Title

Inequalities in life expectancy, healthy life expectancy and disability free life expectancy by country of birth in England and Wales: a total population, repeated cross-sectional approach

Keywords

Life expectancy, Disability-free life expectancy, Healthy life expectancy, Immigrants, England and Wales

Abstract

Introduction: Research finds lower mortality for migrants leading to the idea of a healthy migrant effect. However, recent findings suggest that some immigrant groups may live longer than the native population but in worse health. Meaning they spend a larger proportion of their life in poor health or disabled. Evidence on this topic remains scant and is yet to observe the relationship between health and longevity over time. This study uses the most granular countries of origin possible in England and Wales, across three time points to be the most detailed simultaneous analysis of life expectancy and healthy/disability-free life expectancy differentials to date.

Methods: We apply life table methods and the Sullivan method to compute life expectancy, disability-free life expectancy and healthy life expectancy. We do this over three time points using administrative data from the decennial censuses of 2001, 2011 and 2021. We categorise origins based on how the expectancies compare to that of the native population. Determining if the origin shows a healthy migrant effect, evidence of a mortality-morbidity paradox, an unhealthy migrant effect or a relationship that has changed over time.

Results: Results indicate that there is heterogeneity in health outcomes across origin groups. The healthy migrant effect is still commonplace; however, those born in Turkey, Pakistan, Bangladesh, Iraq and Somalia are found to be living longer lives with higher disability prevalence. The magnitude of difference is more pronounced in women but is found for men also.

Conclusions: Different selection methods for migrants can explain some of the heterogeneity. We see more negative health outcomes for groups known to experience discrimination and poorer socioeconomic positions. Origin groups where humanitarian migration is widespread often show a morbidity-mortality paradox. This implies that accumulated stress and disadvantage through the life course could have negative implications for later life health.

Key messages:

What is already known on this topic

- Life expectancy for immigrant groups is generally higher than the native population. However, recent findings have suggested that despite living longer some immigrant groups may spend longer proportions of their life with disabilities and in worse health.

What this study adds

- To date no other study on this phenomenon in England and Wales has explored as many countries of origins as ours, nor employed a temporal element to look at this relationship over time.

How this study might affect research, practice or policy

- The findings expand existing research by identifying that there is heterogeneity in immigrant experiences of disability free and health life expectancy versus life expectancy.
- Policy makers should be aware of this heterogeneity going forward and target interventions for groups which are particularly effected to try and increase the age that they enter disability, doing so will ensure that a greater proportion of life is spent in better health.

Introduction

As the global population ages [1], and the share of people living in other countries grows throughout the world [2], the health and longevity of immigrants will increasingly shape future population health and healthcare demands [3]. Immigration is often seen as *the* solution to population aging, yet few have acknowledged that immigrants themselves "age-in-place" in their host countries and may do so in different ways from natives. This makes research into immigrant health crucial for policymakers and practitioners alike. Previous findings report lower mortality risks among immigrants compared to natives in high income host countries, particularly among migrants born in lower-middle income countries [4,5]. This has often been interpreted to mean that migrant populations are in better health than the native population—a "healthy migrant effect" **(HIE)** [6]. This lower mortality comes in contrast to lower reported self-rated health and higher incidence of cardiovascular, respiratory and infectious diseases [7–10]. In fact, research tentatively suggests that the probabilistic link between health and mortality may not operate in the same way for immigrants as it does for native populations [11] and this group *might* be living longer lives in worse health, a so called mortality-morbidity paradox **(MMP).**

This highlights a need for more nuance in immigrant health research and to progress beyond single-outcome estimates to consider immigrant health *and* mortality [12]. This echoes the general shift in focus of international health agencies, like the *World Health Organisation,* away from traditional estimates of life expectancy **(LE)** to estimates of healthy life expectancy **(HLE)** or disability-free life expectancy **(DFLE)** that better reflect the quality of years people live and not just the quantity [13]. **HLE** and **DFLE** permits more accurate healthcare planning (through anticipating demands for long-term care and the management of chronic diseases), social policy planning (through welfare, pension, and retirement systems), and targeted public health interventions for society's most vulnerable groups—which regularly include immigrants. Due to stringent data demands, there are few studies of immigrant **HLE or DFLE** alongside **LE**. Those that *do* exist have relied upon smaller-

scale survey data for information on health [14–17], investigated a static point in time [18,19], analysed a single aspect of health [17,20,21], and/or combined immigrants' countries of birth into broad origin groupings that surely mask salient differences at a more granular level [17,22,23]. Despite these drawbacks, they highlight real heterogeneity in the "migrant experience". Some groups are living longer lives in better health, others longer lives in worse health, alongside other permutations [11,18,19,22,24].

