Educational Inequalities in Cause-Specific Mortality in Spain: Analysis Using Multiple Causes of Death

Sergi Trias-Llimós[1], Amand Blanes[2], Jeroen Spijker[2]

1. Department of Non-communicable Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London.
2. Centre d'Estudis Demogràfics, Universitat Autònoma de Barcelona, Bellaterra, Barcelona.

Abstract

Background: Health inequalities in mortality persist in European countries and reducing them is one of the main public health policy priorities. We study the educational gradient in cause-specific mortality, with special attention to life-style related causes of death by making use of multiple causes of death.

Methods: We use individual detailed mortality data, which includes educational attainment and all causes mentioned in the death certificate, for the population aged 30+ living in Spain in 2016-17. We use multiple causes of death (MCOD) to study alcohol-related and drug-related mortality. We estimate cause-specific mortality by age and educational attainment, and we examine educational gradient in cause-specific mortality using Poisson regression models.

Results: Educational inequalities in cause-specific mortality exist in Spain, particularly from major causes such are cardiovascular or respiratory. In addition, population groups with lower educational attainment present higher risks of mortality from lifestyle-related causes such as alcohol- or drug-related causes (higher mortality rate ratios as compared to main causes of death).

Conclusions: The preliminary results from this study highlight the importance of amenable causes of death related with lifestyle factors on overall mortality inequalities in Spain. In the full paper, we will also provide a detailed assessment by age groups and the inclusion of additional causes of death (e.g. smoking, hypertension) to explore both absolute and relative inequalities in mortality.

Extended abstract

Introduction

Health inequalities in mortality persist in European countries (Mackenbach et al., 2018) and reducing them is one of the main public health policy priorities. Spain is not an exception in the European context, although health inequalities are lower as compared to most European countries (Mackenbach et al., 2018; Regidor et al., 2016a).

Recently, several researchers explored socioeconomic inequalities in mortality in Spain from different perspectives (Marí-Dell'Olmo et al., 2016; Permanyer et al., 2018; Regidor et al., 2016b; Reques et al., 2014). Reques et al (2014) estimated total and cause-specific mortality patterns by education based on a 7-year follow-up of all citizens aged 25 years and over residing in Spain in 2001. Regidor et al. (2016) analysed a more recent period as they focused on the mortality decrease during the economic crisis in Spain by socioeconomic groups. The authors concluded that steeper declines occurred for most causes of death during the economic crisis as compared to the pre-crisis period. In addition, two other studies focused on the topic by analysing trends. Marí-Dell'Olmo et al. (2016) concluded in their study based on 33 Spanish cities that socioeconomic inequalities –measured with the socioeconomic deprivation index- in mortality have not declined in the late 1990s and early 2000s. On the other hand, a recent study focused on long-term trends in not only life expectancy but also life span variation by educational attainment. Their results showed higher increases in life expectancy among the higher educated but reductions in length-of-life inequality for all but primary-educated men (Permanyer et al., 2018).

In sum, only two studies have focused on cause-specific mortality (Regidor et al., 2016b; Reques et al., 2014), but did not provide estimates detailed causes regarding lifestyle or risk factors. In addition, other the studies on socioeconomic inequalities in cause-specific mortality in Spain mostly used subsamples of the Spanish population (e.g. Barcelona and Madrid) and exclusively focused on major underlying causes of death (Huisman, 2004; Marí-Dell'Olmo et al., 2015).

We aim to contribute to the field of socioeconomic inequalities in cause-specific mortality in Spain in two ways:

1) Using detailed mortality data including all causes mentioned in the death certificate for all adult population living in Spain;
2) Exploring the role of particular lifestyle factors (e.g. alcohol or drug use) that have long been postulated to be more harmful among low socioeconomic groups.

Several country-specific datasets containing multiple causes of death (MCOD) became available over the last years, including data from Spain. These data are certainly relevant for a better understanding of overall mortality causes. For example, people often die from multiple causes (Désesquelles et al., 2016), especially at older ages where multimorbidity is more common (Alpérovitch et al., 2009). In that sense, MCOD could provide useful insights on the mortality patterns, particularly for those causes that are unlikely to be mentioned as underlying cause of death in the death certificate. Another example where MCOD is relevant is that they allow for better estimates from behavioural causes such as alcohol use as compared to other estimates merely using the underlying cause of death (Trias-Llimós et al., 2018).

