Estimating Mortality Among Immigrants in the Presence of Out-migration

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EPC 2024 Extended Abstract

During the last decades, immigrant populations have increased in both absolute and relative size in many developed countries.[1-4] Given these trends, health and mortality patterns among immigrants are of increasing importance for host countries, as they have an impact on the demand for health care, health insurance schemes, and pension systems.[5,6]

In spite of their significance, mortality levels among immigrants are notoriously difficult to capture in data sources. Two major problems stand out, both of which arising from the fact that immigrants are by nature a very mobile population, subject to high rates of out-migration from their host country.

First, out-migration, when not correctly captured, treats immigrants who left the host country as if they were "immortal." Indeed, in prospective mortality follow-up studies where the survival status of surveyed individuals is determined by the host country's death registers (for example via death matching as in the case of the NHIS-NDI data in the US), immigrants who out-migrate are retained in the risk pool but have by definition a zero chance of dying since their deaths abroad are no longer covered by the host country's vital registration (VR) system. This bias, which we call censoring bias, will artificially inflate the population at risk and produce mortality estimates that are too low.[7]

The classic way of addressing this bias is to censor individuals who leave the country. This could be done in theory with longitudinal surveys or population registers that keep track of out-migrations, but such tracking information is rarely available. This bias is implicitly addressed when mortality rates are calculated on the basis of unlinked mortality data, i.e., combining VR deaths counts with census-based exposure counts.

Second, out-migration can produce bias in immigrant mortality rates via selection, i.e., if the risk of out-migrating from the host country and the risk of death are correlated. This selection is most often discussed in the literature as negative return migration selection or "salmon bias", whereby immigrants who are in poor health may be more likely to return to their country of origin than healthier migrants, for reasons ranging from the willingness to seek better family support to the desire to die in one's birthplace.[8-16] As a result of this "unhealthy remigration," the health distribution of immigrants remaining in the host country will be artificially favored, producing mortality rates that are too low. This out-migration selection effect is equivalent to the classic problem of informative censoring in event history analysis.

Bias arising from return migration selection (salmon bias) is distinct from the censoring bias discussed earlier. Indeed, failure to censor individuals who have out-migrated will affect migrant mortality rates even in the absence of return migration selection effects. Likewise, return migration selection effects will have an impact on migrant mortality rates even if individuals who have out-migrated are correctly censored. If individuals who leave are both more likely to be in poor health and not correctly censored, then the combined effect of these two biases will be larger than either bias considered separately.

Both biases lead to underestimation of immigrant mortality in host countries, making it difficult to track and address the mortality conditions of immigrants in host countries. In particular, the existence of these biases, which both generate mortality underestimation, make it difficult to interpret the so-called

"migrant mortality advantage," i.e., the observation that immigrants tend to exhibit lower mortality than the non-immigrant population of their host country.[17]

The aim of this paper is to examine the relative effect of these two biases on immigrant mortality by using a rich, unique data set from France in which pensioners are followed worldwide until they die. This data set provides a unique opportunity to measure the extent to which conclusions about immigrant mortality are affected by these biases, and which of these biases matters most.

The main innovation of this study is the ability to examine these two biases at the same time in a coherent framework. Previous studies in this line of research have focused either on the censoring bias[18] or on the salmon bias,[14] but not both at the same time. The joint examination of these two biases is important because it allows us to understand the challenges of measuring immigrant mortality in a more global and realistic way.

Data and Methods

This paper is based on a longitudinal data set from the Caisse Nationale d'Assurance Vieillesse (CNAV), France's most important pension fund. This data set is a random sample of individuals aged 65 and above who are alive as of December 31, 2008 and receiving a pension from CNAV as of that date. These individuals, who have all been employed in France at some point during their adult life and reside in France at the beginning of the period (12/31/2008), are followed for six years, until December 31, 2014. This follow-up documents changes of residence, in France or abroad, during the period of observation. It also documents deaths, in France or abroad, among these individuals, using registration information (for deaths in France) or "certificate of life" information (for deaths outside France). Pensioners living abroad are indeed required to produce a "certificate of life" once a year, via the local authorities and after presentation of proper identification documents, to prove that they are indeed alive, so that they continue receiving their pension. If an individual stops producing this certificate, s/he is assumed to be dead and the CNAV stops paying pensions. This sample, which was prepared by the CNAV specifically for this study, includes 300,000 pensioners born abroad and 100,000 pensioners born in France.

