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Methodological assumptions and limitations of life expectancy estimates for minoritised ethnic groups in the UK: implications for validity, practice, and policy

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A B S T R A C T

Experimental life expectancy estimates calculated by the Office for National Statistics (ONS) for the period 2011 to 2014 show significantly longer life expectancy for minoritised ethnic groups in England and Wales when compared with the white majority. These findings are in contrast to a large body of evidence of poorer health outcomes among certain minoritised ethnic groups (predominately Bangladeshi, Black Caribbean, Gypsy/Traveller and Pakistani groups), and have serious practice and policy implications if taken as definitive. We examine the data and methodology used by the ONS in producing these estimates, and consider the sources of error in that approach. We find that the estimates for minoritised ethnic groups exhibit high sensitivity to error that is not seen in the estimates for the White British population; although we note that even in our largest error scenario, many minoritised ethnic groups still have higher life expectancy than the White British group. Although the results are supported by evidence around the "healthy migrant" effect, and other global research on life expectancy by ethnic group, there is a risk that the ONS' life expectancy estimates of minoritised ethnic groups may be being inflated due to the large amount of missing data among these groups, and the potential for those missing cohorts to be at higher risk of morbidity and mortality. The ONS' estimates, while clearly labelled as experimental, have been used in academia, policy and the press without necessary caveats. We remind researchers of the experimental nature of the ONS' life expectancy by ethnic group estimates, and advise caution in how they are used.

1. Introduction

In 2021, the Office for National Statistics (ONS) produced life expectancy estimates by ethnicity for England and Wales, which indicated that during the period 2011–2014 there were lower levels of age-adjusted mortality among minoritised ethnic groups compared with the White group (Office for National Statistics, 2021b). These estimates were labelled experimental by ONS. Experimental statistics are defined by the ONS as being "not yet fully developed" and "in the testing phase" (Office for National Statistics, n.d.). Despite this label, the life expectancy estimates have been widely cited (often without caveat) in press (Borrett, 2023; Iacobucci, 2021; Phillips, 2021), policy (Mirza and Warwick, 2022, p. 88; Public Health England, 2021) and academic debates (Aslam et al., 2023; Ling et al., 2023; Tjepkema et al., 2023).

Higher life expectancy for all minoritised ethnic groups is counter-intuitive, given the extensive literature on ethnic inequalities in health in the UK (Bécares, 2015; Hayanga et al., 2023; Watkinson et al., 2021), which consistently shows that people from certain minoritised ethnic groups (primarily Black Caribbean and Gypsy/Traveller groups, and Bangladeshi and Pakistani women) are in poorer health compared with their White counterparts. Furthermore, the estimated life expectancies are unfeasibly long for some minoritised ethnic groups. For example, Bangladeshi people in the UK are known to suffer from some of the highest rates of multimorbidity (Watt et al., 2022) and poor general health (Stopforth et al., 2021), yet the ONS estimated life expectancy at birth to be 87.3 years for Bangladeshi women, and 81.1 for Bangladeshi men (compared to 83.1 years for White women, and 79.7 years for White men). This is comparable to the predicted life expectancy of men and women in Japan, a country with the third highest life expectancy in the world (87.7 years for women, and 81.8 years for men in 2021) (United Nations, 2022). Furthermore, life expectancy estimates at age 90 are equally implausible for some groups, with life expectancy at age 90+

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being 11 years for Bangladeshi women and 7.9 years for Bangladeshi men. This is in contrast to the White group, where those aged 90+ had life expectancies of 5.3 and 4.6 years respectively. Mortality estimates derived using the same methodology (Office for National Statistics, 2021d) have been used to draw into question the long-established evidence on ethnic inequalities in morbidity (UK Government, 2022, section 3.10). The implications of the widespread use of 'experimental' statistics are not trivial; there is a risk that these supposed contradictions in the literature will lead to policymakers de-prioritising addressing ethnic inequalities. More specifically, these experimental estimates could have a detrimental effect on the health and wellbeing of people from minoritised ethnic groups, since they imply that minoritised ethnic people have a longer life span than White British people, meaning that practice and policy initiatives to address inequalities in health may be deprioritised.

In the present study, we examine the theoretical and methodological assumptions behind life expectancy estimates produced by the ONS, and consider the potential error arising from these assumptions. We examine two key assumptions made in the modelling that produced the life expectancy estimates: i) the amount of unobserved outmigration (i.e. migration out of England or Wales) by ethnic group, ii) the mortality rate of outmigrants. We then show the sensitivity of the life expectancy estimates to those assumptions, and how that sensitivity varies by ethnic group and age, particularly for the eldest age groups. We also produce life expectancy estimates by disaggregated ethnic groups, as the definition of ethnic groups used by the ONS in their published life expectancy estimates masks variation among aggregated groups (particularly the White group). Finally, we attempt to unravel the differences in mortality risk between UK-born and foreign-born minoritised ethnic groups observed in other studies by producing life expectancy estimates split by nativity. To explore the factors described here, we first attempt to replicate the ONS life expectancy estimates. We then use the resulting estimates as a baseline to scenario test the possible impact of the potential sources of error detailed above.

2. Migrant mortality advantage and ethnic mortality "paradox"

Global evidence documents ethnic inequalities in health, whereby many racial or ethnic minority groups have higher rates of poor health than the white majority population, across stages of the life course and across outcomes such as limiting long-term illness, heart disease, and general self-rated health (Bécares, 2015; Blom et al., 2016; Hill et al., 2023). The evidence on ethnic inequalities in mortality, however, is mixed. In some studies, ethnic inequalities in mortality mirror ethnic inequalities in morbidity; for example, in the US, Non-Hispanic Black Americans and Non-Hispanic American Indians and Alaskan Natives have higher all-cause mortality than White Americans, although Hispanics and Non-Hispanic Asians and Pacific Islanders have lower all-cause mortality (Woolf et al., 2018). Other countries show similar patterns, for example, in New Zealand higher morbidity for Māori and Pacific peoples compared with other ethnic groups (Gurney et al., 2020) is also reflected in higher mortality in this group (Jatrana and Blakely, 2008). We also see lower life expectancy for Aboriginal and Torres Strait Islanders in Australia (Australian Bureau of Statistics, 2023).

However, other studies have shown what has been called the 'ethnic mortality paradox', whereby ethnic groups who typically have poorer health than the white majority have lower age-adjusted mortality rates. Wallace and colleagues have written several papers regarding the comparatively low mortality of migrants within the UK (Wallace and Kulu, 2014, 2018), finding that while people born in Bangladesh, the Caribbean, India and Pakistani tend to have higher rates of life-limiting illness, they paradoxically also tend to have lower all-cause mortality rates (Wallace and Darlington-Pollock, 2020a). Similar observations have been seen in other studies using UK data (Bhopal et al., 2018; Scott and Timæus, 2013). In the United States (US), the "Hispanic paradox" is described as the observation that Hispanic people have lower mortality risk than non-Hispanic White people, although careful examinations of this "paradox" have shown considerable variation in mortality rate depending on the country of birth of Latinx people (Fernandez et al., 2023), particularly whether individuals were born in the US or elsewhere (Palloni and Arias, 2004).

One explanation for the migrant mortality advantage is the "healthy migrant" effect (Wallace and Darlington-Pollock, 2020b), which posits that there is a degree of selection on the basis of health, meaning that those in good health are more likely to emigrate. There is a further global body of evidence on the "healthy migrant effect", showing a mortality advantage for migrants that is fairly consistent across origin and destination countries (Shor and Roelfs, 2021). In the UK, the 2011 Census reported that over half of the population of people from minoritised ethnic groups were migrants, although this proportion varied greatly by ethnic group (Office for National Statistics, 2018). As such, it is relevant to consider evidence on the healthy migrant effect, while considering that this effect may vary or disappear for the children of migrants. Palloni and Arias (2004) demonstrated intergenerational variation in the mortality risk of migrants in the US. Wallace (2022) found that while migrants to Sweden generally had lower all-cause mortality than Swedes, this pattern was reversed for the children of immigrants in Sweden and those who immigrated to Sweden as children.