Data and methods

We use individual mortality data and population exposures for the Spanish population aged 30+ for the period 2016/17 from National Institute of Statistics (INE). Educational attainment was estimated by INE using various statistical records and contained four categories: No education, primary, secondary and tertiary.

We selected causes of death in two different ways. On the one hand, we used the following major underlying causes of death: cancer, cardiovascular, respiratory, digestive and external causes, representing about 80% of all deaths. On the other hand, following previous studies, we used multiple causes of death (MCOD) to define alcohol-related (Trias-Llimós et al., 2018) and drug-related mortality (Barbieri, 2019; Bargagli et al., 2006). In the full version of the paper, we will also include the preventable causes hypertension and smoking.

We estimated age- sex- and cause-specific mortality by educational attainment. This was followed by examining the educational gradients using Poisson regression models, with the natural logarithm of population at risk as the offset term. Men and women were analysed separately. For the full paper we will also use more advance methods to study both absolute (e.g. Slope Index of Inequality) and relative (e.g. Relative Index of Inequality) measures of inequality.

Preliminary results

Age- and cause-specific mortality by sex and educational attainment is plotted in Figure 1. A visual inspection of these data suggest higher mortality among low educated groups, irrespective of age and sex (with few exceptions). Inequalities in cause-specific mortality seem narrow for cancer and are large for other important causes such as respiratory, cardiovascular or digestive.

Figure 1. Cause- and age-specific mortality by sex and educational attainment in Spain (2016/17), ages 30-99.
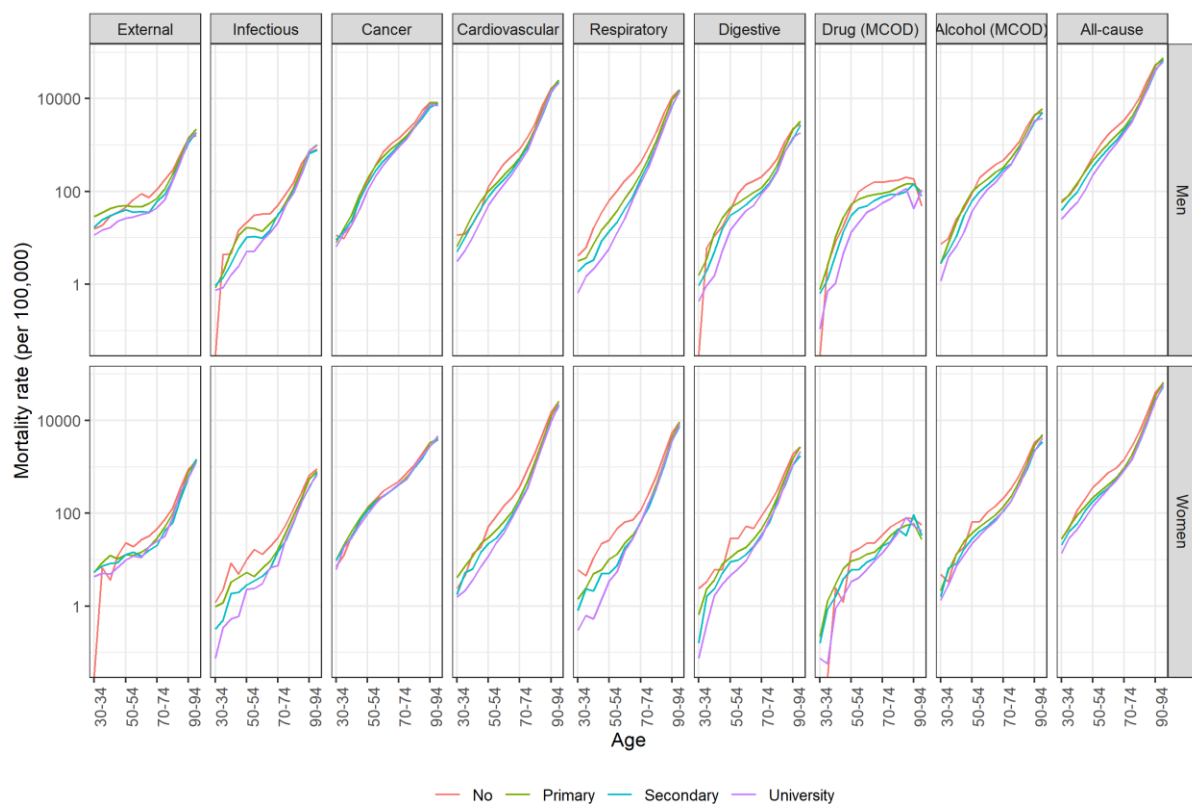

