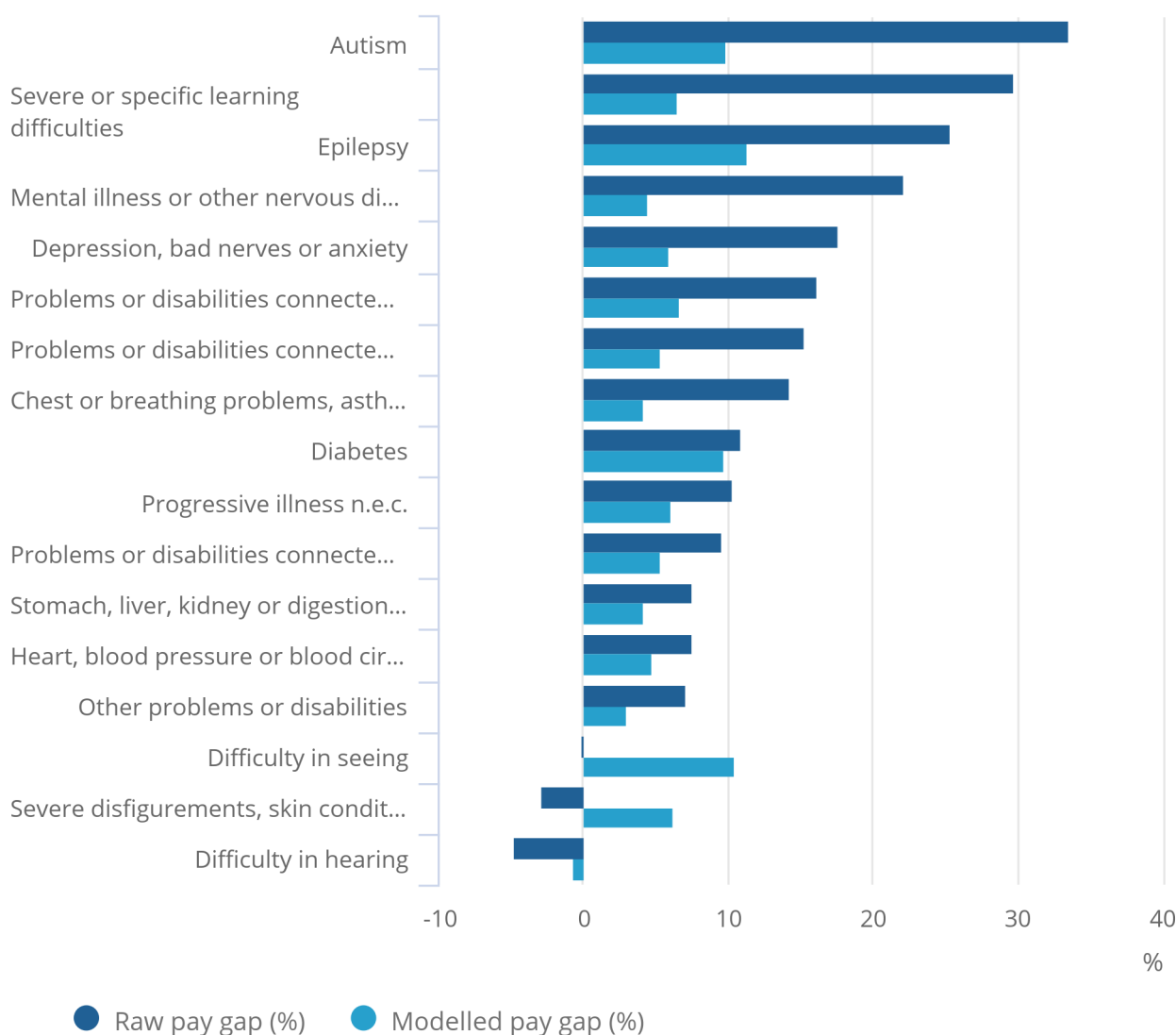
There are, however, some main impairment types where these characteristics understated the extent that pay differed between the two groups (Figure 8).