3. Statistical immortality in return migrants

An alternative explanation for the migrant mortality advantage, and one that would fit with the intergenerational variation in mortality risk seen elsewhere, is "salmon bias", whereby migrants suffering from poor health return to their country of origin when approaching end of life. As these individuals have left the country, their deaths would not be recorded in national statistics, rendering them effectively "statistically immortal" (Abraído-Lanza et al., 1999). Several attempts have been made to investigate salmon bias in countries other than the UK, and to correct for its effect (Boulogne et al., 2012; Di Napoli et al., 2021; Tarnutzer and Bopp, 2012). The problem of statistical immortality remains the principal obstacle in researching the salmon bias. Guillot et al. (2023) overcame this limitation by using French pensions data, from which the deaths of pensioners can be inferred regardless of whether they continued to live in France or migrated abroad. The study found that among foreign-born male pensioners aged 65+, those who had left France to reside abroad in later life had higher mortality than those who stayed in France, with mortality rates being particularly high among recent returnees. The study concluded that the strength of the effect can potentially explain the migrant mortality advantage in France. The innovative methodology used by Guillot and colleagues makes it possibly the best resource for understanding the "salmon bias", the potential extent of its effects in the UK, and the implications for the validity of findings of rendering outmigrants statistically immortal.

Data that cannot reliably capture the outmigration of individuals are severely limited in their ability to tell us about migrant mortality, because subsequent life outcomes are not recorded. Guillot et al. (2023) found that almost half of the cohort of foreign-born pensioners had already left France by retirement age, and noted that the migrant mortality advantage can only be corrected for when these earlier returnees are taken into account. In the UK, such data are currently unavailable, and instead must be estimated. For example, Morris et al. (2015) attempted to model likely levels of mortality within ethnic groups by using known relationships between deprivation, age and mortality to simulate estimates at an ethnic group level. Although the ecological methodology utilised here is not as robust as an analysis based on death registrations, findings from this method show that those from Black ethnic groups were predicted to have the lowest life expectancy of all ethnic groups. Wallace and Kulu (Wallace and Kulu, 2018) used the Office for National Statistics Longitudinal Study (ONS-LS) in an attempt to quantify a salmon bias, and produced revised mortality estimates to account for missing individuals in the dataset. The authors calculated

that mortality would have to be between 1.3 and 4 times higher among outmigrants to explain the migrant mortality advantage seen in some ethnic groups, concluding that such a rise in mortality was unrealistic, and that therefore the migrant mortality advantage could not be "explained away" by salmon bias. However, this mortality increase is in fact comparable to the increased mortality risk (i.e. 1.6 to 3.6) seen among foreign-born outmigrants in the study by Guillot et al. (2023). It should also be noted that Wallace and Kulu (2018) excluded ONS-LS participants who could not be tracked between censuses; however, there is a possibility that these people were missing due to unrecorded outmigration, although as Wallace and Kulu point out, this loss to follow-up could also be due to nonparticipation in the Census, or due to linkage failure due to data inconsistencies. Stopforth et al. (Stopforth et al., 2024, p. 21), demonstrated substantial non-randomness in the characteristics of people lost to follow-up between censuses, with those from minoritised ethnic groups being particularly at risk of missingness. Given the poor quality of data in the UK, it is difficult to fully account for the "salmon bias" effect.

Given the well-documented ethnic inequalities in health, and the methodological limitations identified by the studies described above, we hypothesise that the mortality advantage seen among minoritised ethnic groups in the ONS' experimental statistics may be an artefact of a combination of assumptions made in the ONS' methodology. We aim was to explore the sensitivity of the ONS' estimates to potential sources of error, which we tested in the following way:

1. Document potential sources of error in the ONS' life expectancy estimates.
2. Provide indicative life expectancy estimates using the Public Health Research Database by ethnic group based on more theoretically-informed assumptions around missingness and the mortality rate of outmigrants.
3. Produce estimates split by country of birth (UK/elsewhere).

4. Methods

4.1. Documenting potential sources of error

Before we tested the sensitivity of the ONS life expectancy estimates, we first needed to replicate them. To do this, we needed to document the methodology used by the ONS in their life expectancy calculations, identify the links between data sources, and understand the processes and assumptions that could lead to error in the estimates of life expectancy. Our team comprised researchers from several academic institutions, and members of the ONS team who originally produced the estimates, working in an advisory capacity. As such, we not only had access to methodological documentation already in the public domain, but additional documentation on the principal dataset, and verbal correspondence with ONS team members. We were provided with the software code used to produce the original estimates, which enabled us to closely follow the original model. We also read other ONS documentation which enhanced our understanding of the data and matching process. For example, ONS documentation on the 2011 Census provided information on missingness and imputation. We integrated this information into a comprehensive data map that showed each data source used in the creation of the ONS' estimates of life expectancy, and how these data sources were linked. We then listed any assumptions and data quality issues associated with each data source or linkage action (see Fig. 1).

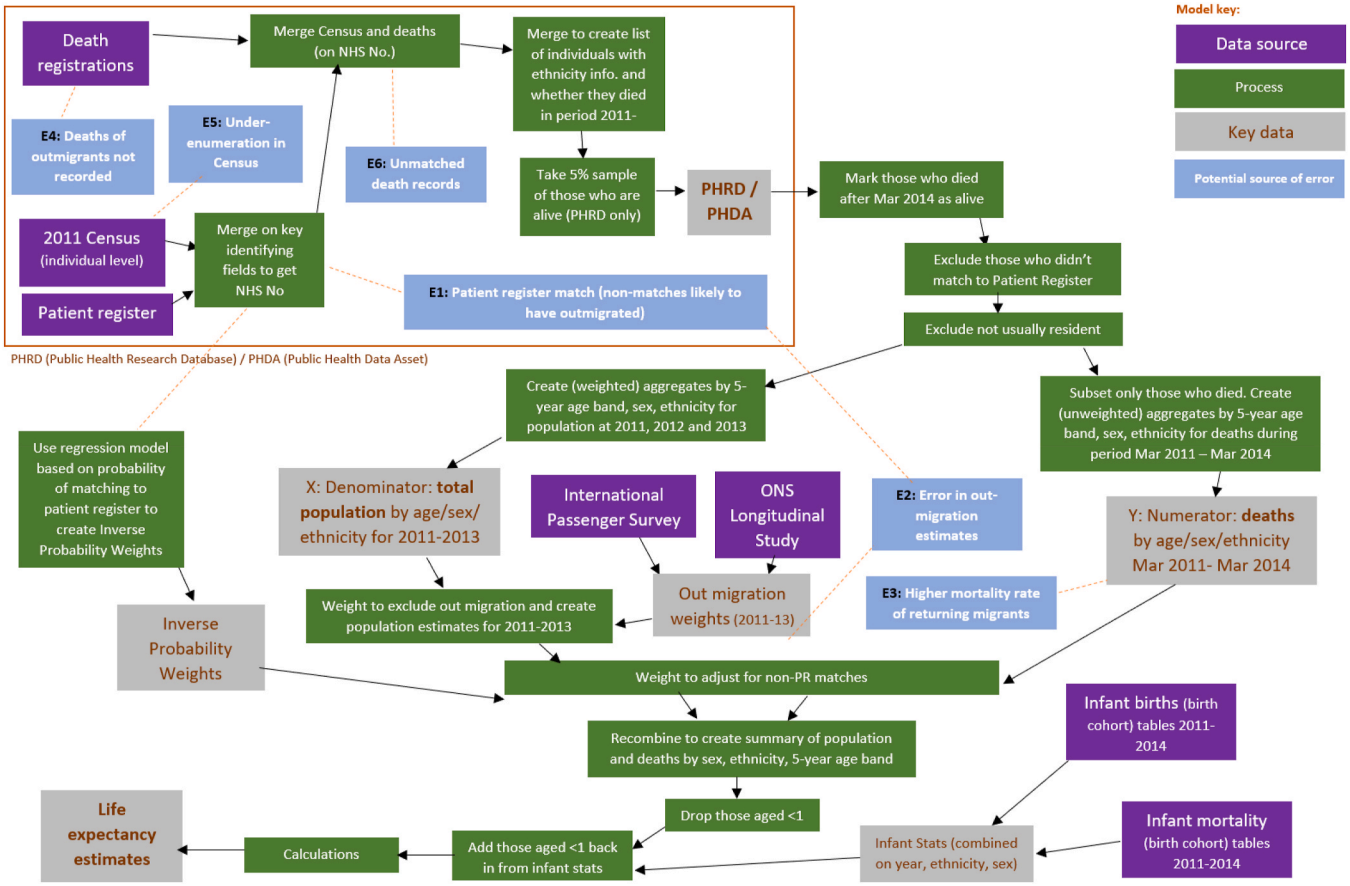

Fig. 1. Map of methodology for producing experimental LE estimates by ethnic group.

