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Multimorbidity patterns and socioeconomic position in vulnerable populations

Mathias Voigt[1], Antonio Abellán[1], Laura Cilek[1], Dariya Ordanovich[1], and Diego Ramiro[1]

[1]Center for Humanities and Social Sciences, Spanish National Research Council

Background and Objective

As prevalence rates for many aging-associated, chronic conditions and disabilities have increased globally due to ongoing population aging, especially the increasing occurrence of multimorbidity in older adults presents a challenge for our health care systems. While a growing body of research has focused on the causes and consequences of multimorbidity over the last decades, surprisingly little is known about age-specific effects of multimordity and different disease cluster or how the socioeconomic context mediates such effects in vulnerable populations [1, 2].

The objective of this study is to examine how different aspects of multimorbidity affect long-term survival in individuals with disability. The two-step process will consists of the examination of different combinations of associative and nonrandom multimorbidity patterns and the assessment of how these patterns are associated with socioeconomic household measures and age-specific risks of dying within a ten year follow-up period (2008-2018).

It is hypothesized that the occurrence and fatality of multimorbidity in individuals with disability is mediated by the socioeconomic context. It is also assumed that this relationship will be less pronounced than in the general population. Individuals with multiple chronic conditions from more than one associative disease group are expected to experience higher mortality risks. Due to the greater dispersion of ages at death, it is further expected that these effects will be stronger for males when compared to females.

Data and Analysis Strategy

To examine different aspects of the association between multimorbidity, socioeconomic context, and mortality in individuals with disability, a newly linked data source is applied to identify individuals with chronic conditions from a nationally representative sample of the Spanish population and following them up to death or censorship between 2008 and 2018. Individual level information on functional limitations and chronic conditions is obtained from the National Survey on Disability, Personal Autonomy, and Dependency (EDAD, Spanish: *Encuesta sobre Discapacidad, Autonomía personal y Situaciones de Dependencia*), a large cross-sectional
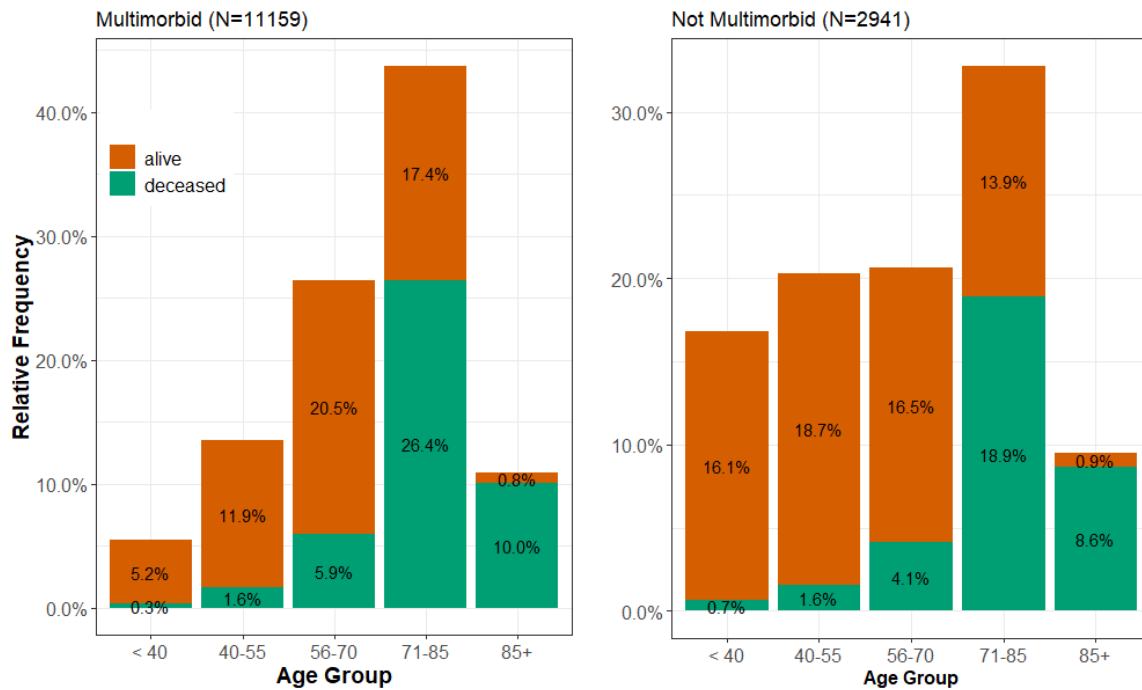
Figure 1: Age and Event Distribution by Occurrence of Multimorbidity in the Population with Disability (2008-2018)

survey study conducted by the Spanish National Institute of Statistics (INE) in 2008 [3]. EDAD is built on the WHO International Classification of Functioning, Disability and Health (ICF) and the questionnaires are directed at the efficiency of personal and technical support and the importance of social participation [4].

