

# **Generation of Osteoarthritis Prevalence Estimates in England: Technical Report**

**Prepared for Arthritis UK**

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## Executive summary

| Key description of the report                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This report presents local level prevalence estimates for hip and knee osteoarthritis (OA) for local authorities and integrated care boards (ICBs) in England.                                                                                                                                                                    |
| This report provides hip and knee OA prevalence estimates at local level by biological sex at birth, age, education, IMD, smoking and BMI.                                                                                                                                                                                        |
| Data was drawn from Wave 10 of the English Longitudinal Study of Ageing (ELSA) which is an ongoing, nationally representative population-based longitudinal cohort of UK older adults. Local level prevalence estimates for local authorities and ICBs were produced using a previously validated synthetic generation procedure. |
| This technical report provides details of the analytical strategy to enable reproducibility in the future.                                                                                                                                                                                                                        |
| Summary of findings                                                                                                                                                                                                                                                                                                               |
| <b>Hip OA in England</b>                                                                                                                                                                                                                                                                                                          |
| Hip OA prevalence in England is estimated to be 15.6% (95% CI: 14.5% - 16.7%).                                                                                                                                                                                                                                                    |
| Moderate or severe hip OA prevalence in England is estimated to be 10.4% (95% CI: 9.5% - 11.3%). Severe hip OA prevalence is estimated to be 2.6% (95% CI: 2.1% - 3.1%).                                                                                                                                                          |
| <b>Knee OA in England</b>                                                                                                                                                                                                                                                                                                         |
| Knee OA prevalence in England is estimated to be 21.8% (95% CI: 20.5% - 23.1%).                                                                                                                                                                                                                                                   |
| Moderate or severe knee OA prevalence in England is estimated to be 14.7% (95% CI: 13.6% - 15.7%). Severe knee OA prevalence is estimated to be 3.9% (95% CI: 3.4% - 4.5%).                                                                                                                                                       |
| <b>For hip and knee OA:</b> Higher prevalence rates are found for women, older population groups, those with lower levels of education, higher levels of social deprivation, current or former smokers and those categorized as overweight or obese according to their BMI.                                                       |
| How can the data be used                                                                                                                                                                                                                                                                                                          |
| The prevalence estimates of this report can be used as benchmarks for hip and knee OA rates in England.                                                                                                                                                                                                                           |
| This report can provide key figures to inform service planning across health services and local government and drive public health policies.                                                                                                                                                                                      |
| Outputs from the stratified analyses can be used to develop strategies to target populations at higher risk in specific local areas.                                                                                                                                                                                              |

## 1. Introduction

Arthritis is a leading cause of disability in the UK and knowing the number and geographical distribution of people with MSK conditions is key to driving public health policy. Without accurate prevalence data, arthritis conditions risk being overlooked by service planners across health services and local government.

Arthritis UK is the UK's largest arthritis charity, changing lives through research, campaigning and support. Arthritis UK aims to raise the profile for MSK and arthritis conditions to both a general health and public health audience and ensure those working in MSK and arthritis can rely on robust data.

Arthritis UK previously produced prevalence estimates of hip and knee osteoarthritis (OA) based on data from 2012 which have been well used in policy and academic settings. This report builds on that data, presenting up to date local prevalence estimates for knee and hip OA in England and describing the methodology followed to produce these estimates. Analytics for Change was commissioned by Arthritis UK to generate these estimates at local authority and integrated care board (ICB) levels in England.

In **Section 3** we present prevalence overall estimates for hip and knee OA and its severity for England. These estimates are shown in **Section 4** at local authority and ICB levels based on 2023 boundaries.

Prevalence estimates were generated using data from the English Longitudinal Study of Ageing (ELSA) which is an ongoing, nationally representative population-based longitudinal cohort of UK older adults. Data was drawn from Wave 10 which took place between June 2021 and March 2023. For consistency, the methodological approach followed the one used to produce prevalence estimates in 2012 which was published by Adomaviciute and colleagues from the School of Public Health at Imperial College London in 2017 [1]. Details of the methodological steps followed can be found in **Section 2**.

## 2. Methodology

This section includes details of the methodology followed to generate prevalence estimates for hip and knee OA at the local level for England. Although the methodological approach followed the steps used to produce prevalence estimates in 2012, published by Adomaviciute and colleagues from the School of Public Health at Imperial College London (ICL) in 2017 [1], some steps needed to be adapted to the data available or refined to facilitate interpretability.

This section describes the data sources, how variables were identified and defined and the analytical approach.

### 2.1. Data sources

Prevalence estimates were generated using data from the English Longitudinal Study of Ageing (ELSA) [2]. Data was drawn from Wave 10 which took place between June 2021 and March 2023.

Geographical and IMD data from ELSA was accessed through UK Data Service SecureLab. Local authority data was extracted from ELSA which uses the post-2009 local authority geography. ELSA respondents were linked to ICB geography using their recorded post-2009 local authority code and the harmonised lookup described below. Where a local authority district (LAD) mapped to more than one ICB, the LAD code alone could not identify an individual respondent's ICB; these LADs were therefore apportioned between ICBs at the synthetic population stage using LSOA-level population shares, as described below.

Regarding ICB data, the available lookup to ICB23 was based on LAD23. However, the LAD code in ELSA uses the post-2009 local authority geography, so it was necessary to harmonise the ELSA geography to LAD23 before linking to ICB23. There was no direct lookup, but we were able to construct one as follows: ELSA post-2009 -> LAD11 to LAD21 -> LAD22 to LAD23 -> LAD23 to ICB23 -> LSOA-level population data.