4.2. Calibration

We re-created the life expectancy estimates produced by the ONS. In their life expectancy estimates, the ONS used the Public Health Data Asset (PHDA), a person-level dataset comprising those enumerated during the 2011 Census mapped to mortality data indicating whether they died between 2011 and 2021 (N_{total} = 47,454,183, N_{died} = 4,816,084, (Nafilyan et al., 2024). We did not have access to the PHDA in its full for as non-ONS, but were able to access the Public Health Research Database (PHRD) (Office for National Statistics & NHS Digital, 2023). The PHRD has a complete record of deaths from 2011 to 2021, but only a 5 % sample of those who participated in the 2011 Census and were still alive in 2021.

As we were using a reduced version of the original dataset, we undertook a process of calibration to replicate the original estimates. The process of calibration required decisions on how the dataset would be sampled, and the derivation and application of inverse probability weights, specifically:

Sample: It was necessary to select a method for processing the 5 % sample, because the dataset contains only a sample of those still alive, but retains all deaths that have occurred. We considered two options: to use sample weights, or to take a 5 % sample of those who had died. The use of sample weights risked complicating the calculation of standard errors (further explained in "Sensitivity testing" section in Results); however, the more complete data was considered a preferable trade-off. As such, we used sample weights, where those in the 5 % sample were given a weight of 20 (i.e. the inverse of the 5 % probability of being in the sample), and all others were given a weight of 1.

Inverse Probability Weights: The ONS used inverse probability weights (IPWs) to adjust for the proportion of Census participants whose data could not be matched to the patient register (meaning that these individuals' NHS numbers could not be obtained, making linkage to death registrations not possible). The ONS created IPWs using a model regressed on the likelihood of non-matching; the coefficients were used to create weights which were applied to both the numerator (deaths) and denominator (population). There were several aspects to the IPWs that we calibrated. Firstly, rather than re-use the same coefficients documented by the ONS, we re-ran the regression ourselves. This had the advantage that we could alter the model, e.g. to include additional ethnic groups. Secondly, to address outliers, the ONS limited their weights by trimming weights above the 99th percentile, then rescaling them to match the population. We opted to limit our IPWs to 2 standard deviations above and below the mean, according to the commonly-used rule applied to exclude outliers in a dataset.

The ONS experimental life expectancy estimates were provided separately for men and women from 10 ethnic groups (Asian other, Bangladeshi, Black African, Black Caribbean, Black other, Indian, Mixed, Other, Pakistani, White) and 20 age groups in 5 year intervals ranging from <1 to 90+ years old, totalling 400 life expectancy estimates for the period 2011–2014 (Office for National Statistics, 2021b). Confidence intervals were provided for each estimate. Calculating life expectancy requires an estimate of the population and number of deaths at each age, ordinarily from birth to 100 years. We derived life expectancy estimates by ethnicity using the revised Chiang method (Chiang, 1984) and following the ONS methodological guidance. To facilitate this, we had access to the original software code used by the ONS to produce their estimates. We aimed to replicate as many of the 400 life expectancy estimates as possible, defining our success as producing a point estimate lying within the original confidence intervals.

4.3. Sensitivity testing

Following identification of the potential sources of error and calibration of the base model, we intended to test the sensitivity of these estimates to the effect of varying the potential sources of error over their feasible range, theoretically informed by other available data. We could then identify the sensitivity points in the model that have the most impact on life expectancy estimates, and to see if this sensitivity varies across ethnic groups.

4.4. Estimates by country of birth

Lastly, we wished to produce estimates by country of birth, to unpick the relationship between life expectancy and migration, and how this varies across ethnic groups. To do this, we produced life expectancy estimates for all disaggregated ethnic groups, split by UK and non-UK country of birth. Expecting small sample size to prohibit estimates for some ethnic groups, we also produced estimates using aggregated ethnic groups, defined according to which groups had sufficient sample size.

5. Results

5.1. Documenting potential sources of error

Fig. 1 presents the potential data and process limitations that could result in error in the calculation of the life expectancy estimates. This figure demonstrates how the principle dataset, the Public Health Research Database (PHRD) has been constructed, and shows how it was used by the ONS to produce the life expectancy estimates by ethnic group. The data map is valid for both the (full) PHRD and (5 % sample) PHDA datasets, with differences between the two identified.

We identified six key sources of error, which are prefixed with an E on the map. The first error, E1, represents linkage error between the patient register and the Census data. This error is adjusted for in the ONS estimates by the application of inverse probability weights (IPWs). The IPW model is defined based on age, sex, ethnic group, area deprivation and region, and the weights are applied to both deaths and populations. Therefore, within each age, sex and ethnic group "cell", the mortality rate can only change according to differences in area deprivation and region. This means that in practice, the IPWs have little to no impact on life expectancy estimates at an ethnic group level.

This observation is linked to the second error, E2, which represents error in outmigration estimates. Outmigration in the ONS' original methodology was estimated by using the International Passenger Survey and the ONS Longitudinal Study (ONS-LS).[1] The IPS, an ongoing survey of passenger intentions among those leaving major UK ports, is used by the ONS to estimate outmigration (Office for National Statistics, 2014); however, ethnic group information is not collected in the survey. As such, the ONS used the ONS-LS to supplement findings from the IPS. The ONS-LS, which has data on ethnic group, collects data on NHS patient de-registrations which can be used to inform outmigration estimates. Patients are not obliged to de-register with the NHS, and although GP practices are expected to undertake list cleaning every 3 years, there are still a substantial number of "ghost patients" (PA Media, 2024), indicating that patients who have left the area or country remain on GP registers. Outmigration weights in the ONS life expectancy methodology were defined according to age group (<25, 25–44, 45–64, 65+), ethnic group and sex. To test the outmigration assumptions in the model, we estimated the implied total outmigration in our model by country of birth (inside/outside the UK). We did this by using Census data to calculate the proportion of each ethnic group (within each age group) who were born outside the UK. We then combined this with the outmigration weights in our model. We calculated the estimated outmigration to be approximately 195,000 a year among people born inside the UK, and approximately 53,000 among those born outside the UK. We compared this to outmigration figures of British nationals from ONS' Long-Term International Migration (LTIM) estimates (Office for

[1] The ONS-LS (Office for National Statistics, 2019) contains census and life events data for a 1 % sample of the population in England and Wales since 1971 (see (Shelton et al., 2019) for further details).

National Statistics, 2014), and estimates produced using Registration and Population Interaction Database (RAPID) data (Office for National Statistics, 2021c). Although nationality does not directly equate to country of birth, the figures (approximately 155,000 British nationals and 308,000 non-British nationals in LTIM (Office for National Statistics, 2014); and 143,000 and 190,000 in RAPID (Office for National Statistics, 2023a) suggest that our model underestimates outmigration among people born outside the UK. This is important because we would expect the mortality rate of outmigrants born outside the UK to be higher than other cohorts, due to salmon bias. Salmon bias, or the higher mortality rate of returning migrants, is represented by the third error, E3, in the data map.

Linked to this is the fourth error, E4, the deaths of outmigrants not being recorded, which represents "statistical immortality" on the individual level. Given that we have no way of knowing if an individual has left the country, we have no way of knowing their mortality outcome. This is an issue in two ways: firstly, because we do not know how many people are missing; and secondly, because given E3, we have reason to believe that the mortality rate of those missing is not comparable to the remaining population. Although adjustments are made to the population counts to account for unrecorded out-migration (see error E2), not having visibility of mortality outcomes of outmigrants contributes to the imprecision in the estimates.