Here, capitalizing on a repeated cross-sectional approach using comprehensive, total population data on the entire resident population of England & Wales, we investigate differences in **LE**, **HLE** and **DFLE** among immigrants at three time points (2000-2, 2010-12, 2020-22), across two health outcomes (self-rated general health [SRH] and limiting long-term illness [LLTI]), and at lowest level country of birth. We aim to provide the most up-to-date, granular estimates of **LE**, **HLE**, and **DFLE** not only in England & Wales, but in the global evidence base so far. We identify England & Wales as a major migrant-receiving country—16.8% of the population was born outside of England & Wales in 2021 [25]—that showcases real diversity in its migration history. Migrants living in England & Wales represent a melting pot of intra-UK and Irish migration, substantial labour and family migration from (now former) colonies all over the world, labour migration from the European Union (EU), highly skilled, highly qualified migration from countries such as India, China and Nigeria, alongside sizeable humanitarian migration flows originating from Middle Eastern and African countries.

Materials and Methods

We use two sources of information. Exposure and health information is based upon "de jure" census counts, while the death information is based on "de facto" vital registration data. Specifically, for prevalence of SRH and LLTI and the population denominator we use decennial censuses in 2001, 2011 and 2021. These were custom ordered from the Office for National Statistics (ONS) *Census Team* disaggregated by age, sex and country of birth. As the wording of the census questions relating to LLTI and SRH have varied over time, we summarise them in **Table 1** along with the age standardised percentage who report being limiting long-term ill. We use death registrations made available to us by the ONS *Health Data Team*. Again, these tables are broken down by age, sex, and country of birth. To increase the number of deaths observed, and increase statistical power, we use deaths from the census year and a year either side. This means that we count deaths across 3-year periods in 2000-2002, 2010-2012 and 2020-2022.

Table 1: Long term illness question and answers across England and Wales censuses

Year	Health Measure	Question	Answer	Age-standardised Percentage
2001	LLTI	Do you have any long-term illness, health problem or disability which limits your daily activities or the work you can do?	Yes No	England: 19.3% Wales: 24.1%

		• Include problems which are due to old age		
	SRH	Over the last twelve months would you say your health has on the whole been:	Good Fairly good Not good	
2011	LLTI	Are your day-to-day activities limited because of a health problem or disability which has lasted, or is expected to last, at least 12 months?	Yes, limited a lot Yes, limited a little No	England: 19.3% Wales: 23.4%
	SRH	How is your health in general?	Very good Good Fair Bad Very bad	
2021	LLTI	Do you have any physical or mental health conditions or illnesses lasting or expected to last 12 months or more? *Subsequent question asks whether these conditions or illnesses reduce ability to carry out day to day activities	Yes No	England: 17.7% Wales: 21.1%
	SRH	How is your health in general?	Very good Good Fair Bad Very bad	

Owing to the changes in question for SRH between 2001 and 2011 we present results for DFLE estimated from the LLTI question. However, the appendix includes details of HLE estimated using the SRH question. The results are similar for both, with larger gaps between LE and DFLE compared to between LE and HLE. To calculate the estimates for **LE** and **DFLE** we use abridged life tables (5 year age gaps, closing the life table at 90+) method and the Sullivan method [26]. This method is widely used for the estimation of healthy or disability free life expectancies [18,22,27]. Although there are well-known limitations to the Sullivan method, we do not have sufficiently detailed longitudinal data in England & Wales to permit an incidence-based approach. We create a life table at each census point for each country of birth and sex. We use R packages 'Demotools' [28] and the Public Health England produced 'PHEindicatormethods' [29] to derive life expectancies and confidence intervals. From the values for remaining years of life expectancy we use the Sullivan method to calculate the expected number of years being disability-free given the prevalence of disability from the census. To maximise comparability with previous research, we present the results for life and health expectancies at age 50 (LE50 and DFLE50). However, we also compute expectancies from birth and age 20 (see online).

