Differences in migrant mortality: For a multilevel approach of spatial inequalities using a fine granularity. An application to Switzerland, 1990-2008

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Introduction

The environment influences mortality risks by social or cultural factors but also by contextual variables (Caselli et al. 2003). Environmental factors are often overlooked in demographic studies because of the lack of appropriate data but also due to the prevalence of individual factors in the literature. Researches including these two dimensions (environmental and individual) yet increased during the last decade and revealed the integration of individual components in a social and cultural environment. This paper aims to deepen the spatial inequalities in migrant mortality. So after taking into account individual factors, we test whether the heterogeneity of mortality force among migrant populations is important or instead, it collapses since captured by the individual variables. Here we focus especially on the foreigners in the Swiss context assuming that migrants are more vulnerable toward environment.
Although some studies showed that the spatial differentials in longevity at a regional level are modest among the Swiss cantons (Wanner et al. 1997), we want firstly to test if there is a real spatial heterogeneity and see whether we observe the same pattern for natives and migrants. Because region boundaries are often arbitrary and may consist of very different regimes, measures at a too large level smooth differentials that exist at a fine granularity. We will analyze, at a descriptive level, if the differentials for a fine scale are important and if it seems interesting to go further in a multilevel approach of mortality taking into account individual and local determinants.

Data

The data used come from the Swiss National Cohort, a longitudinal research platform based on the linkage of individual data from the national census. Probabilistic record linkage methods were used to assign each death or emigration record (1990-2008) to a record in the census data set (Bopp et al. 2009). Thus gives the opportunity to follow the national cohort between 1990 and 2008[1] and to know the individual characteristics of the whole population. Our population of interest is resulting from a migration and will

[1]The linkage continues and will be extended to the 2010 census and beyond.

be measured by the foreigners permanently residing in Switzerland and will be compare to the Swiss citizens. This subpopulation is fairly large and increased in a proportion of 18.3% in 1990 to 20.5% in 2000 to reach 1'495'248 individuals. During the 18 years of risk exposure, the foreign and the Swiss populations have lived 22'371'598 and 98'169'997 person-years and experienced 83'850 and 1'030'136 deaths respectively.

Methods

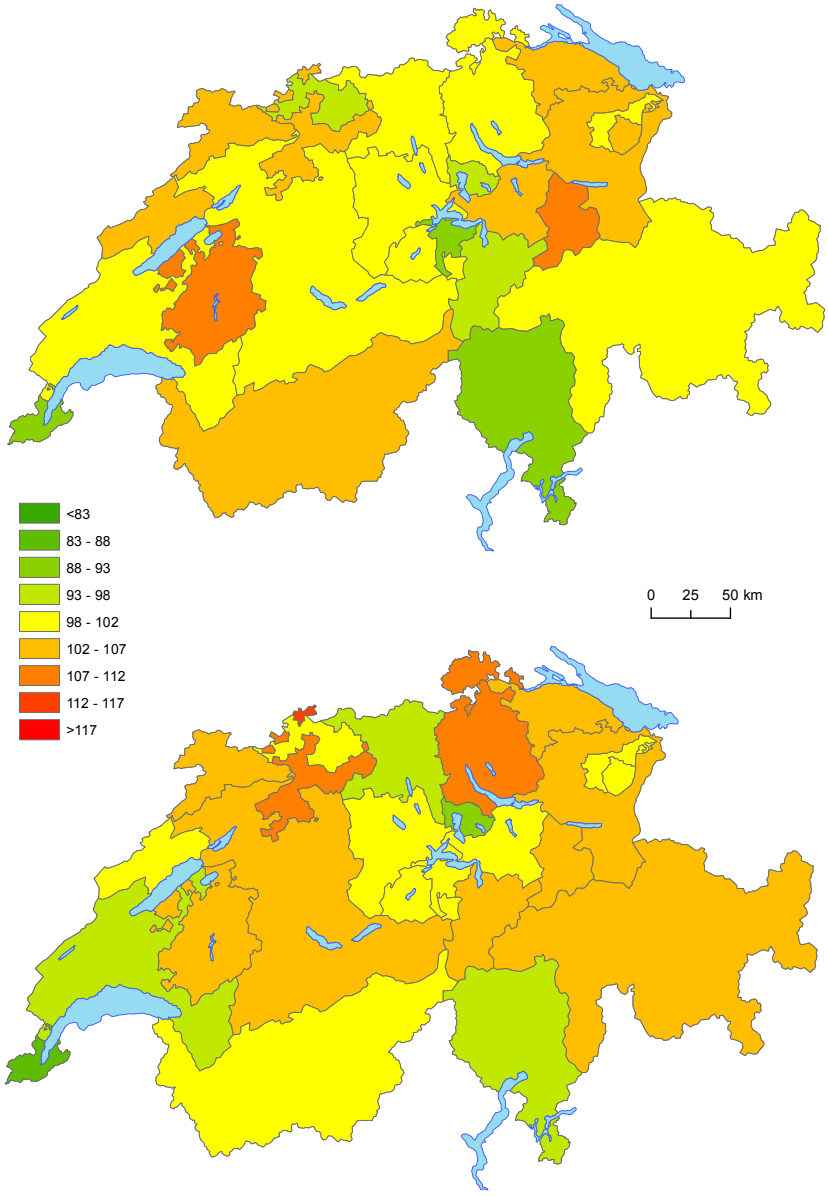
The spatial differentials in mortality are measured with the use of a standardized mortality ratio (SMR). Two Quasipoisson generalized linear models were used to predict the risk of death according to individual characteristics. The first only take into account age, sex and a dichotomic variable that differentiates foreigners and Swiss citizens because of the lower probability of death among migrants who appear to be healthier due to in and out selection effects and probably protective behaviors (Abraido-Lanza et al. 1999). The second model also controls for marital status, socioeconomic status (highest attained education level) and origin (11 regional groups). For each area, we estimate the ratio between expected and observed deaths and interpret it as the spatial mortality gradient. As we work with a fine granularity, the SMR can be very unstable for small areas with a low number of events. The individual frailty brings non observed heterogeneity - a source of variability which could be important for small areas. Bayesian methods allow the optimization of these geographic estimates in particular with the estimation of a spatial autocorrelation parameter (Besag et al. 1991). Our bayesian model is a conditional autoregressive (CAR) with a poisson likelihood, a log-normal prior for random effect with an uncorrelated heterogeneity and an intrinsic Gaussian CAR prior for random effect with a correlated heterogeneity (Lawson et al. 2003).