The fifth error, E5, represents non-participation in the Census. Although it is a legal requirement to participate in UK censuses, not everyone living in the UK does so, and non-compliance is not equally distributed across population groups. In the 2011 Census, participation was approximately 94 %, which varied from 95 % for the White British population and 94 % in the White Irish, Indian and Pakistani groups, to 72 % in the Arab group and 64 % among the Black Other population (Office for National Statistics, 2012). This is a potential source of error in the life expectancy estimates if the mortality rate of those who did not participate in the Census differs from those who did. Relatedly, we detected an inaccuracy (E6*), which represents the 12.4 % of the death registration data that could not be matched to anyone who was enumerated in the 2011 Census (Office for National Statistics, 2021b). Country of birth information shows that there were higher numbers of unmatched deaths among people born in Africa, Pakistan and Bangladesh, compared with people born in the UK. ONS documentation states that these people were mostly people who migrated to England and Wales after the 2011 Census day (Office for National Statistics, 2023b), but also includes people whose NHS data could not be mapped, and people who were in the UK on Census day but did not participate in the Census. As such, E6* is considered mostly not an "error" (hence the asterisk), as the vast majority of people covered here would not be expected to be captured in the 2011 Census, and are hence not within the sampling frame.

A final data issue that we observed was that the life expectancy estimates have been produced for a "White" group that constitutes the White British group as well as three groups that are often considered as minoritised groups in the UK context: White Gypsy/Traveller, White Irish and White Other groups. It should be noted that the health of the three minoritised groups, particularly the Gypsy/Traveller group (Morgan and Belenky, 2024), may differ substantially from the White British group. However, we have maintained the same ethnic group categorisations as used by the ONS for direct comparability with the original estimates.

5.2. Calibration

Table 1 shows the results of our calibration exercise. For most ethnic group and sex cohorts, we were able to match the ONS' estimates closely. Across the 400 estimates, the average error was ± 0.5 years, with over 90 % of our point estimates falling within the confidence intervals of the original ONS estimates. The groups with the highest error, specifically women from the Black African and Black Other groups, had

Table 1
Comparison between best-calibrating model and ONS life expectancy estimates (difference in years).

	Women										Men									
Age group	Asian other	Bangladeshi	Black African	Black Caribbean	Black other	Indian	Mixed	Other	Pakistani	White	Asian other	Bangladeshi	Black African	Black Caribbean	Black other	Indian	Mixed	Other	Pakistani	White
<1	0.4	−0.4	−3.0	−0.1	−1.9	0.0	−0.1	0.2	−0.2	0.0	0.4	−0.1	−0.2	0.1	0.4	0.0	0.4	−0.1	0.0	0.0
01–04	0.4	−0.4	−3.1	−0.1	−2.0	0.0	0.0	0.2	−0.2	0.0	0.4	−0.1	−0.2	0.0	0.4	0.0	0.4	−0.1	0.0	0.0
05–09	0.5	−0.4	−3.0	−0.1	−2.0	0.0	−0.1	0.1	−0.2	0.0	0.4	−0.1	−0.3	0.1	0.4	0.1	0.3	−0.1	0.0	0.0
10–14	0.4	−0.5	−3.0	−0.1	−2.0	0.0	−0.1	0.2	−0.2	0.0	0.4	−0.1	−0.2	0.1	0.5	0.1	0.4	−0.1	0.0	0.0
15–19	0.4	−0.4	−3.0	−0.1	−1.9	0.0	0.0	0.2	−0.2	0.0	0.5	−0.1	−0.2	0.0	0.4	0.0	0.4	−0.1	0.0	0.0
20–24	0.5	−0.4	−3.0	0.0	−2.0	0.0	−0.1	0.1	−0.2	0.0	0.4	−0.1	−0.2	0.0	0.4	0.1	0.4	−0.1	0.0	0.0
25–29	0.4	−0.4	−3.0	0.0	−1.9	0.0	−0.1	0.2	−0.2	0.0	0.4	−0.1	−0.3	0.1	0.4	0.1	0.4	−0.1	0.0	0.1
30–34	0.4	−0.4	−3.0	−0.1	−2.0	0.0	−0.1	0.2	−0.2	0.0	0.4	−0.1	−0.3	0.1	0.5	0.0	0.4	0.0	0.0	0.0
35–39	0.4	−0.4	−3.0	−0.1	−1.9	0.0	−0.1	0.2	−0.2	0.0	0.4	−0.1	−0.2	0.2	0.5	0.0	0.4	0.0	−0.1	0.1
40–44	0.4	−0.4	−3.1	0.0	−2.0	0.0	0.0	0.2	−0.2	0.0	0.4	−0.1	−0.2	0.1	0.5	0.1	0.4	0.0	0.0	0.0
45–49	0.4	−0.4	−3.1	−0.1	−2.0	0.0	0.0	0.2	−0.2	0.1	0.4	−0.1	−0.3	0.1	0.4	0.1	0.4	−0.1	0.0	0.1
50–54	0.4	−0.4	−3.1	0.0	−2.0	0.0	0.0	0.2	−0.2	0.0	0.4	0.0	−0.2	0.1	0.5	0.0	0.4	−0.1	0.0	0.0
55–59	0.4	−0.4	−3.1	0.0	−2.0	0.1	0.0	0.2	−0.2	0.0	0.4	0.0	−0.2	0.2	0.5	0.0	0.3	−0.1	0.0	0.0
60–64	0.4	−0.5	−3.2	0.0	−1.9	0.0	−0.1	0.3	−0.2	0.0	0.5	−0.1	−0.3	0.2	0.6	0.0	0.4	0.0	0.0	0.0
65–69	0.4	−0.5	−3.2	−0.1	−2.0	0.0	−0.1	0.2	−0.3	0.0	0.4	−0.2	−0.2	0.1	0.7	0.0	0.4	−0.1	0.0	0.0
70–74	0.4	−0.6	−3.3	0.0	−2.1	0.0	−0.1	0.3	−0.3	0.0	0.4	−0.3	−0.1	0.1	0.5	−0.1	0.3	−0.1	0.0	0.0
75–79	0.4	−0.6	−3.4	−0.1	−2.5	0.1	0.0	0.1	−0.2	0.0	0.7	−0.3	0.0	0.0	0.7	0.0	0.2	−0.3	0.0	0.0
80–84	0.4	−0.7	−3.6	−0.1	−2.8	0.0	0.1	0.2	−0.2	0.1	0.9	−0.4	0.0	0.0	0.8	−0.1	0.0	−0.3	−0.1	0.0
85–89	0.8	−1.0	−4.2	0.0	−3.0	0.1	−0.3	0.0	−0.2	0.0	1.1	−0.8	0.0	−0.2	1.0	−0.2	0.2	−0.7	0.0	0.0
90+	0.8	−1.5	−5.0	0.1	−3.5	0.3	−0.4	0.3	−0.1	0.0	1.1	−2.0	0.7	−0.3	2.1	−0.1	0.0	−1.2	0.2	0.1

Data source: ONS Public Health Research Database

small sample sizes (N = 68 and 48 respectively for the 90+ age group). Among some ethnic groups, error increased at higher ages, particularly in the 90+ group, where sample size was smallest. Table 2 shows the life expectancy at birth estimates in years for each ethnic group. As per the ONS' original estimates, we observe that life expectancy at birth is lowest for the White group compared to all other ethnic groups except the Mixed group.

5.3. Sensitivity testing

After evaluating the potential sources of error, we observed that the errors mainly stemmed from two key issues: i) lack of visibility and potential underestimation of outmigration (E1, E2); and ii) no method to account for higher mortality rate among outmigrants (E3, E4). Errors E5 and E6 were excluded as they included people outside our sampling window (i.e. those who either did not take part in the 2011 Census, or arrived in England or Wales after the 2011 Census day).

We tested the sensitivity of the life expectancy estimates to these sources of error in two ways. First, we used an alternative method for our derivation of outmigration. We used the ONS-LS to observe the proportion of Census (2001) participants (by ethnic group, age and sex) who were lost to follow-up in the 2011 Census. Loss to follow-up due to linkage failure in the ONS-LS can happen for several reasons, including unreported outmigration, census nonresponse, and discrepancies in date of birth at either Census (Lynch et al., 2015, p. 35). Lynch et al. note that estimating the relative contribution of these factors is difficult; however, they observe that low linkage rates for immigrants are often due to unreported embarkations (Lynch et al., 2015, p. 43). Therefore, for the purposes of the experiment, we assumed that these people had outmigrated; although it should be noted that this may represent an over-estimation of outmigration. While some of these people may have chosen not to participate in the 2011 Census, there is a strong possibility that those who did not participate in the 2011 Census may also have not participated in the 2001 Census, and so would not be in our sampling frame.