We used the following data sources:

1. ELSA Local Authority District Post-2009 Boundaries Data Dictionary available [here](#). ELSA Data Catalogue.
2. LAD11 to LAD21 lookup available [here](#). Open Geography Portal from the ONS.
  - A. By joining to ELSA post-2009 data using ELSA and LAD11 codes and names, we were able to add LAD21 codes and names.
3. LAD22 to LAD23 lookup available [here](#). Open Geography Portal from the ONS.

- A. By joining to data from the previous step using LAD21 and LAD22 codes, we were able to add LAD23 codes and names.
- 4. LAD23 to ICB23 lookup available [here](#). LSOA (2021) to SICBL to ICB LAD (April 2023) Lookup in EN published by the Office of National Statistics (ONS) in 2024.
  - A. By joining to data from the previous step using LAD23 codes, we were able to add ICB23 names.
- 5. LSOA-level population data available [here](#). Lower layer Super Output Area population estimates (Accredited official statistics) published by ONS in 2025.
  - A. By joining to data from the previous step using LSOA codes, we were able to add LSOA-level population figures.

The LAD22 to LAD23 step did not introduce any further changes for the local authorities in the analysis so did not require a lookup. A small number of code changes occurred between the ELSA post-2009 geography and LAD11; these were checked manually against local authority names.

We found that there was a many-to-many relationship between LAD23 and ICB23: 12 LADs appeared in more than one ICB. However, the geographical share between the two ICBs was defined at LSOA level. Therefore, for the 12 LADs in question, we used population counts at LSOA level to apportion each LAD's synthetic population across its corresponding ICBs. For example, if a given LAD's LSOA population was split 70%/30% across two ICBs, then each synthetic population cell for that LAD was split in the same proportions and apportioned to the two ICBs accordingly.

## 2.2. Variables

### 2.2.1. Hip and knee osteoarthritis (main outcome)

Hip and knee OA was defined based on the definition used in the ICL report published in 2017 [1]. This definition was based on previous evidence that indicates that about 95% of those with hip pain can be considered as living with hip OA [3]. Individuals were identified as living with hip OA if they self-reported hip pain and/or they had a hip replacement. The exact same approach was followed for knee OA.

Relevant variables in ELSA referring to pain in the hip and knee: Pain is measured as **HEPAIN**: "Are you often troubled with pain? 1 Yes 2 No." This is the most straightforward question about pain and likely to have the highest response rates. This variable does not refer only to pain from OA; it could also be back pain or any other pain. We identified those with hip or knee OA based on the reported location of their pain.

Those that indicated that they did have pain were asked about the intensity and location of their pain. The specific variables referring to pain location that were used are:

- **HEPAWHI:** Part of body felt pain in: Hips
- **HEPAWKN:** Part of body felt pain in: Knees

As per the ICL report, if pain reports were missing, those that had a hip or knee replacement were considered as hip OA or knee OA respectively. To identify those with hip/knee replacement, we used the variables **HEJIAA1-HEJIAA4** which indicate whether respondents had joint replacement in their left/right knee/hip.

### 2.2.2. Severity

Two definitions of severity were used for this study. Severity was defined conservatively as those that reported their pain to be severe most of the time. Additional analyses were performed to consider a broader definition of severity that includes those that reported their pain to be moderate or severe most of the time. In ELSA, the variables as indicators of severity were how severe they rated their pain. Specifically, the HEPA variable which is a variable that only appears for participants who reported pain.

| **HEPAA:** How bad is the pain most of the time? Is it...

| 1. mild, 2. moderate, 3. or, severe

We produced prevalence estimates separately for severe and moderate or severe hip and knee OA. We recommend using the outputs that combine moderate and severe, but for reference we have also included the severe-only outputs.

### 2.2.3. Socio-demographic and health behaviours

Biological sex at birth, age, education, Index of Multiple Deprivation (IMD), smoking and body mass index (BMI) were included in models to identify empirical hip and knee OA. The sample was restricted to those aged 45 years and older. Education and IMD were considered as individual- and area-level indicators of socio-economic disadvantage following similar research in the field [4].

Some of these variables were re-coded to ensure sample sizes were appropriate and the output could be interpretable. For example, age groups were coded as 45-64, 65-74 and 75+. This decision was based on statistical, epidemiological and public health reasons. Using these cut-offs ensured sample sizes were balanced, and from a public health perspective the cut-off of 65 has been standardly used in similar research and facilitates comparison. Education was grouped into two levels (A-level or below vs. higher education). IMD data in Wave 10 is supplied as quintiles, which are defined from the least to the most deprived as below:

5      0.541 - 8.615 [20% least deprived]

|   |                                     |
|---|-------------------------------------|
| 4 | 8.616 - 14.237                      |
| 3 | 14.238 - 21.555                     |
| 2 | 21.556 - 33.251                     |
| 1 | 33.254 - 92.735 [20% most deprived] |

For smoking, we differentiated current, never and former smokers following research in public health using this type of dataset (e.g., [5]). For BMI, we differentiated those having a normal/underweight BMI from those that had obese/overweight BMI following standard guidelines.

Health behaviour reports are frequently incomplete in large population studies such as ELSA. For smoking, we estimated smoking status at Wave 10 as current, former and never smoker by leveraging data from previous waves. This is a standard approach followed in similar longitudinal population studies examining lifetime smoking [5].