All analyses will be conducted by using Cox proportion hazard models with mortality at ages 65+ as the outcome. In a first set of models, we will replicate the conditions of a typical prospective mortality follow-up study such as the NHIS-NDI study. Individuals who out-migrate during the period of observation (2009-2014) will be treated as if they remained in France and were alive at the end of the period. These individuals will continue to contribute exposure after they out-migrate but will not contribute any deaths. Mortality estimates produced by these models will be affected by both censoring and salmon biases.

In a second set of models, individuals who out-migrate during the period of observation will be censored at the time of their out-migration, i.e., their post out-migration exposures and deaths will be discarded from the analysis. These models replicate the demographically-correct way of calculating relative risks and mimic the unlinked VR-census data approach. While these estimates will be free of the censoring bias, they will still subject to the salmon bias.

In a third and final set of models, individuals who out-migrate during the period of observation will be treated as if they remained in France, but unlike the first approach, they will not be assumed to have survived until the end of the period. Instead, their deaths abroad will be taken into account and treated as if they took place in France. Given the short duration of the follow-up period (2009-2014), this approach allows us to approximate the actual level of immigrant mortality, net of both censoring and salmon biases.

In addition to the CNAV data, we will also examine immigrant mortality based on unlinked VR-census data for the same period in France. This will allow us to verify our premise that the second set of models should approximate the classic demographic approach to estimating immigrant mortality.

Preliminary results

Figure 1 below provides preliminary results for foreign-born (all countries of birth combined) vs. native born male pensioners. Results show that Model 1, where results are affected by both censoring and salmon biases, have the lowest relative level of immigrant mortality, with a hazard ratio 0.914. This is expected given that results under this scenario are affected by the combined effect of the two downward biases. Addressing the censoring bias (Model 2) reduces the immigrant mortality advantage a bit, from 0.914 to 0.927, but the effect is small. Model 3 approximates what the relative mortality of immigrants is in the absence of both censoring and salmon biases. The reduction in the mortality advantage is larger, from 0.927 to 0.946. This confirms that some negative return migration selection is indeed taking place in France, generating a downward bias in immigrant mortality estimates. Accounting for this negative selection, however, does not completely eliminate the mortality advantage, which remains significantly below one.

Figure 1
Mortality Hazard Ratios of foreign-born vs native born male pensioners in France, ages 65+, 2009-2014, using different approaches for treating out-migration
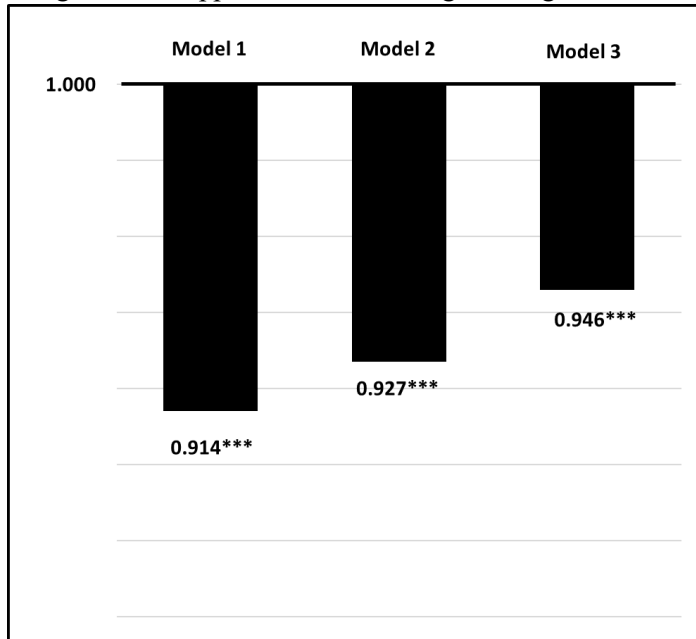
These preliminary results confirm that the biases commonly raised to explain the immigrant mortality advantage do indeed contribute to underestimating the relative mortality of immigrants. These biases, however, appear to be somewhat minor, at least as far as ages 65+ are concerned. They do not change in fundamental ways the overall conclusion that immigrants experience a mortality advantage relative to the native born, here observed at ages 65+ in the context of France. These results remove ambiguity about the veracity of the immigrant mortality advantage and contribute to better understand the actual mortality conditions experienced by immigrants.

In the final paper, we will examine the extent to which results vary by country of birth. The amount of out-migration at ages 65+, and its associated selection, may indeed vary strongly by country of birth. We will also examine relative immigrant mortality levels calculated on the basis of unlinked VR-census data for the same period. This will bring a fresh look at the extent to which unlinked VR-census data can indeed produce reliable estimates of the immigrant mortality advantage. This will also help us determine and understand what the true, underlying levels of old-age mortality among immigrants are in a major host country like France.

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