Secondly, we applied the mortality rates among outmigrants observed in the work of Guillot et al. (2023) to the outmigrants in our model. Our aim in using this research is to simulate how the ONS' life expectancy results might be different if we have full visibility of individuals' mortality outcomes after they have emigrated. While there are undoubtedly differences in immigration patterns between the French and UK context, particularly in the nationality of migrants and quantity of migration across different cohorts, Guillot et al.'s research provides us with mortality hazard ratios of outmigrants split by country of birth (albeit grouped by geographical area), meaning the nature of immigration does not have to be identical between France and the UK for these coefficients to be reasonably applicable. It is also important to note that the methodology employed by Guillot et al. also made assumptions in the interpretation of the data available to them. Chiefly, mortality was determined by individuals failing to return a "life certificate" for two consecutive years; the purpose of the certificate being to indicate to the pension administrators that the individual is still alive. While failure to return a life certificate may indicate death, it may also be that the individual is still alive but has simply not returned their life certificate - for instance, due to a change of address, or deciding that their pension is not worth collecting. As such, we would expect that this method over-estimates mortality. Despite these caveats, we use the work of Guillot et al. as an illustrative example of what might happen to life expectancy estimates if linkage between pensions data and Census data could be achieved in the UK context.

The loss to follow-up (LTFU) proportions from the ONS-LS are shown in Table 3. It is apparent that missingness is much higher among minoritised ethnic groups than it is for the White British group. The importance of this is underscored in the sensitivity testing presented later in this section, which demonstrates how even small amounts of missing data can have large impacts on life expectancy estimates. Due to

Table 2
Life expectancy estimates from the best-calibrating model.

	Women										Men									
Age group	Asian other	Bangladeshi	Black African	Black Caribbean	Black other	Indian	Mixed	Other	Pakistani	White	Asian other	Bangladeshi	Black African	Black Caribbean	Black other	Indian	Mixed	Other	Pakistani	White
<1	87.3	86.9	85.9	84.5	84.9	85.4	83.0	87.1	84.6	83.1	84.9	81.0	83.6	80.8	82.4	82.3	79.7	83.9	82.3	79.7
01–04	86.6	86.3	85.3	84.0	84.4	84.7	82.4	86.4	84.2	82.4	84.4	80.5	83.2	80.4	82.0	81.7	79.0	83.3	81.9	79.0
05–09	82.7	82.3	81.4	80.0	80.5	80.8	78.4	82.4	80.3	78.4	80.4	76.5	79.2	76.5	78.0	77.8	75.0	79.4	78.0	75.1
10–14	77.7	77.3	76.4	75.1	75.5	75.8	73.4	77.5	75.3	73.4	75.4	71.6	74.3	71.6	73.1	72.8	70.1	74.4	73.1	70.1
15–19	72.7	72.4	71.5	70.1	70.6	70.8	68.5	72.5	70.4	68.5	70.5	66.6	69.4	66.6	68.1	67.8	65.1	69.5	68.1	65.1
20–24	67.8	67.4	66.5	65.2	65.7	65.9	63.5	67.5	65.5	63.5	65.5	61.7	64.5	61.7	63.2	62.9	60.2	64.5	63.2	60.2
25–29	62.8	62.5	61.6	60.3	60.8	60.9	58.6	62.6	60.6	58.6	60.6	56.8	59.6	56.9	58.3	58.0	55.3	59.6	58.3	55.4
30–34	57.8	57.6	56.7	55.4	55.9	56.0	53.7	57.6	55.6	53.7	55.6	51.9	54.7	52.1	53.5	53.0	50.5	54.7	53.4	50.5
35–39	52.9	52.6	51.8	50.5	51.1	51.0	48.8	52.6	50.7	48.8	50.7	47.0	49.9	47.3	48.8	48.1	45.7	49.8	48.5	45.7
40–44	48.0	47.7	46.9	45.7	46.2	46.1	44.0	47.7	45.8	43.9	45.8	42.1	45.0	42.5	43.9	43.3	40.9	44.9	43.7	40.9
45–49	43.1	42.9	42.1	40.9	41.4	41.2	39.3	42.8	41.0	39.2	41.0	37.2	40.2	37.8	39.3	38.5	36.3	40.0	38.9	36.2
50–54	38.3	38.1	37.4	36.3	36.9	36.4	34.6	38.0	36.2	34.4	36.2	32.5	35.5	33.2	34.9	33.8	31.7	35.2	34.1	31.5
55–59	33.5	33.5	32.8	31.7	32.5	31.7	30.0	33.3	31.6	29.8	31.5	27.9	30.9	28.8	30.4	29.3	27.2	30.5	29.5	27.0
60–64	28.8	28.9	28.2	27.2	28.1	27.0	25.6	28.7	27.0	25.4	27.0	23.6	26.3	24.4	26.1	24.9	23.1	26.0	25.1	22.7
65–69	24.3	24.8	23.8	22.8	23.7	22.5	21.5	24.2	22.6	21.1	22.6	19.7	22.3	20.2	22.0	20.7	19.1	21.6	21.0	18.7
70–74	20.0	21.0	19.6	18.8	19.5	18.2	17.5	19.9	18.6	17.0	18.5	15.9	18.4	16.3	18.4	16.7	15.4	17.5	17.0	14.9
75–79	15.9	17.5	15.8	14.9	15.5	14.4	13.7	15.8	15.1	13.3	14.9	13.0	15.4	12.8	15.0	13.2	12.0	13.7	13.5	11.5
80–84	12.2	14.8	12.1	11.5	11.7	11.0	10.5	12.3	11.8	10.0	12.0	10.6	12.7	9.9	12.1	10.0	9.0	10.5	10.6	8.6
85–89	9.7	12.5	9.1	8.9	9.2	8.5	7.7	9.4	9.2	7.2	9.8	8.0	10.5	7.3	10.1	7.4	7.0	7.6	8.4	6.3
90+	8.0	9.5	6.7	6.9	7.1	6.9	5.6	7.8	8.0	5.3	8.4	5.9	10.2	5.7	10.4	6.0	5.7	5.2	7.4	4.7

Data source: ONS Public Health Research Database

Table 3
Loss to follow-up between 2001 and 2011 in ONS-LS, by ethnic group, age and sex.

Women									
	Age group								
Ethnic group	0–18	19–29	30–39	40+	40–49	50–59	60+	60–69	70+
Asian Other	17 %	28 %	18 %	–	17 %	18 %	24 %	–	–
Bangladeshi	16 %	15 %	9 %	–	16 %	13 %	34 %	–	–
Black African	27 %	30 %	19 %	–	25 %	16 %	24 %	–	–
Black Caribbean	18 %	18 %	15 %	–	13 %	18 %	–	13 %	18 %
Black Other	23 %	24 %	15 %	23 %	–	–	–	–	–
Chinese	27 %	47 %	23 %	–	16 %	22 %	26 %	–	–
Indian	11 %	16 %	12 %	–	10 %	14 %	–	17 %	21 %
Mixed	18 %	23 %	21 %	–	14 %	12 %	–	16 %	16 %
Other	37 %	44 %	38 %	–	24 %	24 %	28 %		
Pakistani	18 %	19 %	15 %	–	17 %	16 %	–	20 %	23 %
White British	12 %	11 %	9 %	–	7 %	7 %	–	7 %	5 %
White Irish	29 %	43 %	21 %	–	17 %	15 %	–	13 %	10 %
White Other	36 %	55 %	38 %	–	27 %	19 %	–	20 %	12 %
Men									
	Age group								
Ethnic group	0–18	19–29	30–39	40+	40–49	50–59	60+	60–69	70+
Asian Other	18 %	37 %	26 %	–	20 %	15 %	16 %	–	–
Bangladeshi	21 %	21 %	14 %	–	15 %	18 %	25 %	–	–
Black African	27 %	47 %	36 %	–	27 %	21 %	27 %	–	–
Black Caribbean	23 %	34 %	26 %	–	24 %	20 %		20 %	20 %
Black Other	29 %	36 %	32 %	26 %	–	–	–	–	–
Chinese	33 %	52 %	31 %	–	20 %	21 %	17 %	–	–
Indian	13 %	21 %	16 %	–	11 %	12 %	–	13 %	17 %
Mixed	23 %	34 %	27 %	–	20 %	15 %	–	19 %	17 %
Other	37 %	51 %	50 %	–	35 %	28 %	26 %	–	–
Pakistani	20 %	26 %	17 %	–	15 %	15 %	–	19 %	24 %
White British	15 %	17 %	13 %	–	10 %	8 %	–	7 %	4 %
White Irish	34 %	42 %	30 %	–	18 %	19 %	–	13 %	9 %
White Other	37 %	62 %	43 %	–	28 %	23 %	–	19 %	11 %