After deriving the estimates for LE50 and DFLE50 for each country of birth at each time point we compare them to the estimate of those born in England and Wales. Using this comparison, we categorise migrant groups based on whether the expectancy is lower or higher than the native-born population into one of the categories outlined in **Table 2**. This

allows for each migrant group to be categorised across time. For many groups who are inconsistent across time points the differences to the native population are marginal, and often not statistically significant. In these cases, we classify into the most appropriate category. For others that change over time we classify based on whether these changes represent an improvement in the health outcomes or a deterioration.

Table 2: Matrix showing the categorisation of the relationship between life expectancy and disability free life expectancy

	HIGHER LE	**LOWER LE**
HIGHER DFLE/ HLE	Healthy Migrant Effect	Shorter Lives, Better Health
LOWER DFLE/ HLE	Morbidity-Mortality Paradox	Unhealthy Migrant Effect (UIE)

Results

Women

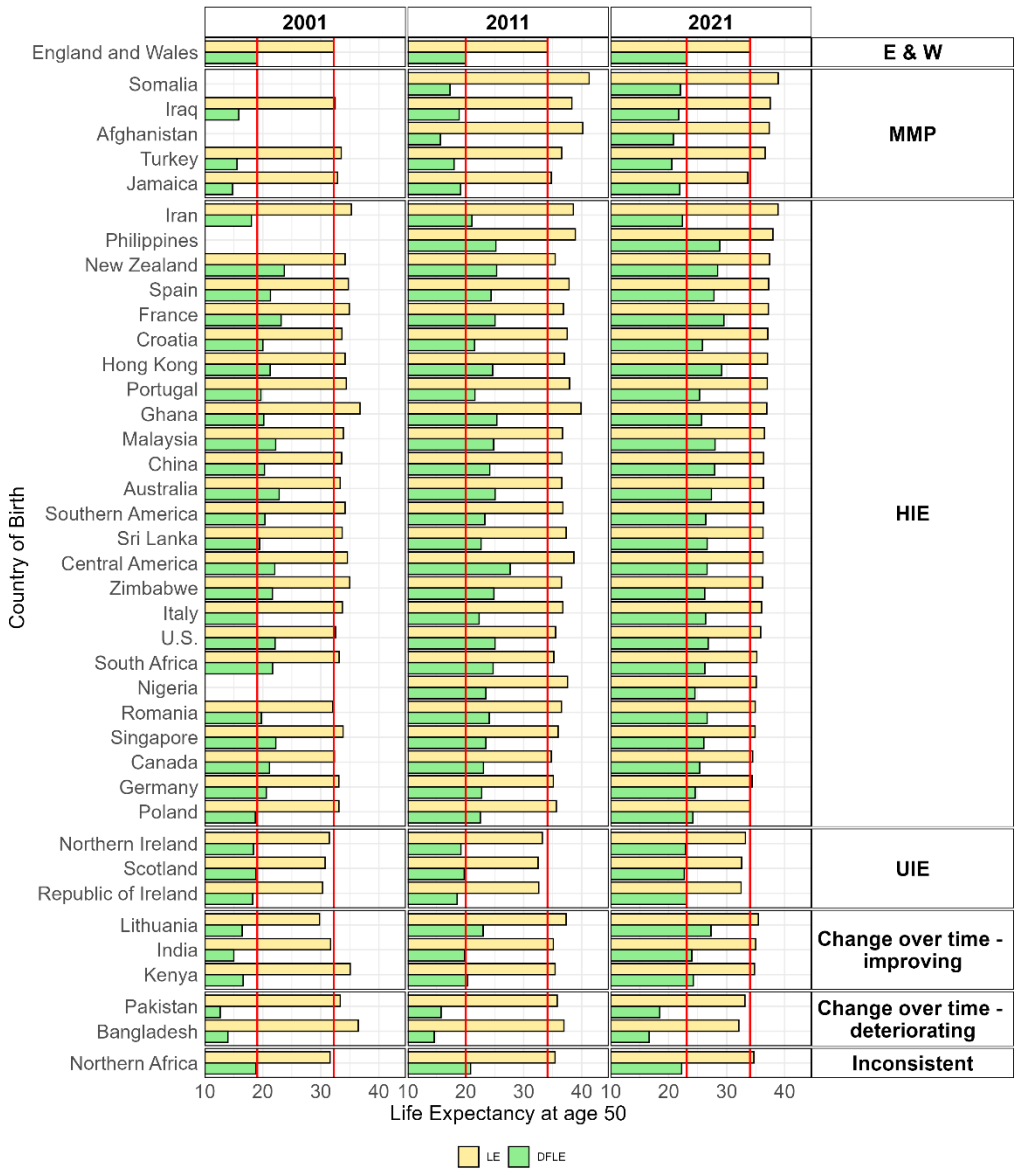
Figure 1 shows the results of DFLE and LE at age 50 for women. For most groups of foreign-born women there is consistent evidence of the HIE, with LE and DFLE being higher across time. European origins and other (predominantly) white immigrant groups from Oceania and North America are consistently in this group. However, there is heterogeneity in the size of the magnitude of advantage; New Zealand, Spain and France show some of the highest LE and DFLE amongst groups studied whereas Cnaada, Germany and Poland have a LE more like that of the natives with similar DFLE too. Other groups which appear in this group are many east and Southeast Asian groups such as Philippines, Malaysia, Singapore and China. Many groups of African origin also appear. This includes West African Nigeria and Ghana and Southern African origin of South Africa and Zimbabwe.

