

Generation of Osteoarthritis Prevalence Estimates in England: Summary Report

Prepared for Arthritis UK

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Executive summary

Key description of the report
This report presents 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, Index of Multiple Deprivation (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. We produced local level prevalence estimates for local authorities and integrated care boards (ICBs).
Summary of findings
Hip OA in England
Hip OA prevalence in England is estimated to be 15.6%.
Moderate or severe hip OA prevalence in England is estimated to be 10.4%. Severe hip OA prevalence is estimated to be 2.6%
Knee OA in England
Knee OA prevalence in England is estimated to be 21.8%.
Moderate or severe knee OA prevalence in England is estimated to be 14.7%. Severe knee OA prevalence is estimated to be 3.9%
For hip and knee OA: 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 estimates of this report can be used as benchmarks for hip and knee OA prevalence in England.
The outputs 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. For example, this data could inform targeted interventions or drive changes in health care provision.

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 of MSK and arthritis conditions for those working in health to ensure decision makers can rely on robust data when designing, planning and commissioning services.

Arthritis UK previously produced prevalence estimates of hip and knee osteoarthritis (OA) based on data from 2012. This report presents up to date local prevalence estimates for knee and hip OA in England and 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 estimates for hip and knee OA and its severity for England.

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. The methodological approach is described in **Section 2**. More technical details can be found in the **Technical Report**.

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 which was published by Adomaviciute and colleagues from the School of Public Health at Imperial College London 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] 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.

Geographical data and IMD data in ELSA were 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 in the **Technical Report**.

2.2. Variables

2.2.1. Hip and knee osteoarthritis (main outcome)

Hip and knee OA was defined based on the definition used the previous report [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.

In ELSA pain is measured with the question “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. 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.

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, those participants who reported pain were asked “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. These represent those that are the least deprived (1) to the most deprived (5) in order.

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). 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 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 we 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 and remained significant when considering all the risk factors together in the fully adjusted model (except for education which was fully attenuated for hip OA 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 (LAs) 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 step-by-step description can be found in the **Technical Report**.

For each model we derived an Excel sheet 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
Overall Prevalence	15.6	14.5	16.7	21.8	20.5	23.1
Sex						
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
Age						
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
Education						
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
IMD						
Quintile 1 (Least deprived)	13.8	12.0	15.6	18.3	16.3	20.4
Quintile 2	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 4	16.0	13.6	18.7	22.2	19.6	25.0
Quintile 5 (Most deprived)	18.5	15.6	21.6	28.6	25.1	32.0
Smoking						
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
BMI						
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

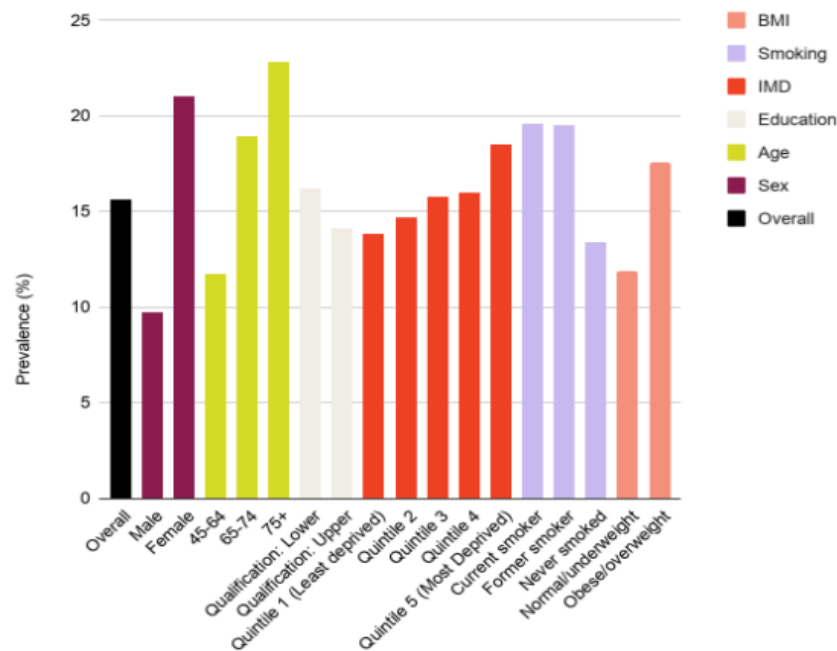
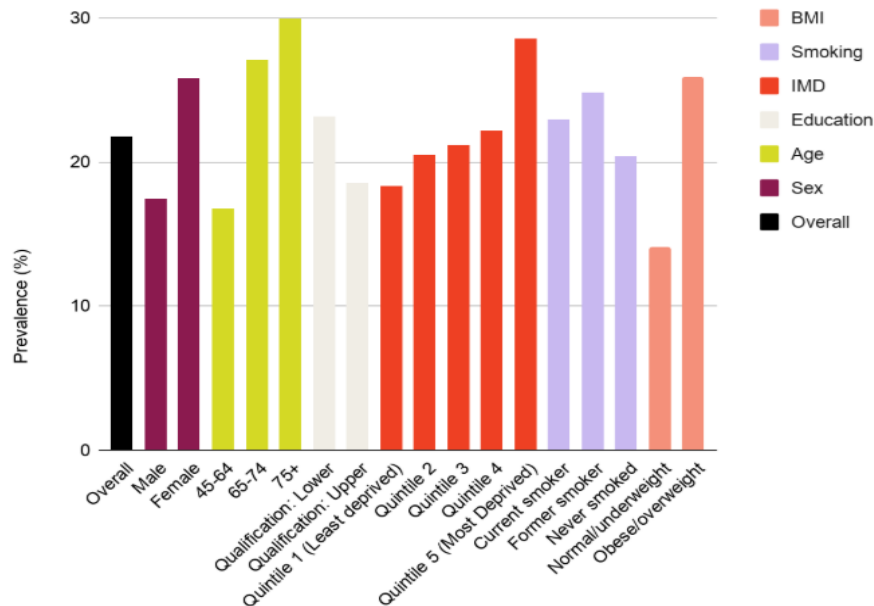


Figure 2. Bar chart with prevalence estimates for empirical knee OA in England



Prevalence estimates for severe empirical hip and knee OA for England and the lower and higher bounds of their 95% CIs are shown in **Table 2** and **Table 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.

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
Overall Prevalence	2.6	2.1	3.1	3.9	3.4	4.5
Sex						
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
Age						
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
Education						
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
IMD						
Quintile 1 (Least deprived)	18.3	16.3	20.4	2.0	1.3	2.8
Quintile 2	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 4	22.2	19.6	25.0	5.2	3.8	6.8
Quintile 5 (Most deprived)	28.6	25.1	32.0	6.5	4.8	8.4
Smoking						
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
BMI						
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
Overall Prevalence	10.4	9.5	11.3	14.7	13.6	15.7
Sex						
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
Age						
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
Education						
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
IMD						
Quintile 1 (Least deprived)	7.6	6.2	9.0	11.4	9.8	13.0
Quintile 2	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 4	10.4	8.5	12.4	16.1	13.7	18.5
Quintile 5 (Most deprived)	14.4	11.8	17.1	21.8	18.7	25.2
Smoking						
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
BMI						
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

References and data sources

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Data sources

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