Data source: ONS-LS. Note: The variation in the upper age group used across ethnic groups is due to some cells being suppressed to prevent disclosure via low sample size.

statistical disclosure, we are not able to present LTFU percentages for all combinations of ethnic group, sex and age group. As a solution, we collapsed the upper age group where sample size was insufficient. We also produced LTFU tables by ethnic group and age group only, which meant that sample size was higher at older ages, giving us a better indication of missingness in these age groups. We interpolated this with the LTFU by ethnic group, sex and age group (see Supplemental Table S1) in order to produce an estimate of missingness.

We then produced a new LE estimate model. Firstly, we replaced the adjustments for IPWs and outmigration with the LTFU data. To calculate the population of outmigrants, we assume linear loss across our time period and scaled accordingly. We subtracted this cohort from the population base, and re-calculated mortality rates for the general population. We then calculated mortality rates for the outmigrants according to the mortality rates seen among outmigrants in the work of Guillot et al. (2023). We then introduced the outmigrated cohort back into our sample, and calculated the final mortality rates. We tested several scenarios for the mortality rate scalers of outmigrants (SMRO = Scaler for Mortality Rate of Outmigrants) based on the mortality rates among outmigrants observed by Guillot et al. (2023). These were as follows: 1 (baseline, mortality rate of outmigrants the same as those remaining); 1.5 (the approximate mortality hazard ratio (MHR) of outmigrants born in Eastern and Central Europe, compared to remainers born in Eastern and Central Europe); 2 (approximate MHR of outmigrants born in Southern Europe); 2.5 (approximate MHR of outmigrants born in Africa); 3.5 (approximate MHR of outmigrants born in Asia and elsewhere); with an MHR of 3 being included as a mid-point between the final two scenarios.

The calculation of standard errors was complicated by the sampling method used in the PHRD, whereby the numerator contained only a 5 % sample of those who were still alive in the year 2020, but a full sample of those who died during the study period. To simplify the calculation of confidence intervals, we treated the data as if a 5 % sample had been taken of all participants. This is the more conservative approach, and would result in wider confidence intervals. We note that this may mean that some differences between ethnic groups that were significant in the original ONS methodology may no longer be significant. The purpose of our analyses is to understand the sensitivity of estimates to alternative assumptions, and therefore we do not focus on the significance of differences, rather the changing magnitude of effect, when interpreting these results.

Figs. 2 and 3 show how estimates of life expectancy at birth changed across the different outmigration/mortality scenarios. The different result for the baseline model compared with our best-calibrating model represents the differences in outmigration levels, i.e. the result of using the ONS-LS LTFU data to estimate outmigration. It is very clear that the sensitivity of the life expectancy estimates for minoritised ethnic groups is much higher than that of the White group. For some cohorts (Black other, Mixed, and Pakistani women; Bangladeshi, Black Caribbean, Black other and Mixed men), the SMRO 3.5 scenario results in point estimates lower than the White British group. For both men and women, the life expectancy estimates of the White British group change by less than 1 year across all scenarios (83.1–82.5 for women; 79.7 to 79.0 for men). However, Bangladeshi women see a change of nearly 4 years from the baseline model to the SMRO 3.5 scenario (86.8–83.0 for women, 81.0 to 78.4 for men). Black African men and women also saw large changes (4.6 and 3.2 years respectively across model scenarios). It should be noted that the baseline model here is not the same figures as the estimates published by the ONS, but the closest that we were able to match their estimates with the data we had (again, Table 1 shows the

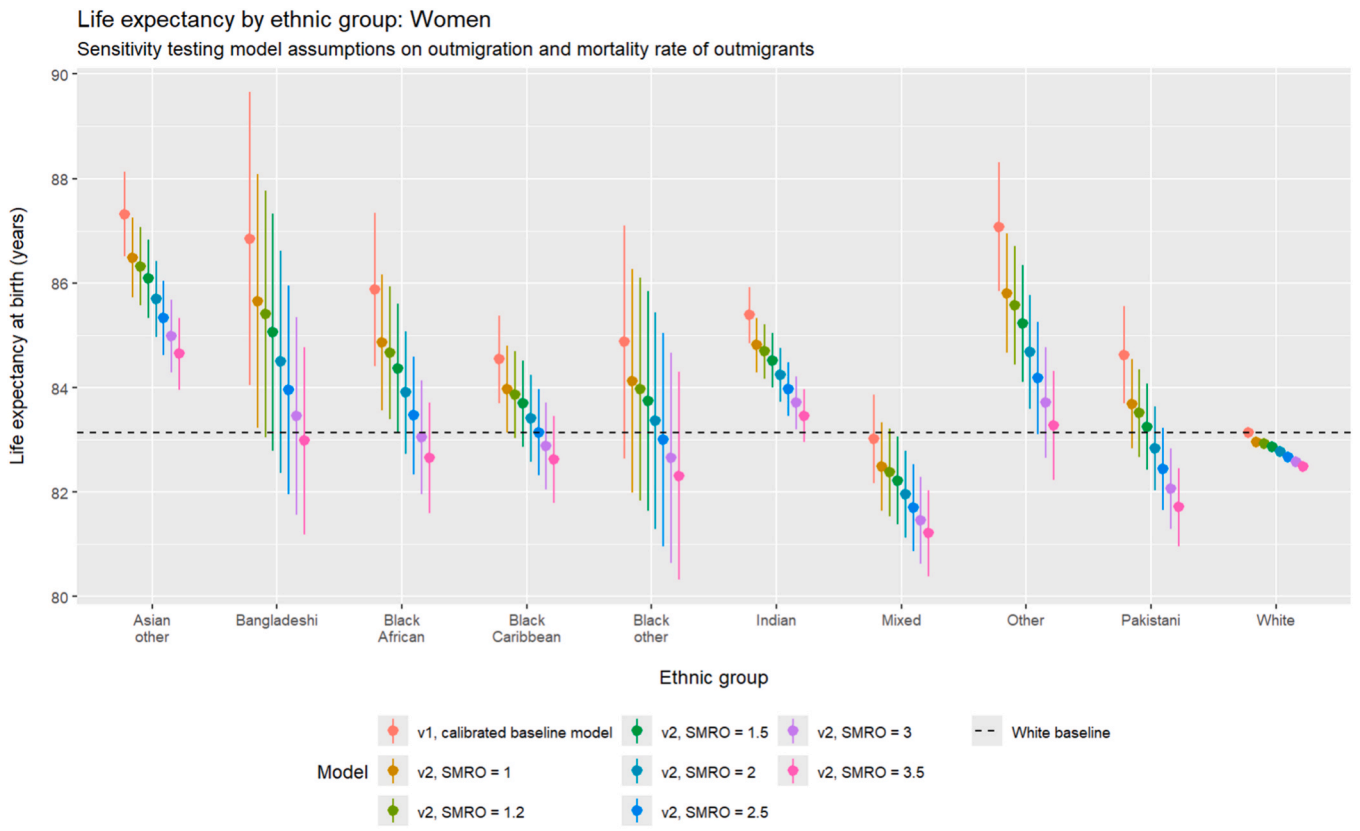

Fig. 2. Scenario testing of LE estimates at birth by ethnic group (women).

difference between our best-fitting estimates and the ONS published figures). In the case of Black African women, our best-fitting baseline estimate was 3 years lower than the ONS estimate. Therefore the SMRO 3.5 scenario for Black African women (82.7 years) is 6.2 years less than the ONS published estimate (88.9 years).

