Patterns and trends of multi-morbidity at death in France in the last 20 years

To a large extent, increase in life expectancy since the 1970s is due to a decrease in the incidence of, but also to better survival from, chronic diseases and more specifically from cardiovascular conditions and cancers. In low mortality countries, an ever-growing share of the population is living with several diseases – a situation referred to as multi-morbidity. From a public health perspective, multi-morbid patients represent a major challenge for caregivers, as interactions between diseases may aggravate the patient's situation and make clinical care more complex while, in addition, polypharmacy increases the risk of adverse drug events and non-compliance to treatments. In this context, monitoring and characterizing multimorbidity is a legitimate objective. It relies on data from health surveys and health data systems but, as multi-morbid patients are at higher risk of dying, cause-of-death statistics based on the information reported on death certificates, usefully complement the picture.

Research relying on the underlying cause of death (UC) – i.e., according to the World Health Organization (WHO) terminology, "the cause that initiated the sequence of events leading to death" –, fails to account for this important shift of the epidemiological profile and mortality patterns. Identifying patterns of multi-morbidity at death requires looking beyond the underlying cause of death to account for all the causes reported on the death certificate, herein labeled multiple causes (MC). In the last decade, the so-called "multiple cause-of-death (MCOD) approach" has emerged as a new and promising field of research. Interestingly, Grippo et al. (2024) developed an algorithm based on the entire set of causes listed on the death certificates, to classify all death records according to three main types of morbid process leading to death (simple, multi-morbid and ill-defined). The output of this classification, allows to measure the contribution from multi-morbidity to the death processes in any given population (Barbieri et al. 2025). In this presentation, we focus on the situation of France over the last 20 years. To our knowledge, it is the first study that examines time trends in the prevalence of multi-morbidity at death. We hope that these trends will provide insight on the drivers of mortality decrease in low-mortality countries.

Data and method

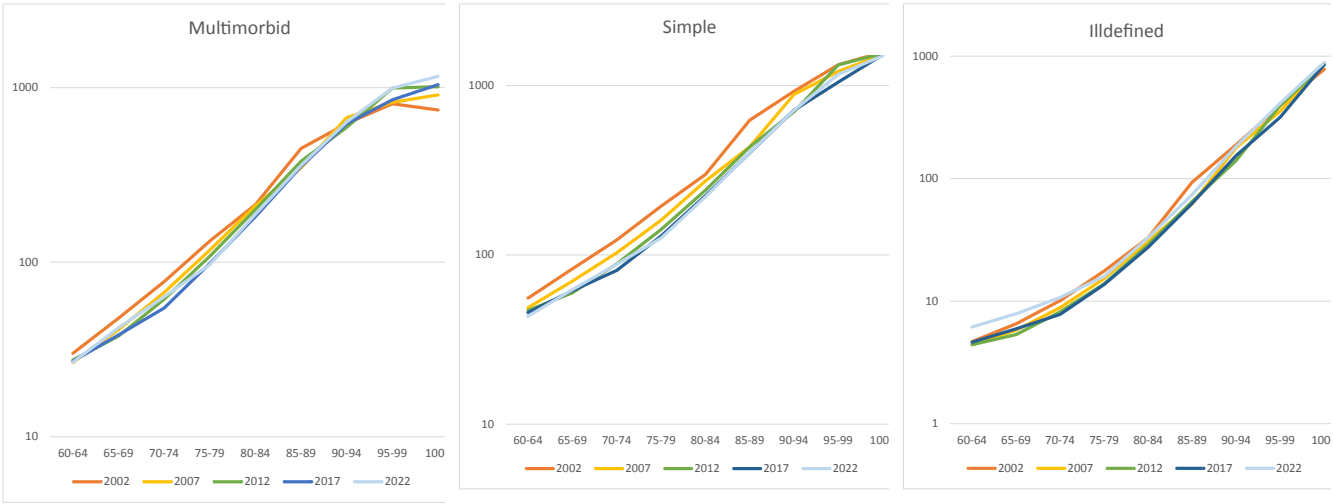
In this study, data are for deaths that occurred at age 60 and over in mainland France from 2002 to 2023. Data are provided by the French National Institute for Health and Medical Research (INSERM). Causes of death are automatically coded under the 10th Revision of the International Classification of Diseases (ICD-10) using the IRIS system (http://www.iris-institute.org). In line with WHO recommendations, the French death certificate comprises two parts. In Part I, which is designed to elicit the underlying cause of death, the certifying physician reports the morbid process that directly led to death, beginning with the immediate cause that started the sequence to the initial cause of the death. Part II is for "*any other significant condition that unfavorably influenced the course of the morbid process but is not related to the condition directly causing death*". Diseases (both chronic and acute) that have contributed to the lethal process should thus be reported in Part II. However, identifying multi-morbidity at death is not merely a question of simply counting the cases for which Part II of the death certificate is not left empty. In particular, the certifying physician may have reported more than one causal process in Part I. Following the approach developed by Grippo et al. (2024), we were able to classify all death records into one of three morbid processes, namely simple causal processes, multi-morbid processes, and ill-defined processes. The algorithm uses the location of the cause on the certificate (Part I or Part II of the death

certificate, line number and position on each line). In brief, first, the algorithm identifies '*ill-defined'* codes. Second, it uses the decision tables embedded in IRIS for the UC selection among the remaining codes, as described in the ICD-10 WHO Manual, to identify one or more '*originating*' causes for any given sequence(s). Originating causes are supposed to be reported alone on the lowest line of Part I, but sometimes they are reported elsewhere (e.g. on Part II). Finally, the algorithm classifies the remaining causes in Part I as '*precipitating*' and those in Part II as '*associated*'. Simple processes characterize deaths with a single originating cause (either a single cause listed on the certificate or a sequence of causes deriving from the same originating condition). Multi-morbid processes characterize deaths with at least two originating causes (where neither one can be the consequence of the other) or with one originating cause and at least one contributing cause in Part 2. Ill-defined processes characterize deaths with no well-defined causes listed on the death certificate, either in Part I or Part II.