We observe for a handful of groups that they are living longer than native born women but transitioning to disability earlier, evidence of a morbidity-mortality paradox. This is found consistently over time for women born in Somalia, Iraq, Afghanistan, Turkey and Jamaica. Pakistan and Bangladesh also show evidence of this at earlier time points. However, there has been a clear change over time in the relationship between DFLE and LE in these groups. We suggest that this is a deterioration in health status as by 2021 DFLE remains lower than that of native women, whilst also the mortality advantage has been reversed, and LE is lower.

Other groups also experience a change over time, but with an improving trajectory. Lithuania, India and Kenya by 2021 all show a pattern consistent with the HIE. However, in 2001 Lithuanian and Indian women both showed evidence for the unhealthy migrant effect whilst Kenyan women displayed evidence of the MMP.

The instances where both LE and DFLE are lower consistently, an unhealthy migrant effect, are made up entirely of the other constituent countries of the United Kingdom and the Republic of Ireland. All have lower LE compared to women born in England and Wales and lower (or very similar) DFLE. Lastly, we leave one group in an inconsistent category, North African immigrant women have exhibited different directions of LE and DFLE across all time points. In 2001 both were lower than that of the majority population, by 2011 this had reversed to a situation where both were higher. Yet in 2021 DFLE had slipped to below that of the native population suggesting some evidence of the MMP. However, it should be noted that the differences between North Africans and the majority population are generally small.

Figure 1: Life expectancy and Disability Free Life Expectancy by country of birth in England and Wales for women



Note: Origin countries are ordered within groups by life expectancy in 2021.
Source: Authors' own calculations using Office for National Statistics data