Given the theoretical link between country of birth, return migration, and the salmon bias effect, and its potential resulting impacts on life expectancy estimate, we produced estimates of life expectancy by country of birth for the minoritised ethnic group cohort.

We saw considerable differences in the mortality rates between UK-born and foreign-born people from minoritised ethnic groups. Fig. 4 shows the age-specific mortality rate for men and women from these groups in comparison to the White British group (born in any country). We observe that the mortality rate of the UK-born minoritised group is similar to that of the White British group in adulthood; although it drops off heavily in the eldest age groups. It should be noted that sample size is small for this cohort in those age groups. In childhood, mortality risk is elevated for boys from minoritised groups regardless of country of birth, and UK-born girls from minoritised groups. Mortality rate is consistently lower for the foreign-born minoritised group in adulthood when compared with the White British and UK-born cohorts.

Life expectancy estimates for the aggregated cohort are seen in Table 4. While the mortality rates by age group are comparable between the White British and minoritised UK-born group, and perhaps even slightly higher for the latter until age 85, it should be noted that the life expectancy estimates of these two groups are not identical. We observe that life expectancy at birth is higher for the minoritised UK-born cohort, when compared with the White British cohort. We also observe that the UK-born minoritised ethnic cohort has lower life expectancy than the foreign-born minoritised ethnic cohort.

While we would ordinarily advocate for the use of disaggregated ethnic groups when presenting ethnicity data, there were insufficient numbers of deaths in some age groups among many ethnic groups to reliably calculate life expectancy estimates. It should be noted that the aggregated "minoritised" group used here has varying proportions of people from different ethnic groups within age group, according to migratory trends within each ethnic group. As such, the lower mortality rate in the UK-born cohort among those aged 85+ may be because this group is comprised of people from ethnic groups who traditionally have better health.

6. Discussion

The overarching aim of this study was to examine the sensitivity of the ONS' 2011–2014 ethnic group life expectancy estimates to potential sources of error. It was not our aim to produce definitive life expectancy estimates, but rather to highlight how the data required to produce life expectancy estimates by ethnic group are in some cases being compiled with limited accuracy due to theoretical gaps in how those data are collected, particularly around how outmigration is reported and recorded. We demonstrate an example where alternative assumptions around data and methodology lead to substantial variation in the resulting estimates. Through carefully re-creating the ONS' original methodology, and adapting it for use with the Public Health Research Database rather than the Public Health Data Asset originally used, we obtained life expectancy estimates that were close to the original estimates. We note that we were not able to adequately replicate the life expectancy estimates for women from the Black African and Black other ethnic groups, which may be due to small sample sizes in these groups, particularly in the oldest age groups.

We found that life expectancy estimates change substantially for minoritised ethnic groups when alternative assumptions are used

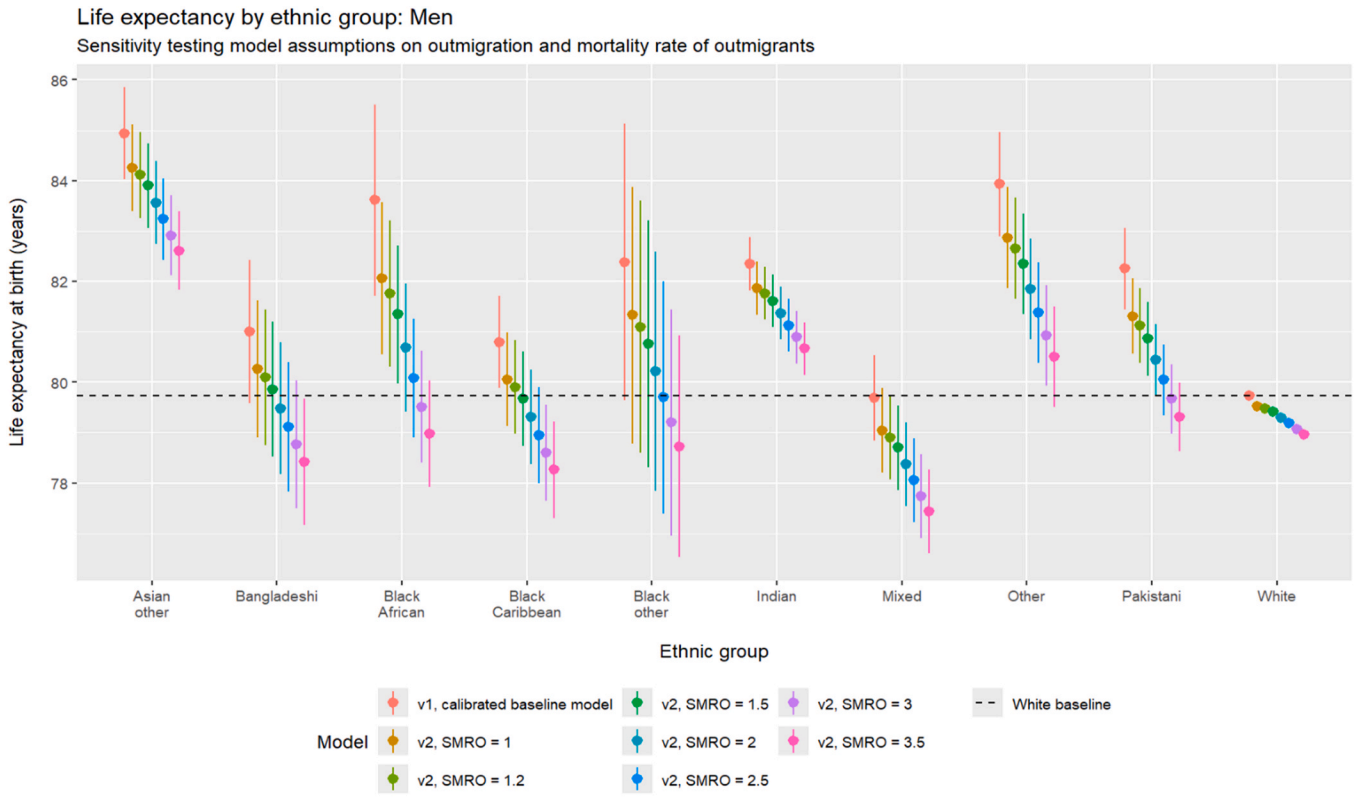

Fig. 3. Scenario testing of LE estimates at birth by ethnic group (men).

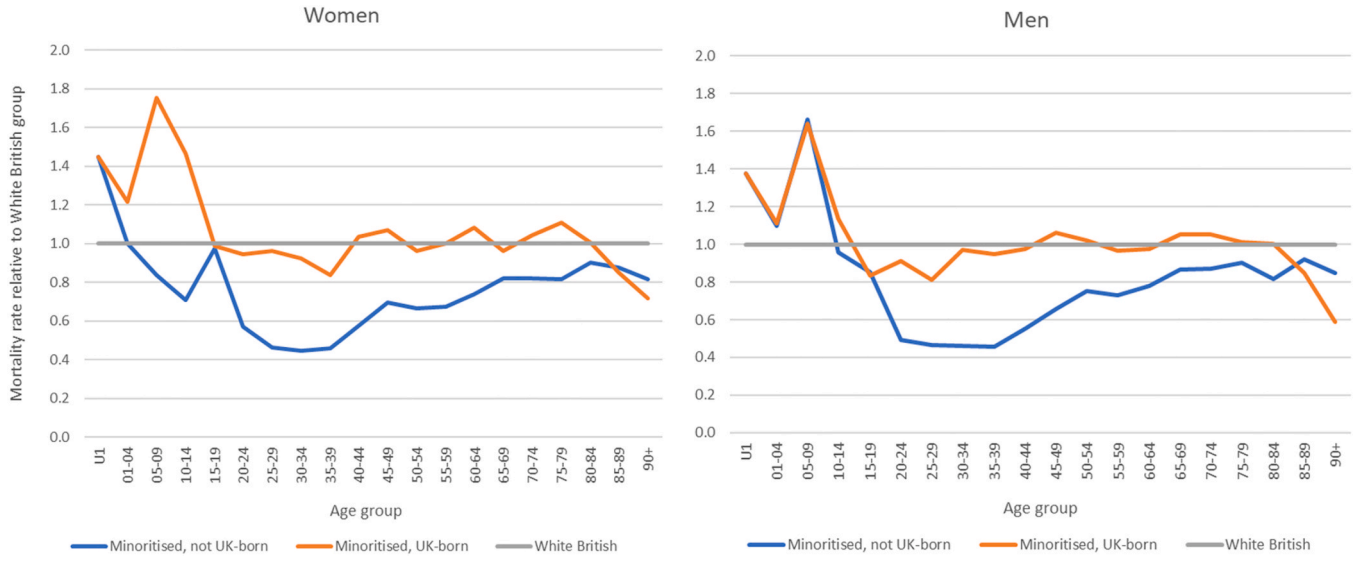

Fig. 4. Age-specific mortality rates relative to White British group for minoritised ethnic groups (UK-born and born outside UK).
Data source: ONS Public Health Research Database. Mortality rate of not-UK born minoritised ethnic group girls aged 1–4 years was suppressed due to small sample size, and has been set to equal that of the White British group for charting purposes.