**Figure 8: Disabled employees with autism (as their main impairment type) had the largest narrowing in their pay gap to non-disabled employees after controlling for pay determining characteristics**

Raw and modelled pay gaps, UK, 2021

Figure 8: Disabled employees with autism (as their main impairment type) had the largest narrowing in their pay gap to non-disabled employees after controlling for pay determining characteristics

Raw and modelled pay gaps, UK, 2021



Source: Office for National Statistics – Annual Population Survey

Disabled employees with autism (as their main impairment type) had the largest reduction in the pay gap after controlling for different characteristics which may affect pay (for example, occupation, qualification level or age). Please see the [accompanying dataset](#) for a full list of characteristics controlled for in the model. The adjusted pay gap shows that median pay for this group was 9.9% less than non-disabled employees with no long-lasting health conditions; a reduction of 23.6 percentage points from 33.5% less when non-adjusted.

By contrast, disabled employees with difficulty in seeing, and with severe disfigurements, skin conditions or allergies (as their main impairment type) saw an increase in their pay gaps after controlling for personal characteristics. The pay gap for disabled employees with difficulties in seeing increased from 0.0% to an adjusted 10.5%, and for disabled employees with severe disfigurements, skin conditions or allergies increased from negative 2.8% to an adjusted 6.2% (Figure 8).

## Factors that influence the disability pay gap

To see the effect of each different characteristic controlled for on the disability pay gap, we predict for all employees what their pay would be, controlling for each characteristic in turn and subsequently calculating the pay gap.

For example, calculating the pay gap if all employees worked in the professional occupations, then if all employees worked in the professional occupations and had a degree. This continues until we have controlled for all variables in the model. Figure 9 shows the cumulative effects of the sequential controlling used.

The order variables added to the regression model were based on the affect the characteristic had on the raw pay gaps observed (see Sections 2 to 6), as well as evidence from other studies on factors that might influence pay. A different order of adding these variables may lead to different contributions to those shown in this article. See [Section 10: Data sources and quality](#) for more information on the regression model.

### **Figure 9: For disabled employees of almost all main impairment types, controlling for occupation contributed most to adjusting their pay gap with non-disabled employees**

Cumulative effect of adjusting, percentage points, UK, 2021

#### Notes:

1. The modelling effect shown between the raw pay gap and the adjusted pay gap from the regression model can be interpreted as the amount of the pay gap which is not explained by the variables included in the model.
2. The data for other main impairment types are available in the [accompanying dataset](#).

#### Download the data

[.xlsx](#)

## Controlling for occupation

For most main impairment types, differences in occupation contributed to most of the narrowing of the disability pay gap. This fits with [recently published data in our Outcomes for disabled people in the UK: 2021 article](#) which showed that disabled adults were less likely to be employed in higher-paid occupations (managers, directors and senior officials, and professional occupations) than non-disabled adults.

This most notably affected disabled employees with autism as their main impairment type or those with severe or specific learning difficulties. The pay gap decreased by 13.4 percentage points and 15.7 percentage points respectively when controlling for differences in occupation.



## Controlling for qualification level

The highest level of qualification was also a characteristic that affected the disability pay gap.

Those with a degree or equivalent tend to have higher median pay than those with lower levels of qualifications. [Recently published data in our Outcomes for disabled people in the UK: 2021 article](#) shows that the percentage of disabled adults aged 22 to 64 years not currently in education who had a degree was lower than non-disabled adults with this percentage varying by impairment type.

For disabled employees with a severe or specific learning difficulty, controlling for qualification level decreased the pay gap by 9.3 percentage points, and those with difficulty in hearing had a decrease of 0.4 percentage points. By contrast, for disabled employees with difficulty in seeing, controlling for qualification level increased the pay gap by 5.6 percentage points.

The effect of controlling for qualification level was not as large as for occupation. This might be because first controlling for occupation removes some of the effect of qualification level. There is a correlation between occupations and qualifications, as some occupations cannot be accessed without the relevant qualification, for example being a doctor needs a medical degree.

## Controlling for geography

The model adjusts the disability pay gap to remove any geographic disparities in pay which may exist in the UK. For example, using this data, median pay in the North East of England (when controlling for all other factors) was 19% less than in London.

The latest available [disability data from the Family Resources Survey \(XLS, 137KB\)](#) from the Department for Work and Pensions shows that disability prevalence tends to vary by region. In England, it ranges from 31% in the North East to 15% in London in 2020 to 2021, so it would be expected that controlling for geography would tend to decrease the disability pay gap.

Most of the main impairment types did show a narrowing of their disability pay gap once controlling for geography. However, the magnitude of this tended to be small, at around a 1 percentage point narrowing.

This might again be because the effect of geography has already been accounted for in the previous controls for occupation and qualification level, given the type of occupations that likely vary by geography (for example more [financial and insurance activities related occupations in London](#)), or any regional differences in people having a degree.

