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Introduction

Life expectancy is often used as a summary measure to describe the state of a population, in terms of mortality as well as in terms of health (van Raalte, Sasson, and Martikainen 2018). In this sense, life expectancy is indeed very convenient. However, precisely because of this synthesis, life expectancy can camouflage other important characteristics of a population. One of such characteristics is the variation in the age at death also known as lifespan inequality. Lifespan inequality, which at the individual level describes the uncertainty of the timing of death, has been decreasing as life expectancy and the modal age at death have increased. Yet, life expectancy and lifespan variation have been shown to follow different historical trends, so that one does not necessarily imply the other (Wilmoth and Horiuchi 1999). Therefore, by only focusing on life expectancy, we miss a fundamental inequality in age at death.

on a specific subset of populations: those experiencing a mortality crises such as…. Although we will use historical data from the HMD, as these are more readily available, our ambition is not confined to historical research. In fact, mortality crises, such as epidemics, famines and natural or artificial catastrophes, are not a thing of the past. On the contrary, they will become an ever more pressing question as extreme weather events increase in frequency with climate change (Cynthia et al. 2001). By analysing and comparing the evolution of different populations, we wish to understand whether a regular pattern emerges which could be a consequence of mortality crises. In this way, studying the patterns in lifespan variation of past populations will help us better understand the impact of mortality crises today.

Data & Methods

Although studying the variation in the mortality distribution will already inform us on the existence of repeating trends, we also plan to understand the sources of these variations. The HMD does not include information on socio-economic status or other similar characteristics, so that it is impossible to understand whether the variation is linked to social inequalities. It is possible, however, to decompose the variation of the mortality distribution by age and gender. This will help us understand whether certain age and gender populations contributed more to the increase or decrease in lifespan variation. These results will be particularly helpful for organising the response to mortality crises in the future. Indeed, if some specific age groups are revealed to be especially vulnerable in such cases, the organisations responsible for the response will be able to better prepare and organise it.

**Research questions**

In this work, we will answer to three main research questions.

First of all, we want to study whether the variation in lifespan changes during and after a mortality crisis. In order to provide an answer, we will compare the mean variation before the crisis to the one measured during the crisis year(s) and in the following years. One could expect that a severe enough crisis would cross social lines, affecting the whole population equally, as happened for the European Black Plague (Livi Bacci 2012), so that lifespan inequality would decrease in such situations. However, more recent episodes have shown clear inequalities in the mortality during extreme events, famously hurricane Katrina (Zoraster 2010). In fact, most of our data is connected to famine episodes, from which the wealthy are protected to a certain degree. Even if a crisis were to cross social lines, it would likely affect individuals differently depending on their age, disproportionately increasing the mortality of the extreme and more vulnerable ages and thus variation. Finally, a decrease in life expectancy, which is inevitable during a mortality crisis, gives mechanically more space for variation in age at death, as the modal age at death shifts to the left. All of these considerations lead us to believe that variation will increase rather than decrease during a mortality crisis. After the end of the episode, we expect that variation will continue to be higher than pre-crisis level, but that it will gradually decrease as the parts of the population most affected by the crisis recover. However, this trend could be balanced by a selection, during the crisis, of the more robust individuals, who would die later on average.

As indicated in the introduction, in our second question we ask whether some ages especially contributed to the change in variation witnessed during and after the crisis, and if so which ones. We predict that a mortality crisis will particularly affect children and the elderly, as these sub-groups are physically less equipped to deal with extreme conditions and because their survival might become less of a priority in situations where resources are scarce. Moreover, deaths at the extremes of a distribution will more heavily affect variation. Therefore, we expect that these age groups will largely contribute to the expected increase in lifespan variation.

Our final research question looks at gender differences. Zarulli *et al.* (2018) have found that the gender gap in life expectancy remains during high-mortality regimes. In the same way, we expect that mortality crises will affect both subpopulations similarly, so that the gender gap in lifespan variation, which generally favours females (van Raalte 2011), will not change in high mortality situations.

Preliminary Results

Discussion

References