For BMI, missing values were imputed using multiple imputation by chained equations (MICE). These models were informed by other model risk factors (age group, sex, qualifications, smoking status and IMD) and a series of auxiliary variables that were likely to be informative predictors of BMI (i.e., self-assessed weight, whether the respondent was trying to change their weight, diabetes, hypertension and cholesterol). Multiple imputation acknowledges the uncertainty associated with imputing missing values by creating multiple plausible values based on the information contained in the observed data, rather than replacing each missing value with a single estimate. The multiple imputation procedure was run over 20 imputations and 20 iterations, producing 20 imputed datasets which were carried forward into the subsequent analyses. Sensitivity analyses were performed to examine the robustness of the models.

### 2.3. Analytical approach

Preliminary exploratory and descriptive analyses were performed to understand ELSA data and examine the distribution of the key variables of interest for this study.

We conducted a series of logistic regression models on ELSA Wave 10 data to evaluate the association between the selected risk factors (age, sex, education, IMD, smoking and BMI) and hip and knee OA prevalence and its severity. We examined univariate models for each risk factor to understand the independent association of each of these risk factors with our main outcomes. We ran multivariate logistic regression models considering all the risk factors and compared the following models:

Model 1: Adjusted by age and sex

Model 2: Model 1 additionally adjusted by education and IMD

Model 3: Model 2 additionally adjusted by smoking

Model 4 (fully adjusted model): Model 3 additionally adjusted by BMI

This process allowed us to understand the independent association between risk factors and main outcomes and understand whether these independent associations were potentially confounded by other risk factors. We could confirm that all the risk factors were independently associated with the main outcomes (hip and knee OA and severity) in the expected direction. This association remained significant even when considering all the risk factors together in the fully adjusted model (except for education which was fully attenuated for hip OA models). Sensitivity analyses were performed to compare each model outputs, and we also ran comparisons between models with and without imputed values for BMI and found consistent and similar trends across models. All these steps provided evidence that the resulting models and outputs are robust from an epidemiological perspective.

The last step was the synthetic generation of population-level prevalence estimates of the main outcomes: hip and knee OA (and severity) by local authorities (LA) and ICBs. Following the procedure described in the ICL report, we used the logistic regression models derived from ELSA data and applied them to synthetic population estimates to produce estimates of OA prevalence by LA.

We constructed a synthetic population for each geographical area representing the 2024 resident population aged 45+ split by the risk factor strata required for the OA prevalence models. The approach combines (i) ONS population projections for 2024 split by age/sex, combined with (ii) Census 2021 distributions for education within age/sex/LA cells, and (iii) marginal distributions at the LA level (or LA by sex where available) for additional risk factors. The method apportions known totals into finer strata using proportions from the best available sources; all splits are designed to sum back to the original totals.

#### **a) Base totals**

The base data are ONS population projections for 2024, comprising population counts by LA, sex, and single/5-year age groups. We filtered the population base to ages 45+ and collapsed ages into the modelling age bands (45-64, 65-74, 75+). This produced the base population totals.

#### **b) Education**

To obtain education by age and sex within each LA, we used Census 2021 tabulations providing proportions by LA, sex, age band, and highest qualification. Qualifications were collapsed into two groups: upper (higher than A-level / Level 4+), lower (A-level or below).

Within each LA × sex × age cell, we calculated the Census 2021 education proportions and applied these proportions to the 2024 projected totals. This

step ensures the education split varies appropriately by age and sex within each LA, while totals sum back exactly to the 2024 LA x sex x age projections.

### **c) Smoking**

Smoking status was incorporated using the Office of Health Improvement and Disparities (OHID) Fingertips 2024 data, constituting smoking prevalence by sex at the LA level, expressed as proportions for three categories (current / former / never). These were applied uniformly within each LA × sex across age and education strata:

Where smoking inputs used historical LA codes, codes were recoded to current LA codes. Where smoking values were suppressed or missing for an LA, sex-specific England averages were used as fallback proportions. Smoking proportions were normalised to sum to 1 within each LA × sex prior to application. After this step, sums over smoking categories return to the pre-split population in each LA × sex × age × education cell.

### **d) IMD**

To create a population base for the IMD variable, it was necessary to determine the proportion of the population of each LA that was in each IMD quintile. IMDs are defined according to geographical location; inspection of the IMD ranges in the ELSA data showed that IMD quintiles had been calculated at the LSOA level. Therefore, we obtained IMD and population data for each LSOA. Using an LSOA-to-LA lookup, we were then able to calculate the IMD quintile proportions within each LA. Data was only available at the LA level, with no splits for age/sex, and was applied uniformly to all strata within an LA.

### **e) BMI**

BMI data for prevalence of overweight/obesity was obtained from PHE Fingertips 2023-2024. Data was only available at the LA level, with no splits for age/sex, and was applied uniformly to all strata within an LA.

At each splitting stage, we verified that the calculated population estimates summed back to the base totals. Counts across the newly created categories were aggregated to confirm they reproduced the pre-split totals for each LA (and for each LA × sex × age cell where applicable).

This synthetic population approach makes the following assumptions (that were also made in the ICL report):

- Smoking varies by LA and sex but is assumed independent of age, education, IMD and BMI within each LA × sex.
- IMD and BMI are applied at the LA level and are assumed independent of age, sex, education and smoking within each LA.

