The search for selection: estimating migrant mortality relative to origin.

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The term 'migrant mortality advantage' (MMA) is used to describe international migrant populations with a lower risk of mortality than non-migrants [1]. Although three reference groups exist against which to compare migrant mortality (non-migrants in the destination, non-migrants in the origin, and migrants from the same countries in different destinations) [2], the MMA has almost always been conceptualized and estimated relative to non-migrants in the destination. This greater focus on an 'advantage-versus-destination' (*an MMA observed relative to non-migrants in the destination country*) is partly because researchers have been trained to study the effects found in developed destinations [3]. Additionally, comparisons to origin are much more data intensive than to destination. To estimate an 'advantage-versus-origin' (*an MMA observed relative to non-migrants in the origin country*) for just one migrant group would require two harmonized data sources: one to calculate migrant mortality in the destination and another to calculate non-migrant mortality in the origin. Sourcing such data is difficult, but becomes more challenging when migrants come from countries in which accurate data collection is behind that of developed destination countries.

Consequently, very few studies have compared migrant mortality to non-migrants in the origin country. Most have done so for a specific cause of death for a single migrant group [4-13], which provides little insight into the patterns and explanations of the MMA. To the best of our knowledge, just two studies have examined all-cause mortality for (a small number of) multiple origins [14,15]. However, most of the migrant groups were of European origin, which is not reflective of the increasingly diverse range of migrant groups in developed countries today. Further, both studies only produced age-standardized mortality rates, ignoring revealing age variation (an issue that can be extended to destination comparisons) [16]. This lack of origin comparisons means we do not have much, if any, empirical evidence of the supposed main explanation of the MMA: health selection. Selection theory posits that migrants do not simply represent a random sample of the origin population; rather they are positively selected from a less frail subset more likely to survive [14]. This could be due to direct selection on health or its determinant factors e.g. education and income. To begin to explore such an explanation requires a direct comparison between migrants and the origin population they left behind, *and selected from*, not the host population in the destination country.

Thus, in this study, we re-conceptualize the 'migrant mortality advantage' in the perspective of the origin country and produce detailed estimates of migrant mortality relative to origin. In doing so, we give greater salience to the origin population as a reference group and the consequences of the MMA in the origin country context, provide detailed new estimates of the MMA (to a level of detail that has rarely been possible before, even for comparisons to destination), and present crucial new insight into patterns and processes of migrant selection [17].