## Controlling for age

The age profile of the disabled population may also be a factor that influences the disability pay gap, with this age profile likely to vary by the main impairment type of disabled employees (Figure 10).

After controlling for all other factors, median pay increased by 3.8% per year older in our data. Therefore, any large differences in age profiles of the disabled and non-disabled populations would be expected to affect the disability pay gap.

[Data from the Department of Work and Pensions' Family Resources Survey \(XLS, 137KB\)](#) shows that the prevalence of disability tends to be higher among older age groups, with the likely effect of increasing the median pay for disabled employees as a whole compared with non-disabled employees.

There were differences in the age profile of disabled employees in our data when considering these disabled employees' main impairment type (Figure 10).

### **Figure 10: The age distribution of disabled employees was different depending on their main impairment type**

Age distribution of each main impairment type in the working age population (16 to 64 years), % 2021, UK

## Download the data

[.xlsx](#)

For example, in the data used for this modelling, around half of disabled working-age adults with heart, blood pressure or blood circulation problems (as their main impairment type) were aged 50 years and over, while for non-disabled adults without a health condition this was a quarter.

Controlling for age reduces the positive impact that older age generally has on the increase in the median pay for this group of disabled employees. As such controlling for age (after controlling for the previous variables) increases the pay gap for this group by 5.8 percentage points. For the majority of main impairment types, controlling for age increased the disability pay gap.

By contrast, nearly three in five disabled working-age adults with autism were aged under 30 years in our data. Controlling for age in the model decreased their pay gap with non-disabled employees by 10.4 percentage points.

For full results of the modelling undertaken, please see the [accompanying dataset](#).

## 8 . Disability pay gaps data

### [Raw pay gaps by disability](#)

Dataset | Released 25 April 2022

Raw pay gaps and median pay by disability and other personal characteristics in the UK, 2014 to 2021, using data from the Annual Population Survey.

### [Regression outputs: disability pay gaps](#)

Dataset | Released 25 April 2022

The model coefficients for models at a UK and subnation level, including the adjusted pay gap related information.

## 9 . Glossary

### Disability

To define disability in this publication we refer to the [Government Statistical Service \(GSS\) harmonised "core" definition](#). This identifies "disabled" as a person who has a physical or mental health condition or illness that reduces their ability to carry out day-to-day activities and has lasted, or is expected to last, 12 months or more.

The GSS definition is designed to reflect the definitions that appear in legal terms in the [Disability Discrimination Act \(DDA\) 1995](#) and the subsequent [Equality Act 2010](#).

The respondent is asked the GSS-harmonised questions in the survey, meaning that disability status is self-reported.

## Impairment

Impairment is defined as any physical or mental health conditions or illnesses lasting, or expected to last, 12 months or more. Respondents were presented with a list of impairments and then asked to select all and subsequently their "main health problem". For further details see [Volume 3: Detail of Labour Force Survey and Annual Population Survey variables](#).

From January 2020 onwards, the list of impairments in the Annual Population Survey (APS) changed because of the addition of "Autism (including Autism Spectrum Condition, Asperger's syndrome)" as a possible response option. As the response options changed in January 2020, comparison with previous years is not recommended.

The impairments or condition categories compared in this release relate to the categories within the question in the survey. The exception is speech impediment, which has been grouped with the "other" category because of low sample size.

## Occupation

Occupations are classified using the Standard Occupation Classification (SOC). For data from 2014 to 2020, the 2010 version is used. For 2021 data, the 2020 version is used.

For details of the general nature of qualifications, training and experience for occupations, see Table 2 of [SOC 2010 Volume 1: structure and descriptions of unit groups](#) and Table 2 of [SOC 2020 Volume 1: structure and descriptions of unit groups](#). Definitions of these and other labour market variables are also available in [A guide to labour market statistics](#).

## Severity

The ability of disabled people to carry out day-to-day activities is self-reported as "limited a lot" or "limited a little" by their impairment. Respondents were asked: "Does your condition or illness reduce your ability to carry out day-to-day activities?" with the responses, "yes, a lot" and "yes, a little" being taken to indicate severity of disability.

## 10 . Data sources and quality

## Data sources

Though this analysis makes use of the [Annual Population Survey \(APS\)](#), the primary source of data for earnings analysis in the UK is the [Annual Survey of Hours and Earnings \(ASHE\)](#). As a business survey, ASHE collects detailed information on the composition and distribution of earnings among employees. However, as a business survey, it collects only a limited range of personal characteristics regarding individual employees. This limits its usefulness in analysing earnings, for instance, by education and/or by different protected characteristics including ethnicity and disability.