Table 1 presents the mortality rate ratios (MRR) of cause-specific mortality by educational attainment with reference to the highest educated group (tertiary

education). Having tertiary education is associated with lower mortality among both men (MRR Secondary 1.15 (95% CI: 1.14-1.17), Primary 1.42 (1.40-1.43), No 1.77 (1.75-1.79)) and women (Secondary 1.07 (1.05-1.09), Primary 1.29 (1.27-1.30), No (1.65 (1.63-1.68)). Higher mortality is observed for all causes and for men and women with low educational levels, with the only exception of mortality from respiratory causes among women with secondary education (1.03 95%CI: 0.97-1.10). Lifestyle related causes showed high educational inequalities. Men with no education or with primary education had >2 times higher risk of alcohol- and drug-related mortality. Similar results were observed among women, but relatively low OR.

Table 1. Mortality rate ratios of cause-specific mortality by educational attainment in Spain (2016/17), ages 30-99.

Men	No	Primary	Secondary	Tertiary
External	2.05 (1.93-2.17)	1.77 (1.69-1.85)	1.35 (1.27-1.43)	1 (ref.)
Infectious	2.13 (1.94-2.34)	1.70 (1.57-1.85)	1.30 (1.17-1.44)	1 (ref.)
Cancer	1.55 (1.52-1.59)	1.33 (1.31-1.35)	1.12 (1.10-1.15)	1 (ref.)
Cardiovascular	1.69 (1.65-1.73)	1.36 (1.33-1.39)	1.15 (1.12-1.18)	1 (ref.)
Respiratory	2.23 (2.15-2.30)	1.57 (1.52-1.62)	1.15 (1.10-1.20)	1 (ref.)
Digestive	2.46 (2.34-2.60)	1.83 (1.75-1.92)	1.36 (1.28-1.44)	1 (ref.)
Drug (MCOD)	2.49 (1.95-3.19)	2.37 (2.02-2.77)	1.64 (1.35-1.98)	1 (ref.)
Alcohol (MCOD)	3.61 (3.27-3.98)	2.36 (2.18-2.56)	1.65 (1.50-1.82)	1 (ref.)
All-cause	1.77 (1.75-1.79)	1.42 (1.40-1.43)	1.15 (1.14-1.17)	1 (ref.)

Women	No	Primary	Secondary	Tertiary
External	1.67 (1.54-1.81)	1.31 (1.22-1.41)	1.12 (1.02-1.22)	1 (ref.)
Infectious	2.36 (2.09-2.66)	1.76 (1.57-1.98)	1.28 (1.11-1.48)	1 (ref.)
Cancer	1.22 (1.19-1.26)	1.09 (1.07-1.12)	1.03 (1.00-1.06)	1 (ref.)
Cardiovascular	1.87 (1.82-1.93)	1.41 (1.37-1.45)	1.11 (1.07-1.15)	1 (ref.)
Respiratory	1.69 (1.61-1.77)	1.25 (1.19-1.31)	1.03 (0.97-1.10)	1 (ref.)
Digestive	2.20 (2.05-2.37)	1.61 (1.50-1.72)	1.16 (1.06-1.27)	1 (ref.)
Drug (MCOD)	1.99 (1.50-2.63)	1.40 (1.12-1.76)	1.61 (1.25-2.08)	1 (ref.)
Alcohol (MCOD)	2.83 (2.37-3.38)	1.90 (1.62-2.22)	1.38 (1.14-1.67)	1 (ref.)
All-cause	1.65 (1.63-1.68)	1.29 (1.27-1.30)	1.07 (1.05-1.09)	1 (ref.)

*Results derived from Poisson regression models controlling by age.

Preliminary discussion

We presented the preliminary results on educational inequalities in cause-specific mortality in Spain in 2016/17. Consistent with results from other countries socioeconomic differences in total mortality also exist in Spain, albeit with a lower gradient (Mackenbach et al., 2018). However, compared to the 2000s (Reques et al., 2014) our results seems to show potential decrease in educational inequalities in cause-specific mortality, which should be analysed in more detail. Underlying causes of death, however, do not allow us to identify behaviours behind the observed socioeconomic health differences, reason why we also analysed MCOD for lifestyle-related causes of death. Indeed, inequalities were especially large for alcohol-related mortality. The use of MCOD as a tool to analyse actual causes of death contributes to a better understanding in how individual behaviours contributed to overall mortality inequalities.