Preliminary results

From the tabulation of deaths by five-year age group, sex, and type of morbid process, we calculated the corresponding age-specific death rates and prevalences at death series. We first present the age- and sex-mortality rates according to the type of process for years 2002, 2007, 2012, 2017 and 2022 separately. Over this period of time, mortality rates for both simple and multi-morbid processes decreased at all ages under the age of 90-94 (figure 1). For deaths at older ages, the trend is less clear, with in particular higher mortality rates for multimorbid processes in 2022 compared to the previous years. Mortality rates for ill-defined processes that stand at a much lower level, generally decreased from 2002 to 2017 but increased in 2022. Globally, from 2002 to 2022, standardized mortality rates at 60+ decreased from 197 p. 10,000 to 143 p. 10,000 for simple processes and from 131 p. 10,000 to 114 p. 10,000 for multi-morbid processes. They remained stable at 26 p. 10,000 for ill-defined processes.

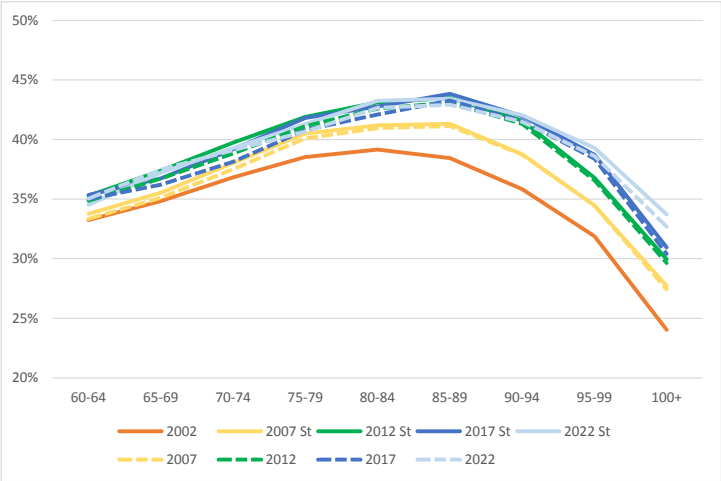
Figure 1 - Mortality rates (p. 10 000) by type of morbid process - All deaths at age 60+, France, 2002-2022



The sharper decline for simple processes resulted in an increase of the proportion of multi-morbid deaths among all deaths at age 60+. As the underlying causes of death of multimorbid and simple processes are not exactly the same (i.e. simple processes are more frequently due to neoplasm), we computed a UC-standardized prevalence at death of multi-morbid processes (figure 2 – the reference year is 2002). The increase is especially strong in the

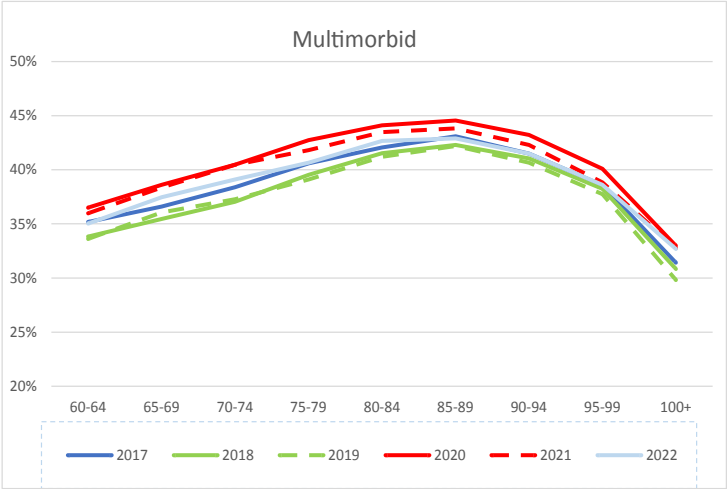
oldest age groups. The shape of the curve is the same for all years: the prevalence increases from ages 60-64 to ages 85-89 and then decreases at older ages, where ill-defined processes become more frequent.

Figure 2: UC-standardized prevalence (%) at death of multi-morbid processes by age group- All deaths at age 60+, France, 2002-2022



In the years preceding the pandemics (2018-2019), the prevalence of multimorbidity at death decreased. This is likely to be due to novelties in the data production (a new version of the death certificate and use of AI to code part of the death certificates). In 2020 and 2021, the prevalence of multimorbidity at death was again on the rise. In 2022, it decreased and reached the levels of 2017.

Figure 3: Prevalence (%) at death of multi-morbid processes by age group- All deaths at age 60+, France, 2017-2022



These preliminary results will be discussed and completed by results of multivariate models to examine the determinants of multimorbidity at death.

References

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