It is accepted that the accuracy and detail of earnings information captured by the APS falls short of that obtained by ASHE. The greater range of personal and household characteristics broaden its potential uses. Part of this is down to the sample size being smaller. The achieved sample for the APS earnings questions is usually between 50,000 and 80,000 respondents, compared with approximately 150,000 respondents for ASHE. This limited sample size then restricts the extent to which we can perform multivariate analysis of earnings on the APS, particularly where the variables of interest have many categories.

Earnings analysis using the APS has only recently been possible when an appropriate weight became available. The income weight is calculated in a similar way to the Labour Force Survey (LFS) income weight. More information on this can be found in [Volume 6 of the Labour Force Survey user guide](#).

For 2014 to 2019, the main differences are that there are six calibration groups used to calculate the APS income weight, while for the LFS income weight there are four. As part of the impact of the coronavirus (COVID-19) pandemic on the APS data collection, the weighting methodology for the APS has been updated to overcome any biases introduced. Details of these changes can be found in [our Impact of reweighting on Labour Force Survey key indicators, UK: 2020 article](#).

Earnings data collected from the APS are known to be subject to greater recall error than data collected from ASHE, a business survey. ASHE is thought to capture more accurate earnings information as employers can consult payroll records when responding to the survey.

In comparison, earnings information collected in the APS is self-reported and as such is likely to be subject to a higher degree of recall error. This sometimes causes implausible levels of pay, for example, less than £1 per hour or more than £100 per hour. Even though medians are more robust to outliers than means, as a form of outlier treatment we have removed the top 1% and bottom 2% of the pay distribution from our data, to give more reliable and accurate estimates.

## Regression model

The regression model used to analyse pay on 2021 data is different from the model used to analyse [pay on data in our Disability pay gaps in the UK: 2018 article](#).

The form of the model has changed from Ordinary Least Squares Regression to Quantile Regression, to allow for a comparison between the modelled estimates and the raw pay gaps. These changes mean that the models aren't comparable between years.

The 2021 model includes more factors (marital status and whether they have dependent children), which could affect pay to improve the fit of the model. The chosen exploratory variables are known to affect pay directly (for example, occupation) or indirectly (for example, having a dependent child might affect the choice of occupation).

The variables included in the model (including the APS variable name) are:



- log of hourly pay – log(hourpay)
- disability status – disea
- main impairment – health20
- ethnicity – ethukeul
- country of birth – cryox7
- sex
- occupation – sc10mmj
- highest qualification – hiqul15d
- age and age squared
- region - gor9d/nuts163
- marital status – marsta
- working pattern – fpt
- sector of employment – sector
- dependent children – fdpch19 and relhf

The order variables added to the regression model were based on the affect the characteristic had on the raw pay gaps observed (see Sections 2 to 6), as well as evidence from other studies on factors that might influence pay. A different order of adding these variables may lead to different contributions to those shown in this article.

For the UK and Great Britain level models, the region variable uses the English regions and three nations. For the subnational models, we have adjusted to the Nomenclature of Territorial Units for Statistics: NUTS 3 level of geography.

Given that most of the variables are categorical variables, we have included them as dummy variables. We must do this and exclude one of the levels of the variables to avoid perfect multi-collinearity. Collinearity is where one of the variables can be derived from the rest of the variables in the model. For example, if our categorical variable has three levels, A, B, and C, then if our model is:

$$y = \text{constant} + A + B + C$$

then A can be derived if B and C are set to zero. In this example A is our reference level.

Reference levels were selected if they satisfy one of two criteria. Either they had the highest proportion of respondents in that category, for example, disability status and occupation, or they are natural choice that would aid interpretation, for example, marital status and qualification status. The categories chosen as reference levels are indicated by the notation of "No data, reference level" in the [accompanying dataset](#).

The dependent variable is the log of hourly pay. This is because the distribution of pay is positively skewed. There is a higher density in the lower values of pay than in the higher values of pay. Taking the log of the hourly pay helps to make the distribution more symmetric and like a normal distribution so the assumptions used in regression are more valid. The rest of the variables in the model are the independent variables.

Both age and age squared are used in the model to approximate for a non-linear relationship between age and log(pay). A linear relationship between age and pay would infer that, for each year old a person is, their pay would on average increase by the same amount. This is not the case in the APS data.