around outmigration and the mortality rate of outmigrants. In some cases, the point estimates of life expectancy at birth for some minoritised ethnic groups became lower than the White British group. This demonstrates the sensitivity of the life expectancy estimates to different assumptions around missing respondents, and different assumptions on the characteristics of those missing cohorts.

We also note that even though the mortality rate for the UK-born minoritised ethnic groups is comparable to that of the White British group, their life expectancy estimates are higher. This was unexpected, as this group would not be affected by salmon bias. However, sample sizes for the eldest (i.e. aged 90+) UK-born people from ethnic minority groups are small, and while the recommendations for life expectancy estimates are that there are at least 40 deaths per cell (Toson and Baker, 2003), recent research indicates that life expectancy estimates of

Table 4
Life expectancy estimates for minoritised ethnic groups (UK-born and born outside UK) and White British group.

	Women			Men		
Age group	**Minoritised, foreign-born**	**Minoritised, UK-born**	**White British**	**Minoritised, foreign-born**	**Minoritised, UK-born**	**White British**
<1	85.5	83.9	83.3	82.0	80.8	80.0
01–04	84.9	83.3	82.6	81.5	80.2	79.3
05–09	80.9	79.4	78.6	77.5	76.3	75.3
10–14	76.0	74.4	73.6	72.5	71.3	70.3
15–19	71.0	69.4	68.7	67.6	66.3	65.4
20–24	66.0	64.5	63.7	62.7	61.4	60.5
25–29	61.1	59.6	58.8	57.7	56.5	55.6
30–34	56.1	54.6	53.9	52.8	51.7	50.7
35–39	51.2	49.8	49.0	47.9	46.8	45.9
40–44	46.2	44.9	44.1	43.0	42.0	41.1
45–49	41.4	40.1	39.4	38.2	37.3	36.4
50–54	36.6	35.4	34.7	33.4	32.7	31.8
55–59	31.9	30.8	30.1	28.8	28.3	27.3
60–64	27.3	26.4	25.6	24.3	24.0	23.0
65–69	22.9	22.2	21.4	20.1	20.0	18.9
70–74	18.7	18.2	17.3	16.3	16.3	15.2
75–79	14.8	14.6	13.5	12.8	13.2	11.8
80–84	11.3	11.6	10.2	9.8	10.6	8.8
85–89	8.6	9.3	7.5	7.3	9.0	6.6
90+	6.8	7.7	5.6	5.9	8.4	5.0

Data source: ONS Public Health Research Database

minoritised ethnic groups are particularly sensitive towards missingness at older ages (Taylor et al., 2024). This leads us to conjecture that larger sample sizes are needed to provide robust estimates. As such, it may be that the standard methodology for producing life expectancy estimates is unsuitable for certain minoritised ethnic groups who experienced only limited numbers of deaths at older ages during our study period, and that other methods to report on mortality outcomes should be considered. We note that issues caused by underestimating salmon bias are not limited to calculations of life expectancy, but could also lead to inaccuracies in other statistical estimates of the UK population, for example, quantifying the number of elderly people in geographical areas of high ethnic density.

We note some limitations of our methodology. For example, we do not address non-participation in the 2011 Census (error E5 on the data map). We were unable to identify the characteristics of people from minoritised ethnic groups who do not participate in the Census to be able to make a judgement about whether their mortality rate is likely to differ from the population who did participate in the 2011 Census. As such, we did not attempt to address this potential source of error. Furthermore, we acknowledge that our loss to follow-up proportions are calculated using the period 2001 to 2011, whereas our study period is 2011–2014. We assume that the loss is linear across the period in question; whereas there might be precipitating events (e.g. Brexit) which caused large changes in outmigration. We also acknowledge that we assume that everyone lost to follow-up outmigrated; whereas it is possible that some individuals simply did not participate in the 2011 Census, or may have been lost for other reasons. We note some potential issues around our use of the mortality rate hazard ratios reported by Guillot et al. Firstly, the migration context may differ between France and the UK. Secondly, mortality was determined according to pensioners renewing their proof of existence every year. If an individual did not undergo the renewal process for reasons other than death, this could artificially inflate mortality figures. For example, in the circumstance where an individual has lost contract with the pension administrators (e.g. in the case of moving house), if an individual's pension was relatively modest they might not be motivated to follow-up and re-claim their pension by submitting a life certificate. Whilst we acknowledge these limitations in our methodology, we emphasise that our aim for this research was not to claim our life expectancy estimates are correct and should supersede the ONS estimates, but to document the existence and impact of a large number of potential errors in the calculation of life expectancy estimates by ethnicity. However, when interpreting our findings, the reader should also consider the global body of evidence regarding lower mortality among migrants, such as the meta-analysis by Shor and Roelfs (2021).

Although in this manuscript we posit that salmon bias is an important factor acting upon the life expectancy estimates of return migrants, we acknowledge that not all return migration is due to salmon bias. Dustmann and Weiss (2007) suggests that common reasons for return migration include accumulation of skills that increase earning potential in their home country, among other economic reasons, suggesting that returning migrants may often be in good health. Dustmann also notes that among migrants to Britain who have stayed for more than one year, 40 % of men and 55 % of women will have left Britain after 5 years, suggesting that many returning migrants will be relatively young on their return. However, Dustmann also notes that white immigrants have a substantially higher rate of return migration than immigrants from minoritised ethnic backgrounds (particularly those from India and Africa).

This study has investigated the experimental ONS life expectancy estimates by ethnic group, finding that there is considerable sensitivity of these estimates among minoritised ethnic groups to assumptions around missing data, and the characteristics of those who are missing. The ONS are actively researching how to improve their estimates of migration, such as the admin-based migration estimates (ABMEs), which use the Registration and Population Interaction Database (RAPID); a database that aggregates indicators of economic activity from across the Department for Work and Pensions (DWP), His Majesty's Revenue Customs (HMRC) and other services (Office for National Statistics, 2021a). These datasets have the potential to provide us with greatly-improved estimates of life expectancy by ethnic group. However, given that these datasets are not yet available to researchers compiling more accurate estimates of life expectancy, we strongly advise researchers, journalists and policymakers to exercise caution when uncritically using the ONS' current estimates of life expectancy in their research or publications, given the high amount of missing data in the ONS' life expectancy estimate model, and the sensitivity of the model to that missingness. We note that, despite the ONS' clear labelling, these estimates have been routinely cited without caveat or mention of their experimental nature, and would advise users of these statistics to be prudent when reporting these estimates.

CRediT authorship contribution statement

Harry Taylor: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sarah Stopforth:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **Dharmi Kapadia:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **James Nazroo:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Chris White:** Writing – review & editing, Supervision, Resources, Methodology, Investigation. **Laia Bécares:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

EA statement

Not required.

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This work contains statistical data from ONS which is Crown Copyright. This work was undertaken in the Office for National Statistics Secure Research Service using data from ONS and other owners and does not imply the endorsement of the ONS or other data owners. This work uses research datasets which may not exactly reproduce National Statistical aggregates.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2025.118796.

Data availability

The data that has been used is confidential.

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