We then applied the logistic regression coefficients to each of the stratum in the population estimates, creating a prevalence estimate for each of the stratum. We then multiplied this prevalence estimate by the population count for the stratum, giving an estimate of the number of people with OA in each subgroup. The final OA prevalence in a LA is then obtained by summing the estimated case counts, then dividing by the LA population to obtain a synthetic OA prevalence estimation for that LA.

The England estimate was derived using the same synthetic population approach as the local area estimates. The population of England was divided into cohorts representing each combination of the risk factors included in the model (age, sex, education, smoking status, IMD and, where applicable, BMI). The regression coefficients were then applied to each cohort to estimate its expected prevalence of osteoarthritis. This prevalence was multiplied by the population size of the cohort to estimate the number of cases. Finally, the population sizes and estimated cases were summed across all cohorts, and the total estimated cases were divided by the total population to give the estimated prevalence for England. Synthetic prevalence estimates for ICBs were calculated using the same procedure, with the estimated cases and population totals aggregated across the synthetic population cohorts within each ICB.

Models were built in stages, and sensitivity analyses were performed to compare results from each stage, allowing us to assess the robustness of the results to alternative model specifications.

We derived CIs for the synthetic local-area prevalence estimates using the same method as in the ICL report, which uses bootstrapping to produce 1,000 different prevalence estimates, from which CIs can be calculated. For each of the 20 imputed datasets, we first restricted the analysis dataset to complete cases on the outcome and covariates. We then generated 1,000 bootstrap samples by drawing in individuals with replacement (where  $n$  is the sample size of the imputed dataset), refitted the same logistic regression model to each resample, and saved the resulting coefficients for each model run. Each set of bootstrapped coefficients was then applied to the population estimate model, generating 20,000 sets of synthetic prevalence estimates for every local area (1,000 for each of the 20 imputations). The prevalence estimate was calculated using the mean of the 20,000 sets; CIs were calculated using the 2.5th and 97.5th percentiles of this distribution as a 95% CI.

Finally, we performed stratified analyses by sex, age, education, IMD, smoking and BMI. For each bootstrap run of the regression model, we predicted a prevalence estimate for every cohort in the synthetic population table.

For each model we derived an Excel spreadsheet with prevalence estimates at the LA/ICB levels with their stratifications. Thus, the outputs of this study consist of 12 Excel documents with 7 sheets each. The first sheet of each Excel document shows overall prevalence estimates and the other 6 show prevalence estimates by

biological sex at birth, age, education, IMD, smoking and BMI. These have been combined into a single Excel document containing all outputs. These include:

- Four models outputs for hip and knee OA at the LA and ICB levels
- Four models outputs for moderate/severe hip and knee OA at the LA and ICB levels
- Four models outputs for severe hip and knee OA at the LA and ICB levels

### 3. Hip and knee OA prevalence estimates in England

Hip and knee OA prevalence and severity were estimated using reports of pain, severity and pain location from Wave 10 of ELSA. Key socio-demographics such as age, gender, education and social deprivation (Index of Multiple Deprivation [IMD]), and health risk factors such as smoking and body mass index (BMI) were accounted for to generate prevalence estimates. In this report, generated hip and knee OA prevalence estimates are labelled as *empirical hip and knee OA*.

The overall prevalence of hip OA in England is estimated to be 15.6% (95% CI: 14.5% - 16.7%) and the overall prevalence of knee OA in England is estimated to be 21.8% (95% CI: 20.5% - 23.1%).

Prevalence estimates for overall empirical hip and knee OA for England and the lower and higher bounds of their 95% confidence intervals (CI) are shown in **Table 1** and **Figures 1** and **2**. These estimates are also shown by gender, age ranges, educational level, IMD quintiles, smoking and BMI. Higher prevalence rates are found for women, older population groups, those with lower levels of education, higher levels of social deprivation, current or former smokers and those categorized as overweight or obese according to their BMI.

**Table 1. Prevalence estimates for empirical hip and knee OA in England**

|                             | Empirical Hip OA |        |         | Empirical Knee OA |        |         |
|-----------------------------|------------------|--------|---------|-------------------|--------|---------|
|                             | Percentage       | Low CI | High CI | Percentage        | Low CI | High CI |
| <b>Overall Prevalence</b>   | 15.6             | 14.5   | 16.7    | 21.8              | 20.5   | 23.1    |
| <b>Sex</b>                  |                  |        |         |                   |        |         |
| Male                        | 9.7              | 8.6    | 11.1    | 17.4              | 15.8   | 19.0    |
| Female                      | 21.0             | 19.4   | 22.6    | 25.8              | 24.2   | 27.5    |
| <b>Age</b>                  |                  |        |         |                   |        |         |
| 45-64                       | 11.7             | 10.2   | 13.2    | 16.8              | 15.1   | 18.5    |
| 65-74                       | 18.9             | 17.1   | 20.8    | 27.1              | 25.0   | 29.3    |
| 75+                         | 22.8             | 20.4   | 25.2    | 29.9              | 27.4   | 32.6    |
| <b>Education</b>            |                  |        |         |                   |        |         |
| Qualifications: Lower       | 16.2             | 14.9   | 17.5    | 23.2              | 21.7   | 24.7    |
| Qualifications: Upper       | 14.1             | 12.7   | 15.7    | 18.5              | 16.7   | 20.2    |
| <b>IMD</b>                  |                  |        |         |                   |        |         |
| Quintile 5 (Least deprived) | 13.8             | 12.0   | 15.6    | 18.3              | 16.3   | 20.4    |
| Quintile 4                  | 14.7             | 12.9   | 16.6    | 20.5              | 18.4   | 22.7    |
| Quintile 3                  | 15.8             | 13.7   | 17.8    | 21.2              | 19.0   | 23.7    |
| Quintile 2                  | 16.0             | 13.6   | 18.7    | 22.2              | 19.6   | 25.0    |
| Quintile 1 (Most deprived)  | 18.5             | 15.6   | 21.6    | 28.6              | 25.1   | 32.0    |
| <b>Smoking</b>              |                  |        |         |                   |        |         |
| Smoking: Current            | 19.6             | 16.2   | 23.0    | 23.0              | 19.4   | 26.6    |
| Smoking: Former             | 19.5             | 17.8   | 21.4    | 24.8              | 23.1   | 26.8    |
| Smoking: Never              | 13.4             | 12.0   | 14.7    | 20.4              | 18.7   | 22.0    |
| <b>BMI</b>                  |                  |        |         |                   |        |         |
| Normal/underweight          | 11.9             | 10.3   | 13.7    | 14.1              | 12.3   | 16.1    |
| Obese/overweight            | 17.6             | 16.3   | 18.9    | 25.9              | 24.4   | 27.5    |