Some of the independent variables might interact with each other. Interaction means that effect of one variable is dependent on the values of a second variable. When this happens, we add a term to the model, where the two variables of interest are multiplied. For example, if variable  $x_1$  interacts with variable  $x_2$  then the model is as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2$$

Adding interaction terms to a model drastically changes the interpretation of all the coefficients in the model. If we have no interaction, then  $\beta_1$  would be interpreted as the unique effect that  $x_1$  has on  $y$ . But with the interaction, the effect that  $x_1$  has on  $y$  is different dependent on the value of  $x_2$ . The effect of  $x_1$  is now not limited to  $\beta_1$  but also depends on the values of  $\beta_3$  and  $x_2$ . The effect of  $x_1$  is represented by everything that is multiplied by  $x_1$  in the model.

This is:

$$\beta_1 + \beta_3 x_2$$

$\beta_1$  is now interpreted as the effect of  $x_1$  on  $y$  only when  $x_2=0$ . For our model we have interacted:

- disability and main impairment
- sex with working pattern
- ethnicity with country of birth

This year we have updated the model estimation methodology to Quantile Regression (QR) rather than Ordinary Least Squares regression (OLS).

Ordinary Least Squares is a model of the form:  $y = X\beta + \epsilon$  Whereas Quantile Regression is a model of the form:

$$Q_\tau(y) = x\beta_\tau + \epsilon$$

$Q$  is the quantile function. A quantile  $q$ , for the probability  $\tau$  is a value such that:

$$p(y \leq q) = \tau$$

Or

$$Q(\tau) = q$$

The median is the quantile where  $\tau = 0.5$  (or 50%).

Using QR means that we can talk about the effect a variable has on median pay, with OLS we can only talk about the effect in terms of means.

We need to take some care when interpreting the coefficients for each variable. As the dependent variable is log transformed, the coefficient is the effects on the log-scale of the variable. To interpret the coefficient in a meaningful way we take the exponential of the coefficient, which can then be interpreted as the percentage change in the level of median pay.

For example, if the estimate of the coefficient of  $x_1$  is 0.1 then the effect on pay is:

$$\exp(0.1) = 1.105$$

which shows that each additional unit of  $x_1$  increase pay by 10.5% with all other variables held constant. There are caveats that must be considered when interpreting estimates using the QR method. For example, predictor variables will have been excluded from the model because of their unavailability in the data, such as family background. These excluded variables will influence the explanatory power of the model. It might be possible that the functional form of the model could be improved, for example, the relationship between log (hourly pay) and age, which would improve the accuracy of our estimates.

The full outputs for each regression model are provided in the datasets.

## Pay gaps methodology

### Raw pay gaps

Raw pay gaps are calculated as follows:

$$RawPayGap = \frac{median(Disabled) - median(Non - disabled)}{median(Non - disabled)} \times 100$$

### Adjusted pay gaps

Adjusted pay gaps are calculated as follows:

Adjusted Pay Gap

$$= 100x(1 - \exp(\beta Disability + \beta impairment + \beta Disability : impairment))$$

## 11 . Related links

### [Gender pay gap in the UK: 2021](#)

Bulletin | Released 26 October 2021

Differences in pay between women and men by age, region, full-time and part-time, and occupation.

### [Ethnicity pay gaps: 2019](#)

Article | Released 12 October 2020

Earnings and employment statistics for different ethnic groups, using regression analysis to provide more insight into factors that affect pay.

### [Understanding the gender pay gap in the UK](#)

Article | Released 17 January 2018

This analysis builds on the raw gender pay gap, using regressions techniques to provide more insight into the factors that affect men's and women's pay.

### [Income and earnings statistics guide](#)

Methodology | Released 2 March 2022

Explains the relationship between income and earnings data and outlines the statistics produced by the Office for National Statistics, Department for Work and Pensions and HM Revenue and Customs.

### [Impact of reweighting on Labour Force Survey key indicators, UK: 2020](#)

Article | Released 8 July 2021

Indicative estimates of the LFS reweighting methodology on key indicators for January to March 2020 to October to December 2020.

### [Coronavirus and the effects on UK labour market statistics](#)

Article | Released 6 May 2020

How the global outbreak of coronavirus (COVID-19) and the wider containment efforts are expected to affect the UK labour market, providing some of the practical challenges that the Office for National Statistics is likely to face.