Men

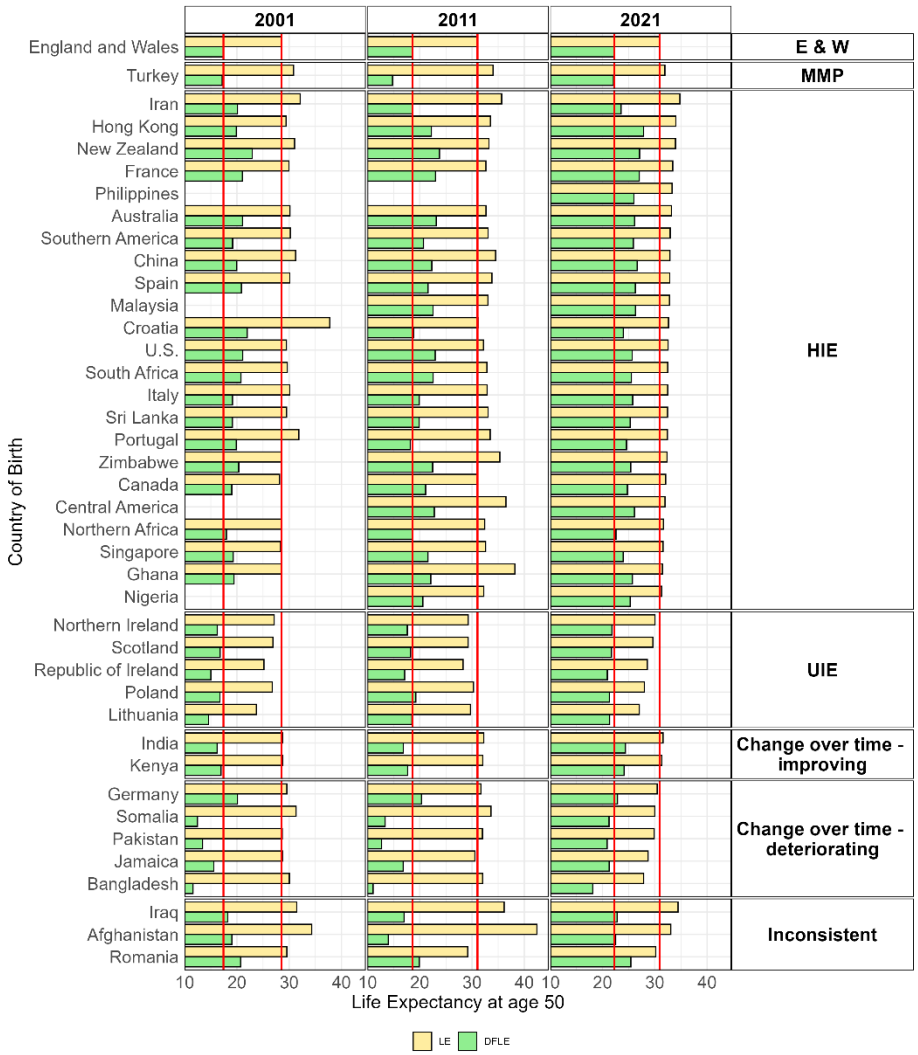
In Figure 2 are the results for men. As with women many origin groups display evidence of the HIE. As with women this is the typical categorisation of most European and other high-income country of births. Hong Kong, New Zealand, Australia and many western European nations appear in this group consistently over the census periods. Low- and middle-income countries are also represented in this group, such as Sri Lanka, Malaysia, Kenya and Iran. Iran noticeably has the highest 2021 LE.

Unlike amongst women it is not only other countries of the British Isles that show an UIE. Poland and Lithuania also show a pattern where LE and DFLE are below that of the majority

population across time. There are also instances of the deterioration of these health measures over time such that in 2021 both LE and DFLE are lower than that of the natives. This is the case amongst men born in Somalia, Jamaica, Pakistan and Bangladesh. In earlier time points these groups were showing higher incidence of disability alongside higher LE than natives, however by 2021 LE had also become lower than the native population. Germany is also in this group with an even more stark reversal over time, in 2001 and 2011 both LE and DFLE were higher than the majority population, however by 2021 this had changed to both being below that of the natives.

Much like for women, Indian and Kenyan born men show an improvement in their health metrics over time. By 2021 they show higher DFLE and LE than the native men, having transitioned from both being lower in 2001, to higher LE and lower DFLE in 2011. Lastly, three groups; Iraq, Afghanistan and Romania show little consistency over time. The former two show similar pattern of higher LE and DFLE in 2001, to a situation of high LE and low DFLE in 2011 and then to a place of higher LE and similar DFLE in 2021. Romania is unique in reaching a situation in 2021 where higher DFLE coexists with lower LE implying living shorter lives in better overall health. But this has occurred after having had higher LE and DFLE in 2001.

Figure 2: Life expectancy and Disability Free Life Expectancy by country of birth in England and Wales for men



Note: Origin countries are ordered within groups by life expectancy in 2021.
Source: Authors' own calculations using Office for National Statistics data

Supplementary Analysis

Whilst the analysis presented is for LE and DFLE at age 50, we produced estimates for LE and DFLE from birth and age 20 also. On the whole results are stable regardless of the age used. Moreover, we opt to not present HLE derived from responses to the self-reported health category as the overlap is very high. Nevertheless, we acknowledge that the concept of a LLTI (disability) is different from an individual's perception about their own health. Results where SRH is used to derive healthy life expectancy are also available in the supplementary materials. To align the answers, we deemed 'fair health' in 2011 and 2021 to be equivalent to 'fairly good' in 2001. Consequently, the proportion of responses which indicate good health is much higher than reporting of no LLTI. Therefore, differences between HLE and LE look less stark yet, the usage of HLE instead of DFLE does not render widespread differences in the categorisation of countries.