Data and methods

We use macro-level data (deaths and exposure) from the UK *Office for National Statistics*, the *Human Mortality Database* and the *United Nations World Population Prospects* for the period 2010-2012 to compare all-cause mortality of the 35 largest migrant populations in the UK to their origin populations. Due to the focus on selection, we also compare education for the same 35 migrant groups. Specifically, we calculate estimates of all-cause mortality and tertiary-level educational attainment by age, sex, and development level of the country of origin.
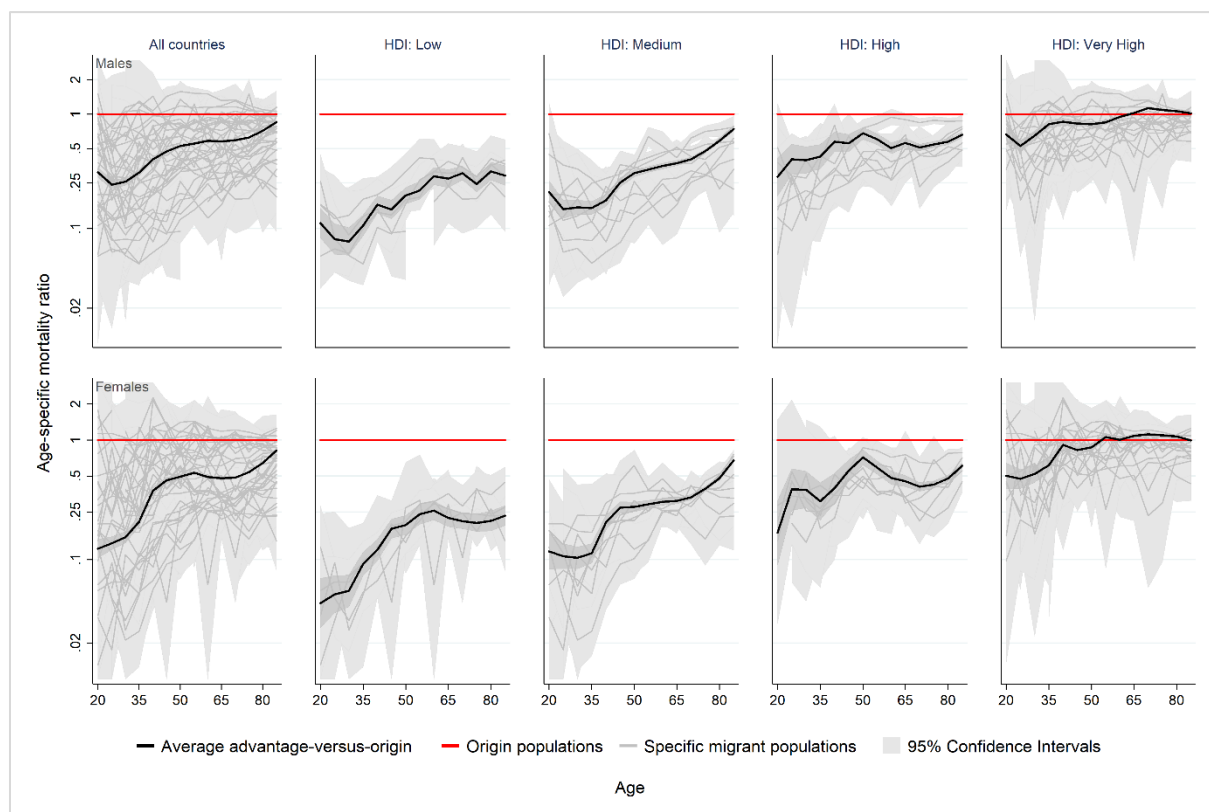
Results

Figure 1: Mortality advantage-versus-origin for 35 largest migrant groups in the UK.

Fig.1 shows age-specific mortality ratios of migrant males and females relative to their origin populations. Each migrant group is allocated an official group from the Human Development Index (HDI) based upon the most recent HDI score of the origin country. In the first panel "all countries" (which combines all 35 migrant groups), the average shape of mortality is one in which mortality differences are most pronounced at young adult ages and converge over age. Among specific migrant populations, we observe marked age variation in the MMA, but few points rise above 1.0 (excess mortality). Despite the increased visual noise in specific migrant groups, an age convergence can be observed. The same pattern we observe in the first panels presents in all of the other panels averages. In terms of major differences across category averages, the size of the initial 'advantage-versus-origin' at age 20 decreases with increasing development. Furthermore, while the mortality differences between migrants and non-migrants in all of the categories decrease with age, the gradient becomes steeper the lower the level of development. Finally, while the mortality of the migrant populations in category 'HDI: Very High' has fully converged by age 60-years, migrants in the other HDI categories still have considerable advantages over their origin population at old ages. For