The INE department for socio-demographic statistics linked 207.529 individuals, who were surveyed in EDAD, to administratively collected, longitudinal mortality and exposure data for the period between 2008 and 2018. The data was derived from the annually updated statistics of natural population movements (MNP, Spanish: *Estadística de defunciones. Movimiento natural de la población*). Exposure rates are based on yearly updated data from the population register (Spanish: *Padrón*) and allow capturing migration movements. Thus, the linked data set allows for assessment of multimorbidity and functional limitations in 2008 and contains information on deaths and migration for the time after the survey till 2018. The sample is restricted to all non-institutionalized individuals who report one or more of 44 different limitations.

Multimorbidity will be assessed based on individual level information on at least 19 different chronic conditions, including diabetes, hypertension, and cancer. While the preliminary definition of multimorbidity is solely characterized by the presence of two or more chronic conditions in one individual, we aim to meaningful group morbidity clusters and distinguish between random and nonrandom associations [i.e. 5, 6]. A descriptive overview by age groups, as shown in Figure 1, indicates that multimorbidity is highly prevalent in the disabled population and confirms commonly observed patterns. The population with multimorbidity is on average older and appears to be exposed to higher risks of dying.

Mortality hazards by single age are then estimated using a Gompertz proportional hazards survival model. The Gompertz model assumes that the logarithm of mortality risks grows linearly with increasing age and
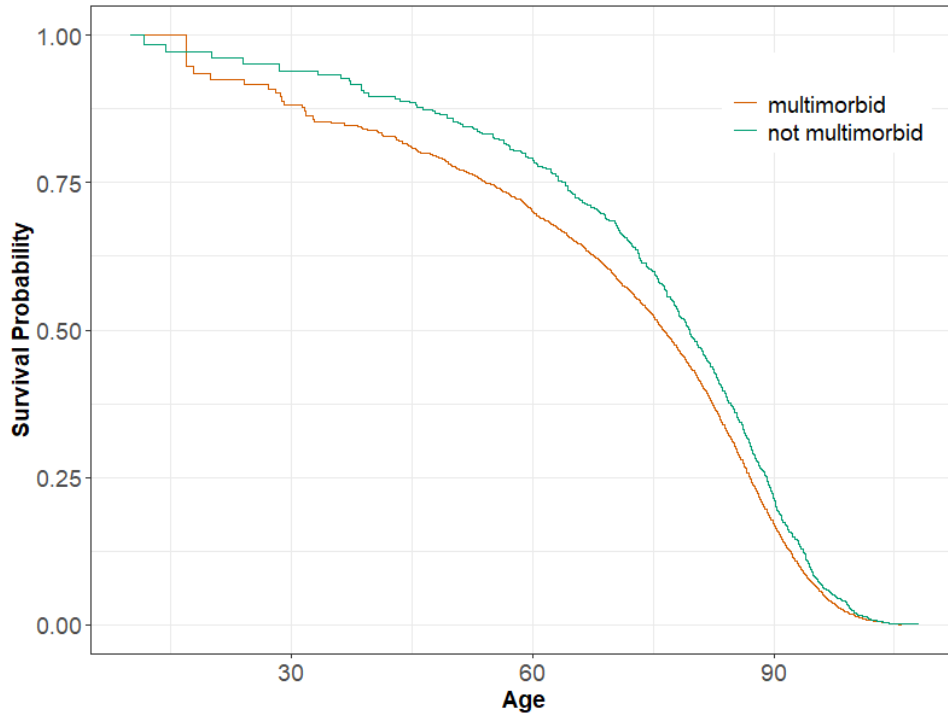
Figure 2: Estimated Survival Probabilities (Kaplan Meier Estimator) by Age and Occurrence of Multimorbidity

it has been shown repeatedly that it models human adult mortality accurately with only two unknown parameters [7]. Regression coefficients are asymptotically normally distributed and estimated via Maximum Likelihood Estimation (MLE). The hazard function of the Gompertz model can mathematically be expressed as follows.

$$h(t) = a * \exp^{(bx)} \tag{1}$$

, where a and $b > 0$ are the rate and shape parameter of the model. Due to differences in the ages at death distribution and to allow for identifying underlying patterns more specifically, it is planned to stratify the survival models by sex.

Preliminary Results and Outlook

Survival probabilities over age and by the preliminary classification of multimorbidity are estimated with a Kaplan Meier product limit estimation and presented in Figure 2. The survival curves suggest that individuals who suffer from multiple chronic conditions have a lower survival probability over the whole age range. This is in line with previous findings and underlines the severity of this condition. First analyses of covariate effects with a preliminary survival model and a limited set of variables, suggest that women with multiple chronic conditions have 24 percentage point higher risk of dying during the follow up period when compared to those with maximum one chronic condition. Males with multimorbidity are exposed to a 20 percentage point higher risk than their counterparts without multiple conditions. The results further suggest an mediating effect of social position and higher risks for individuals without a formal education.

In the next step, we aim to meaningfully differentiate between different disease clusters that either occur randomly or are closely associated with other prevalent conditions. To quantify the impact of different reoccurring

disease patterns can help us to inform geriatrics and policy maker about the effects of multimorbidity in high risk populations such as people with chronic limitations. It is further attempted to test the effects of different household measures, daily activities and social networks of the individuals with and without multimorbity.

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