Discussion

In this study we sought to further evidence the inequalities between immigrant groups when it comes to life expectancy and disability free life expectancy in England and Wales. We find that there is heterogeneity in the health experience of migrants in England and Wales. On the whole many groups experience what is traditionally seen as the healthy migrant effect. Longer life expectancy than the majority population and lower prevalence of LLTI and poor health. However, some groups do experience a morbidity-mortality paradox of living longer lives in worse health [11,12]. Men and women born in Turkey and women born in Somalia, Iraq, Afghanistan and Jamaica suffer from this paradox. What is noteworthy is that this phenomenon is firstly, more common for women than men and secondly, exclusively seen amongst origin countries of origin that are low and middle income. Our results also suggest that over time the health outcomes for some groups have deteriorated where even advantages in LE have been lost, particularly for Pakistani and Bangladeshi immigrants and Jamaican and Somalia born men. This situation is not limited to low- and middle-income countries as deterioration over time can be observed for German men too. Importantly, are results do also suggest that the existence of the mortality-morbidity paradox or unhealthy migrant effect is not permanent as many groups have changes over time that are positive, namely immigrants born in India and Kenya.

This work extends upon previous research considerably. We have highly detailed country of birth information with which we can add substantially to the limited evidence on HLE and DFLE for immigrants in England and Wales. Moreover, the full coverage of deaths and prevalence of poor health and limiting long term illness from the census means we have unprecedented detail in the estimates we derive. These estimates are consistent with previous findings. They complement previous research on the gender discrepancy between healthy life expectancy and life expectancy [30,31]. Our results show that women are expected to live longer whilst experiencing transitions to disability and morbidity earlier. Further, we confirm that the existence of the MMP is found more in LMIC origins [11,18,27]. Finally, we have added an important temporal element which means we can show the persistence of the MMP and HIE over time for some groups and find evidence that the state of immigrant groups can transform over time in both positive and negative ways.

Amongst groups where we see the expected HIE, we see as strong support for the idea that the selection hypothesis is valid when it comes to immigrant health [32]. Immigrants entering the UK have better health than the average of the origin country, resulting in better health outcomes (higher DFLE, HLE, and LE) in the destination. Migrants from high income countries in particular show this outcome, these migration streams are selected based on socioeconomic potential and this would correlate with better health characteristics overall, increasing longevity and lowering LLTI. However, it is not exclusively high-income countries Iran, Ghana, China, Sri Lanka and Nigeria for example can also be found in this category. However, these groups also represent a highly selective migration stream of young student and professional labour. The impact of selection is even more telling when seeing that the groups which consistently experience lower LE And DFLE are those which face no barriers

to migrating to England and Wales from the other constituent countries of the UK and Republic of Ireland.

This is contrasted with other low and middle income country backgrounds, such as those from South Asian and Jamaica who have a longer history in the UK [33]. Their longevity offers some explanation for their different outcomes compared to other groups. Firstly, the selection of these groups was different, less restrictive migration regimes owing to the need for labour market gaps to be filled after the second world war might see less influence of the healthy migrant effect. Moreover, as these groups fall into categories where DFLE and HLE are lower than the majority there could have been a sustained decrease in their health (but not mortality). Representing a decline in the health advantage as duration of stay has decreased [34,35]. This could be through accumulated disadvantage which triggers worse health [34,36] or exacerbated by experiences of discrimination which are known to negatively impact health [37,38]. What is noteworthy is that for Pakistani and Bangladeshi migrants the situation seems worse compared to Indian immigrants who have shown a positive health trajectory since 2001. This would support the idea that differences in socioeconomic circumstances of these groups have contributed to this divergence. It may also be an artefact of the new selection of young high-skilled Indian migrants who report better health compared to previous migration cohorts and deflating the group level incidence of poor health and disability. The other origin groups that are highly represented in showing the MMP consistently or at some point in time are origins of Turkey, Somalia, Afghanistan and Iraq. The migration of people from these groups has been dominated by humanitarian migration and refugee flows- suggesting that there is an additional disadvantage in terms of health that persists with those who migrate through these routes.