*Note.* Prevalence estimates are shown in percentages. Low and High CI represent the lower and higher bound of their 95% confidence intervals.

Figure 1. Bar chart with prevalence estimates for empirical hip OA in England

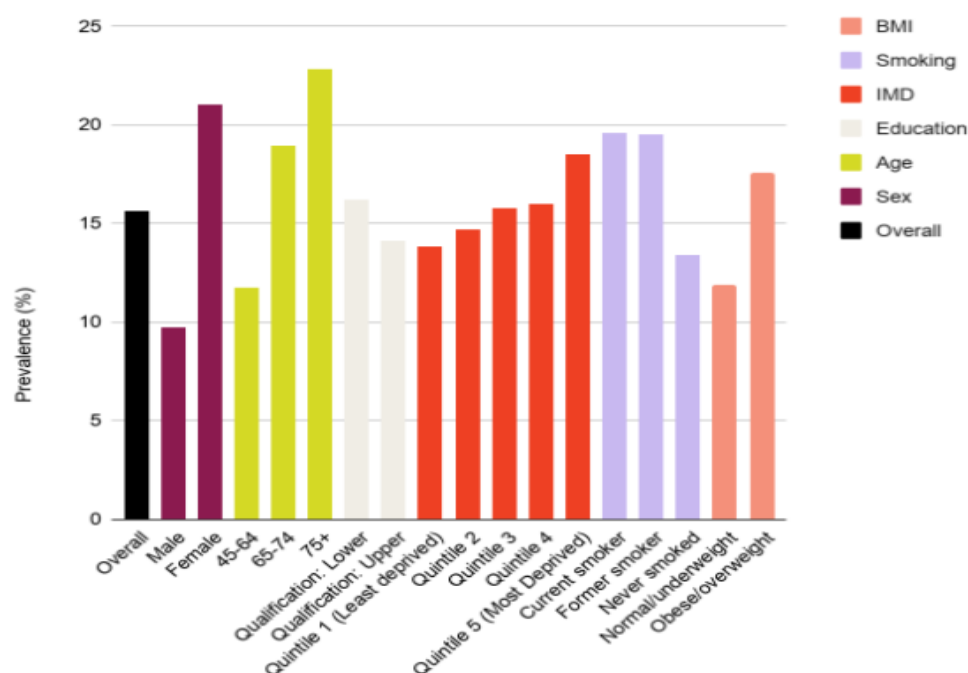
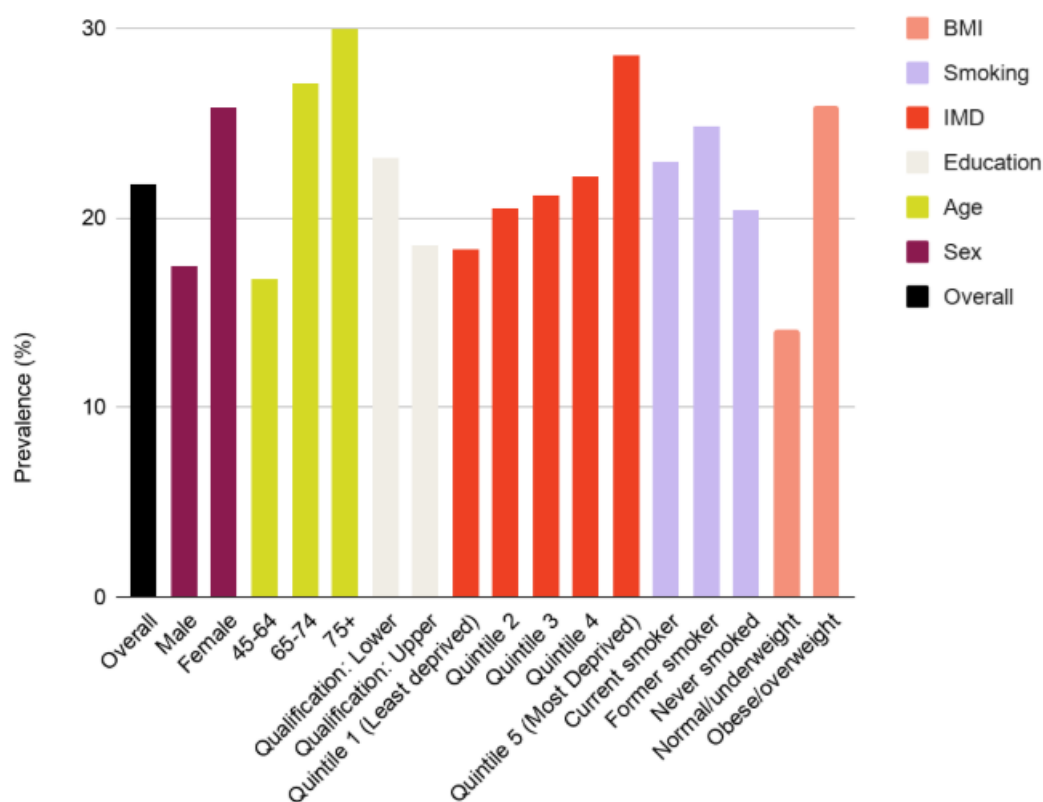