References

Alpérovitch, A., Bertrand, M., Jougla, E., Vidal, J.-S., Ducimetière, P., Helmer, C., Ritchie, K., Pavillon, G., Tzourio, C., 2009. Do we really know the cause of death of the very old? Comparison between official mortality statistics and cohort study classification. Eur. J. Epidemiol. 24, 669–675. https://doi.org/10.1007/s10654-009-9383-2

Barbieri, M., 2019. The contribution of drug-related deaths to the US disadvantage in mortality. Int. J. Epidemiol. 48, 945–953. https://doi.org/10.1093/ije/dyy288

Bargagli, A.M., Hickman, M., Davoli, M., Perucci, C.A., Schifano, P., Buster, M., Brugal, T., Vicente, J., 2006. Drug-related mortality and its impact on adult mortality in eight European countries. Eur J Public Health 16, 198–202.

Désesquelles, A., Gamboni, Andrea, Demuru, Elena, 2016. We only die once… but from how many causes? Popul. Soc. 534.

Huisman, M., 2004. Socioeconomic inequalities in mortality among elderly people in 11 European populations. J. Epidemiol. Community Health 58, 468–475. https://doi.org/10.1136/jech.2003.010496

Mackenbach, J.P., Valverde, J.R., Artnik, B., Bopp, M., Brønnum-Hansen, H., Deboosere, P., Kalediene, R., Kovács, K., Leinsalu, M., Martikainen, P., Menvielle, G., Regidor, E., Rychtaříková, J., Rodriguez-Sanz, M., Vineis, P., White, C., Wojtyniak, B., Hu, Y., Nusselder, W.J., 2018. Trends in health inequalities in 27 European countries. Proc. Natl. Acad. Sci. 115, 6440–6445. https://doi.org/10.1073/pnas.1800028115

Marí-Dell'Olmo, M., Gotsens, M., Palència, L., Burström, B., Corman, D., Costa, G., Deboosere, P., Díez, È., Domínguez-Berjón, F., Dzúrová, D., Gandarillas, A., Hoffmann, R., Kovács, K., Martikainen, P., Demaria, M., Pikhart, H., Rodríguez-Sanz, M., Saez, M., Santana, P., Schwierz, C., Tarkiainen, L., Borrell, C., 2015. Socioeconomic inequalities in cause-specific mortality in 15 European cities. J Epidemiol Community Health 69, 432–441. https://doi.org/10.1136/jech-2014-204312

Marí-Dell'Olmo, M., Gotsens, M., Palència, L., Rodríguez-Sanz, M., Martinez-Beneito, M.A., Ballesta, M., Calvo, M., Cirera, L., Daponte, A., Domínguez-Berjón, F., Gandarillas, A., Goñi, N.I., Martos, C., Moreno-Iribas, C., Nolasco, A., Salmerón, D., Taracido, M., Borrell, C., 2016. Trends in socioeconomic inequalities in mortality in small areas of 33 Spanish cities. BMC Public Health 16, 663. https://doi.org/10.1186/s12889-016-3190-y

Permanyer, I., Spijker, J., Blanes, A., Renteria, E., 2018. Longevity and Lifespan Variation by Educational Attainment in Spain: 1960–2015. Demography 55, 2045–2070. https://doi.org/10.1007/s13524-018-0718-z

Regidor, E., Reques, L., Belza, M.J., Kunst, A.E., Mackenbach, J.P., de la Fuente, L., 2016a. Education and mortality in Spain: a national study supports local findings. Int. J. Public Health 61, 139–145. https://doi.org/10.1007/s00038-015-0762-z

Regidor, E., Vallejo, F., Granados, J.A.T., Viciana-Fernández, F.J., de la Fuente, L., Barrio, G., 2016b. Mortality decrease according to socioeconomic groups during the economic crisis in Spain: a cohort study of 36 million people. The Lancet 388, 2642–2652. https://doi.org/10.1016/S0140-6736(16)30446-9

Reques, L., Giráldez-García, C., Miqueleiz, E., Belza, M.J., Regidor, E., 2014. Educational differences in mortality and the relative importance of different causes of death: a 7-year follow-up study of Spanish adults. J. Epidemiol. Community Health 68, 1151–1160. https://doi.org/10.1136/jech-2014-204186

Trias-Llimós, S., Martikainen, P., Mäkelä, P., Janssen, F., 2018. Comparison of different approaches for estimating age-specific alcohol-attributable mortality: The cases of France and Finland. PLOS ONE 13, e0194478. https://doi.org/10.1371/journal.pone.0194478