First results

We first evaluate the SMR by age, sex and nationality (model 1) for Swiss and foreigners among the 26 cantons. The map (figure 1) shows a relative low spatial gradient and a heterogeneity which appears to be slightly more important for foreigners. When controlling for socioeconomic and cultural variables (model 2), the heterogeneity drops since partly captured by the socioeconomic variables but still stays larger for migrants - the variance of the standardized mortality ratios attests this trend as shown in table 1. The cantons have diverse sizes and populations regions, we therefore computed a weighted (by person-years lived between 1990 and 2000) variance which shows a rising heterogeneity for migrants, but decreasing for the Swiss. For the natives, the sparsely populated cantons have larger deviations from mean so that at the end, the heterogeneity across the regions is weak. For the migrants, we observed the opposite trend, the variance is higher when weighted by population. So it seems to be a stronger regional impact on the mortality differentials among migrants.

In a second time, we explore the inequalities in migrant mortality for small areas to determine whether there is a large variability within cantons. We choose a fine granularity - the 2896 communes of the country- and estimate again a SMR. This has only been possible with data covering almost 20 years and therefore have enough events. The variance

Figure 1: Mortality force by age and sex for Swiss (top) and foreigners (bottom), Swiss cantons 1990-2008.



is higher than previously which means that the deviations are larger on average (table 2). There is more heterogeneity by decomposing the regions and, as before, the trend is amplified for migrants when we controlled for the populations size. We can notice that the contribution of control variables in the variance reduction is more important when working at a fine scale than at the regional level. With large area, we smooth existing differences on a fine scale and thereby it is no longer possible to distinguish the real impact of the local environment on mortality. As shown by figure 2, the differences between the two levels we have chosen are important. It's therefore appropriate to work with a fine granularity do detect the spatial effects on mortality differentials.

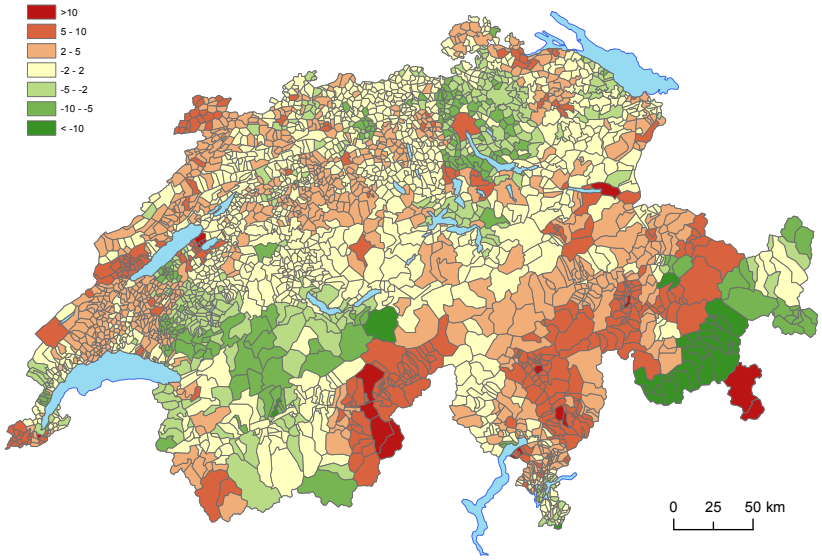
Table 1: SMR variance and weighted variance, Swiss cantons 1990-2008.

	Variance		Weighted variance	
	Swiss	Foreigners	Swiss	Foreigners
model 1	19.26	36.93	13.16	65.35
model 2	14.53	22.12	9.39	45.89

Table 2: SMR variance and weighted variance, Swiss communes 1990-2008.

	Variance		weighted variance	
	Swiss	Foreigners	Swiss	Foreigners
model 1	46.12	56.60	46.02	91.64
model 2	25.83	32.03	26.55	55.67

Figure 2: Mortality differentials between the canton level and the commune, foreigners, 1990-2008.



Preliminary conclusion

The analyze presented here highlighted the importance of spatial mortality differentials among migrants. As we have seen, the spatial gradient also exists for Swiss but is minor. Foreigners in Switzerland are so more vulnerable toward environmental factors. It would be appropriate to go further and decompose the share of individual and local factors in a multilevel approach. We will test in the future the impact of the environment through contextual, social and cultural variables while considering the usual individual factors.
In the second step, we also saw the importance of working with a fine spatial gradient that allows bringing out the heterogeneity within major regions. These preliminary results have been able to show a trend which has to be tested in a multilevel framework.

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