Figure 2. Bar chart with prevalence estimates for empirical knee OA in England



Prevalence estimates for moderate or severe empirical hip and knee OA for England and the lower and higher bounds of their 95% CIs are shown in **Tables 2 and 3**. We produced prevalence estimates for those that rated their pain severe (**Table 2**) and those that rated their pain moderate or severe (**Table 3**). People reporting their pain as severe are more likely to report difficulties with daily living activities. Figures are provided in the slide deck.

**Table 2. Prevalence estimates for severe hip and knee OA in England**

|                             | Severe Hip OA |        |         | Severe Knee OA |        |         |
|-----------------------------|---------------|--------|---------|----------------|--------|---------|
|                             | Percentage    | Low CI | High CI | Percentage     | Low CI | High CI |
| <b>Overall Prevalence</b>   | 2.6           | 2.1    | 3.1     | 3.9            | 3.4    | 4.5     |
| <b>Sex</b>                  |               |        |         |                |        |         |
| Male                        | 1.3           | 0.9    | 1.8     | 2.5            | 1.9    | 3.2     |
| Female                      | 3.8           | 3.1    | 4.5     | 5.2            | 4.4    | 6.1     |
| <b>Age</b>                  |               |        |         |                |        |         |
| 45-64                       | 1.7           | 1.2    | 2.3     | 2.4            | 1.8    | 3.1     |
| 65-74                       | 3.0           | 2.3    | 3.9     | 5.1            | 4.1    | 6.3     |
| 75+                         | 4.6           | 3.4    | 5.8     | 6.7            | 5.3    | 8.2     |
| <b>Education</b>            |               |        |         |                |        |         |
| Qualifications: Lower       | 3.0           | 2.4    | 3.6     | 4.6            | 3.9    | 5.4     |
| Qualifications: Upper       | 1.6           | 1.1    | 2.2     | 2.2            | 1.6    | 2.9     |
| <b>IMD</b>                  |               |        |         |                |        |         |
| Quintile 5 (Least deprived) | 18.3          | 16.3   | 20.4    | 2.0            | 1.3    | 2.8     |
| Quintile 4                  | 20.5          | 18.4   | 22.7    | 3.1            | 2.2    | 4.0     |
| Quintile 3                  | 21.2          | 19.0   | 23.7    | 3.7            | 2.7    | 4.8     |
| Quintile 2                  | 22.2          | 19.6   | 25.0    | 5.2            | 3.8    | 6.8     |
| Quintile 1 (Most deprived)  | 28.6          | 25.1   | 32.0    | 6.5            | 4.8    | 8.4     |
| <b>Smoking</b>              |               |        |         |                |        |         |
| Smoking: Current            | 3.9           | 2.2    | 5.7     | 5.2            | 3.4    | 7.2     |
| Smoking: Former             | 3.6           | 2.8    | 4.5     | 4.1            | 3.3    | 5.1     |
| Smoking: Never              | 2.0           | 1.4    | 2.5     | 3.6            | 2.9    | 4.4     |
| <b>BMI</b>                  |               |        |         |                |        |         |
| Normal/underweight          | 1.2           | 0.7    | 1.8     | 2.0            | 1.3    | 2.8     |
| Obese/overweight            | 3.3           | 2.7    | 3.9     | 5.0            | 4.2    | 5.7     |