specific migrant populations, we can see that the pattern of converging mortality over age is near systematic in the HDI categories 'low', 'medium' and 'high'. In the 'very high' category, the shape of migrant mortality over age then begins to vary substantially. It is also in this final HDI category that mortality begins to rise, and remain, above 1.0 for certain migrant groups.
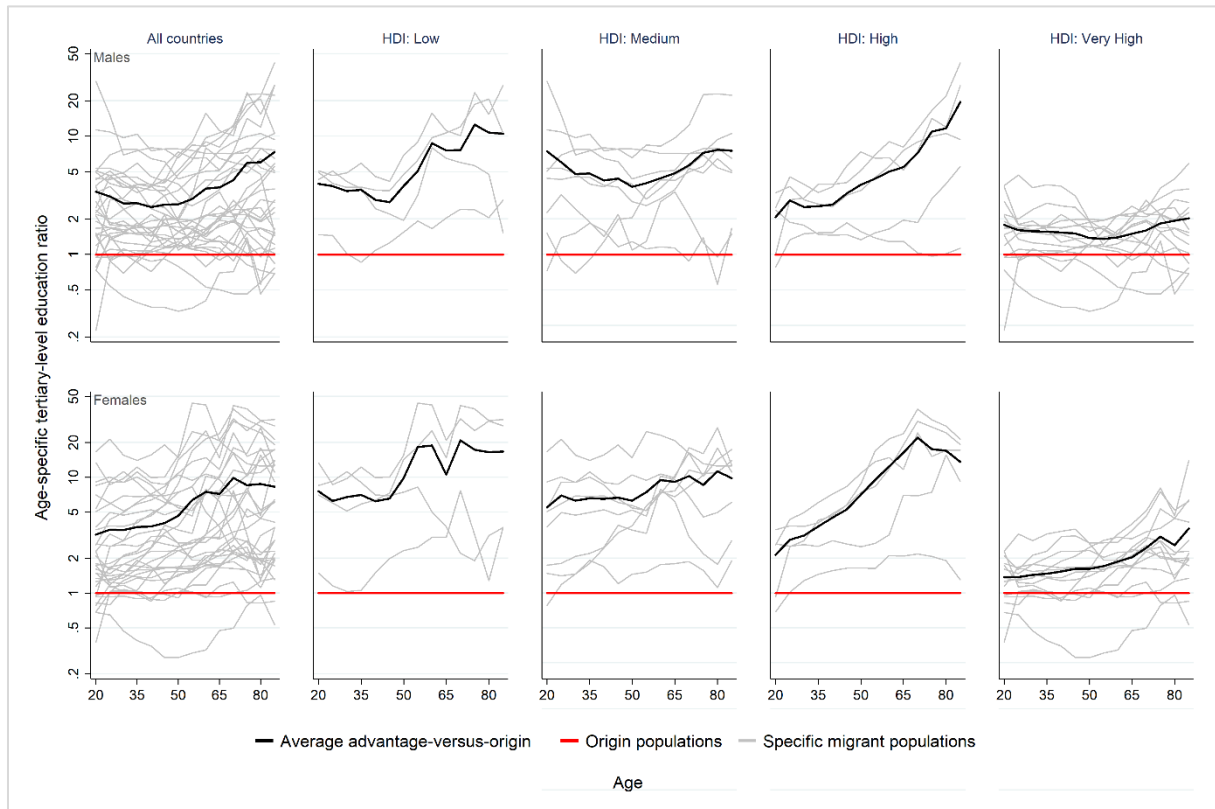

Fig 2: Educational advantage-versus-origin for 35 largest migrant groups in the UK.

Fig.2 shows age-specific tertiary educational attainment ratios for migrant groups relative to the origin population with an identical setup to Fig.3. In the first panel 'all countries', the average shape is one in which migrants have systematically higher proportions of tertiary level education over age. Among specific migrant populations, we observe variation in the size and shape of the education advantage, but interestingly few points fall below 1.0 (i.e. a lower proportion having obtained tertiary-level education). One exception is Lithuanian males and females, with consistently lower proportions having achieved a tertiary level of education at all ages. The same overall trend in the first panels presents in all of the HDI-specific panels. That said, we observe differences in the scale and shape of this advantage across panels. In short, the lower the level of development, the higher the tertiary-level education ratio appears to be (consistent with mortality). We also observe differences in the gradient of the ratio. It increase sharply for high HDI over age, but less so across the other categories.

Discussion

For the first time for a large and diverse range of migrant groups, we have re-conceptualized the MMA in the context of origin country, providing new estimates of the MMA and finding evidence consistent with selection effects. That we studied mortality across such a disparate

range of migrant groups and observed a near systematic advantage (all-cause mortality ratios not shown), speaks to the idea of a universal mechanism generating the 'migrant mortality advantage' (such as selection) rather than country-specific factors (like social and cultural norms affecting health behaviours). Moreover, the 'advantage-versus-origin' increased with decreasing origin country development levels, was pronounced at young adult ages then converged over age, *and* mirrored the magnitude and the direction of migrants' educational selectivity. All patterns are consistent with those theorized for the presence of selection effects.

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