Whilst patterns between women and men are similar regarding the relationship between health and mortality, the magnitude of differences between DFLE and LE for the most vulnerable groups are much larger for women than men. This is expected given what is known about women entering disability earlier than men, despite living longer [30,31]. However, it does confirm that migrant women face a double disadvantage of this gender gap and the disadvantage of having a migration background. Reasons behind this for women are thought to be due to the different illnesses that afflict them which are less lethal but have earlier onset compared to the illnesses that afflict men [31]. Additionally, there could be gender differences in how questions around health are interpreted and answered by women which may be exacerbated further by cultural and ethnic differences in the conceptualisation of health and therefore what ‘good health’ or a ‘limiting illness’ means might not be reported equally between groups [39].

The extent to which these results can be generalised across other contexts must be considered. The UK context and migration history is unique. The legal pathways and therefore selection of immigrants from former colonies has varied across time and that might explain some of the patterns in our results and could also suggest that as older immigrants die that the categorisation we place groups in will change as the composition of the origin group changes. The UK also has a welfare state that includes a national health service that is free at the point of use, the implications of this should also be considered as it could limit the impact

of poor socioeconomic success that would be felt worse in a paid for healthcare system. Overall our results that the LE and DFLE/HLE relationship is heterogeneous across origin groups does compliment findings from Australia [19,24]. Moreover, similar findings of living longer in worse health for refugee populations has been found in Denmark [23], which could suggest that the disadvantage of that legal status exists across contexts.

Our research has three main strengths that contribute to an expansion of the literature on migrant-native differentials in health in England and Wales. First, we greatly benefit from data that has allowed us to study country of birth at the lowest level and have included countries that previous research in the UK has never been able to study individually. Second, we have been able to add a temporal element by employing a repeated cross-sectional approach at three time points. Last, our use of census data means that we can study morbidity using both the self-reported health and the prevalence of LLTI questions. Overall, extending discussion on migrant health beyond that of mortality and analysing the relationship between morbidity and mortality for different groups.

Limitations to this work must be acknowledged though. The question changes between censuses must be considered. For self-reported health the use of the five-point scale in 2011 and 2021 includes a ‘fair health’ category that did not exist in 2001. We deem ‘fairly good health’ in 2001 to be equivalent to fair health in later years; however, this means we see very high reported levels of positive SRH, which should be considered when interpreting the results of HLE differentials. This is why we elected to show DFLE primarily since the questions have been more stable. Nevertheless, questions on LLTI have also changed over time which could impact our results particularly the broadening of the definition to include mental health in 2021. Although, the census in 2021 found substantially less disability than 2011; thought to be down to the 2021 census coinciding with the Covid-19 pandemic and lockdowns which changed the perception of health for people having seen the outcomes for those in poor health during the pandemic [40]. The results for 2020-2022 should be considered with Covid in mind. We know that Covid was not felt evenly across society and in the UK context long standing immigrant groups from India, Pakistan, Bangladesh and the Caribbean did have elevated mortality compared to the majority population [41] which is a reason behind why life expectancy differentials have appeared, or widened for these groups at that time point. Nevertheless, our results are indicative of the real experience of people during the pandemic and offer an important contribution to how the pandemic may have influenced not only life expectancy but healthy life expectancy also. Going forward future research should identify if there has been recovery of LE and DFLE that may reverse these negative trends of health particularly for immigrants from Pakistan, Bangladesh and Jamaica.

Overall, our results show very clearly that there is heterogeneity in the life expectancy, disability free life expectancy and healthy life expectancy between different immigrant groups in England and Wales. By using measures of health instead we uncover health inequalities which are masked if relying on LE alone. In doing this we have uncovered that some immigrant groups are paradoxically living longer in a state of worse health than natives. We have produced reliable empirical evidence on this phenomenon and its existence over time. The use of more nuanced measures such as DFLE and HLE better reflect the lived

experience and morbidity that people experience in their later years. This data should be used by policymakers to inform changes to healthcare systems and introduce public health measures that are targeted at groups with the aim of increasing the proportion of life spent disability free and in good health. Researchers and policymakers alike should continue to explore this phenomenon and find data that will help discover which morbidities may be driving the inequalities faces by different immigrant groups.

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