**Table 3. Prevalence estimates for moderate or severe hip and knee OA in England**

|                             | Moderate or Severe Hip OA |        |         | Moderate or Severe Knee OA |        |         |
|-----------------------------|---------------------------|--------|---------|----------------------------|--------|---------|
|                             | Percentage                | Low CI | High CI | Percentage                 | Low CI | High CI |
| <b>Overall Prevalence</b>   | 10.4                      | 9.5    | 11.3    | 14.7                       | 13.6   | 15.7    |
| <b>Sex</b>                  |                           |        |         |                            |        |         |
| Male                        | 6.1                       | 5.2    | 7.1     | 10.9                       | 9.6    | 12.3    |
| Female                      | 14.4                      | 13.0   | 15.7    | 18.1                       | 16.6   | 19.6    |
| <b>Age</b>                  |                           |        |         |                            |        |         |
| 45-64                       | 7.7                       | 6.4    | 8.8     | 10.5                       | 9.1    | 12.0    |
| 65-74                       | 12.4                      | 10.9   | 14.1    | 18.7                       | 16.8   | 20.4    |
| 75+                         | 15.9                      | 13.9   | 18.0    | 21.7                       | 19.3   | 24.1    |
| <b>Education</b>            |                           |        |         |                            |        |         |
| Qualifications: Lower       | 11.3                      | 10.1   | 12.4    | 16.3                       | 15.0   | 17.6    |
| Qualifications: Upper       | 8.4                       | 7.3    | 9.7     | 10.8                       | 9.5    | 12.2    |
| <b>IMD</b>                  |                           |        |         |                            |        |         |
| Quintile 5 (Least deprived) | 7.6                       | 6.2    | 9.0     | 11.4                       | 9.8    | 13.0    |
| Quintile 4                  | 9.1                       | 7.7    | 10.5    | 12.3                       | 10.7   | 13.9    |
| Quintile 3                  | 11.8                      | 10.0   | 13.6    | 13.8                       | 11.9   | 15.8    |
| Quintile 2                  | 10.4                      | 8.5    | 12.4    | 16.1                       | 13.7   | 18.5    |
| Quintile 1 (Most deprived)  | 14.4                      | 11.8   | 17.1    | 21.8                       | 18.7   | 25.2    |
| <b>Smoking</b>              |                           |        |         |                            |        |         |
| Smoking: Current            | 14.2                      | 11.4   | 17.2    | 17.7                       | 14.6   | 21.0    |
| Smoking: Former             | 13.9                      | 12.5   | 15.5    | 17.3                       | 15.8   | 19.0    |
| Smoking: Never              | 8.4                       | 7.3    | 9.5     | 13.1                       | 11.7   | 14.5    |
| <b>BMI</b>                  |                           |        |         |                            |        |         |
| Normal/underweight          | 6.9                       | 5.7    | 8.3     | 8.5                        | 7.1    | 10.1    |
| Obese/overweight            | 12.3                      | 11.2   | 13.4    | 18.0                       | 16.6   | 19.3    |

## 4. Hip and knee OA prevalence estimates by local authority and integrated care board (ICB) in England

Hip and knee OA prevalence was also estimated at the local level. In this section we provide summary findings for hip and knee OA at local authority and ICB levels using 2023 boundaries. Details of how these were generated are provided in **Section 2**. Excel tables with overall prevalence estimates for all local authorities and ICBs in England and by gender, age, education level, social deprivation (IMD quintiles), smoking and BMI are provided as **Appendices**.

### 4.1. Local authorities with the highest hip and knee OA prevalence in England

**Table 4** shows the top 10 local authorities by prevalence of hip OA ordered from highest to lowest prevalence and **Figure 3** shows a map of these. **Table 5** shows the top 10 local authorities by prevalence of knee OA ordered from highest to lowest prevalence and **Figure 4** shows a map of these. As shown in these tables, Tendring, Blackpool, Great Yarmouth, City of Kingston upon Hull, Hartlepool, East Lindsey and Burnley are local authorities with high levels of hip and knee OA.

**Table 4. Local authorities with highest prevalence of hip OA in England**

| Local Authority             | Population Est. | Cases Est. | Prevalence Estimate %     |
|-----------------------------|-----------------|------------|---------------------------|
| Tendring                    | 87,156          | 16,650.3   | 19.1 (17.6 - 20.7 95% CI) |
| Blackpool                   | 68,491          | 12,953.0   | 18.9 (17.0 - 21.0 95% CI) |
| Great Yarmouth              | 51,554          | 9,465.7    | 18.4 (16.9 - 20.0 95% CI) |
| Fenland                     | 52,188          | 9,523.9    | 18.2 (16.8 - 19.7 95% CI) |
| Kingston upon Hull, City of | 106,633         | 19,308.5   | 18.1 (16.3 - 20.1 95% CI) |
| Knowsley                    | 68,665          | 12,403.9   | 18.1 (16.1 - 20.2 95% CI) |
| Hartlepool                  | 44,860          | 8,058.4    | 18.0 (16.3 - 19.7 95% CI) |
| Rother                      | 56,981          | 10,228.7   | 18.0 (16.8 - 19.1 95% CI) |
| Burnley                     | 41,745          | 7,480.8    | 17.9 (16.3 - 19.7 95% CI) |
| East Lindsey                | 86,947          | 15,598.7   | 17.9 (16.3 - 19.6 95% CI) |

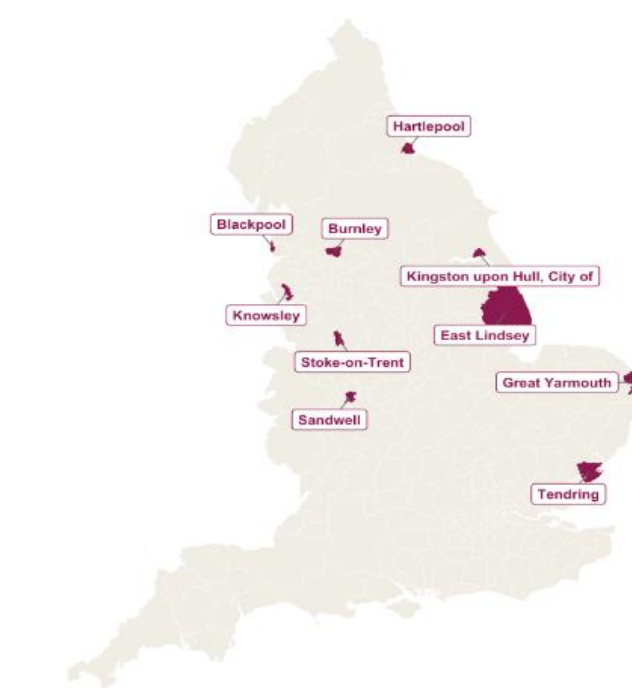
**Table 5. Local authorities with highest prevalence of knee OA in England**

| Local Authority             | Population Est. | Cases Est. | Prevalence Estimate %     |
|-----------------------------|-----------------|------------|---------------------------|
| Blackpool                   | 68,491          | 18,711.6   | 27.3 (25.1 - 29.6 95% CI) |
| Knowsley                    | 68,665          | 18,374.2   | 26.8 (24.5 - 29.0 95% CI) |
| Kingston upon Hull, City of | 106,633         | 28,342.9   | 26.6 (24.5 - 28.7 95% CI) |
| Tendring                    | 87,156          | 23,145.5   | 26.6 (25.0 - 28.3 95% CI) |
| Hartlepool                  | 44,860          | 11,831.5   | 26.4 (24.5 - 28.2 95% CI) |
| Sandwell                    | 134,787         | 35,395.1   | 26.3 (24.0 - 28.5 95% CI) |
| East Lindsey                | 86,947          | 22,717.7   | 26.1 (24.4 - 28.1 95% CI) |
| Burnley                     | 41,745          | 10,843.3   | 26.0 (24.1 - 27.9 95% CI) |
| Great Yarmouth              | 51,554          | 13,397.0   | 26.0 (24.3 - 27.7 95% CI) |
| Stoke-on-Trent              | 108,582         | 28,223.2   | 26.0 (24.1 - 27.9 95% CI) |

**Figure 3. Map of local authorities with highest prevalence of hip OA in England**



**Figure 4. Map of local authorities with highest prevalence of knee OA in England.**



## 4.2. ICBs with the highest hip and knee OA prevalence in England

**Table 6** shows the top 10 ICBs by prevalence of hip OA ordered from highest to lowest prevalence. **Table 7** shows the top 10 ICBs by prevalence of knee OA ordered from highest to lowest prevalence. **Figures 5** and **6** show maps for these ICBs. As shown in these tables, NHS Black Country, NHS Cornwall and the Isles of Scilly, NHS Norfolk and Waveney, NHS North East and North Cumbria, NHS South Yorkshire and NHS Cheshire and Merseyside are ICBs with high levels of hip and knee OA.

**Table 6. ICBs with highest prevalence of hip OA in England**

| Integrated Care Board (ICB)          | Population Est. | Cases Est. | Prevalence Estimate %     |
|--------------------------------------|-----------------|------------|---------------------------|
| NHS Black Country                    | 516,795         | 87,867.1   | 17 (15.4 - 18.6 95% CI)   |
| NHS Cornwall and the Isles of Scilly | 311,587         | 52,509.2   | 16.9 (15.5 – 18.3 95% CI) |
| NHS Norfolk and Waveney              | 543,181.5       | 91,229.4   | 16.8 (15.6 – 18 95% CI)   |
| NHS North East and North Cumbria     | 1,444,043.5     | 241,958.   | 16.8 (15.5 – 18.1 95% CI) |
| NHS South Yorkshire                  | 613,332         | 102,908.   | 16.8 (15.4 – 18.2 95% CI) |
| NHS Devon                            | 637,288         | 104,872.   | 16.5 (15.4 – 17.6 95% CI) |
| NHS Lincolnshire                     | 400,825         | 66,326.4   | 16.5 (15.4 – 17.7 95% CI) |
| NHS Somerset                         | 306,195         | 50,282.4   | 16.4 (15.3 - 17.6 95% CI) |
| NHS Suffolk and North East Essex     | 502,599.5       | 82,640     | 16.4 (15.3 - 17.5 95% CI) |
| NHS Cheshire and Merseyside          | 1,197,695       | 195,739.8  | 16.3 (15.1 - 17.6 95% CI) |

**Table 7. ICBs with highest prevalence of knee OA in England**

| Integrated Care Board (ICB)          | Population Est. | Cases Est. | Prevalence Estimate %     |
|--------------------------------------|-----------------|------------|---------------------------|
| NHS Black Country                    | 516,795         | 128,639.5  | 24.9 (23.1 – 26.7 95% CI) |
| NHS South Yorkshire                  | 613,332         | 147,813.3  | 24.1 (22.6 – 25.7 95% CI) |
| NHS North East and North Cumbria     | 1,444,043.5     | 346,584.1  | 24 (22.5 – 25.5% CI)      |
| NHS Birmingham and Solihull          | 511,813         | 120,851.8  | 23.6 (21.8 – 25.5 95% CI) |
| NHS Greater Manchester               | 1,169,473       | 274,385.9  | 23.5 (21.9 – 25 95% CI)   |
| NHS Cheshire and Merseyside          | 1,197,695       | 278,108.3  | 23.2 (21.8 – 24.7 95% CI) |
| NHS West Yorkshire                   | 1,025,033.1     | 238,265    | 23.2 (21.8 – 24.7 95% CI) |
| NHS Norfolk and Waveney              | 543,181.5       | 125,576.6  | 23.1 (21.8 – 24.4 95% CI) |
| NHS Cornwall and the Isles of Scilly | 311,587         | 71,416.1   | 22.9 (21.4 – 24.5 95% CI) |
| NHS Lancashire and South Cumbria     | 838,162.4       | 192,220.9  | 22.9 (21.6 – 24.3 95% CI) |

**Figure 5. Map of ICBs with highest prevalence of hip OA in England**



**Figure 6. Map of ICBs with highest prevalence of knee OA in England**



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