TRENDS IN SOCIOECONOMIC INEQUALITIES OF CHRONIC DISEASES' MORTALITY IN SWITZERLAND: A POPULATION-BASED STUDY OF MULTIPLE CAUSES OF DEATH DATA

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EXTENDED ABSTRACT

Topic and theoretical focus

Chronic diseases are the first cause of death globally, with cardiovascular diseases, specifically Ischaemic Heart Disease and Stroke as the primary sources of mortality in the world (1,2). This is closely followed by neoplasms and chronic obstructive pulmonary disease (3). Previous projected reductions of chronic diseases mortality in countries like Switzerland (4) may have been impacted by the COVID-19 pandemic. Disruptions of care, changes in care-seeking behaviours, reductions in diagnostic procedures, among others, have affected chronic patients' care (5). Likewise, mobility restrictions (i.e. lockdowns) reportedly reduced air pollution in urban settings impacting mortality (6). Furthermore, well-documented social inequalities in mortality and life expectancy broadened during this period in low and middle income countries (7,8). Yet, inequalities aren't solely confined to these economies. They've also manifested in high income settings, as Switzerland (9) and France (10).

To comprehend cause-specific mortality and formulate public health policies, national and international statistics utilize the classic approach of selecting one cause of death, the underlying cause of death (UC) from the death certificates completed by physicians (11,12). However, this method has been a subject of contention, considering the potential interaction of concurrent diseases leading to death. In many cases, the decision to prioritize one disease over others could be arbitrary or subjective (12–16). This study seeks to advance this perspective by incorporating a multiple causes of death (MC) analysis, which consider additional data from death certificates often overlooked in traditional mortality statistics. Because chronic diseases are frequently accompanied by co-existing ailments, the interplay of these conditions adds to the complexity of understanding mortality patterns.

This research aims to enhance our understanding of chronic disease mortality in Switzerland, focusing on socioeconomic inequalities and the impact of the COVID-19 pandemic. Our primary goal is to analyze trends of chronic disease mortality rates from 1995 to 2021 across different socioeconomic strata, employing a multiple causes of death approach, and emphasizing the influence of the 2020 COVID-19 pandemic.

Specific aims:

Aim 1: To analyse the long-term temporal trends of chronic diseases' mortality rates (deaths with chronic diseases as underlying causes or contributing causes of death) by socioeconomic position in Switzerland between 1995 and 2021.

Aim 2: To assess the impact of first lockdown during COVID-19 pandemic on inequalities in chronic diseases' mortality rates (deaths with chronic diseases as underlying causes or contributing causes of death) by socioeconomic position in Switzerland between March and July 2020.

Data and methods

Data: We will conduct a population-based analysis of all deaths in Switzerland between the years 1995 and 2021. Data about specific causes of death, age at death, sex and population size aggregated per week, month, and year will be extracted from the mortality statistics database of the Swiss Federal Statistical Office. Causes of death are recorded via the International Classification of Diseases 10th Revision (ICD10) coding system. Mortality data contain the underlying cause of death as well as secondary causes related to concomitant diseases (part II of death certificate).

Mortality and socioeconomic position: We will analyze separately deaths with neoplasms, diabetes, and cardiovascular diseases, as underlying and contributing causes of death. These represent the most common chronic diseases related causes of death in Switzerland (17). These death causes will be identified via ICD-10 codes of corresponding chapters in the Global Burden of Disease Study. Socioeconomic position will be measured using the profession of decedents (last known profession for retired persons) collected in civil registry. To assess the changes by occupational position, we will use the European Socioeconomic Classification - ESeC88 and ESeC0. These systems stem from the International Standard Classification of Occupation (ISCO-88), enabling the creation of three distinct socioeconomic categories based on the decedents' occupations (18).

Statistical analysis: For aim 1, we will estimate age-standardized yearly mortality rates between 1995 and 2021. We will estimate mortality rates at all ages (overall population aged 30 or older), and in specific age groups, for example in working age (30-65y) and retirement (66+). The analysis will be stratified by sex, due to differences in mortality and occupation patterns. We will implement the direct standardization method using the 2013 European standard population as a reference. Finally, we will estimate the potential variability of annual percentage change in mortality rates using segmented regression (JoinPoint Regression Program).

For aim 2**,** we will conduct an interrupted time series (ITS) analysis to assess the change in the trend of chronic diseases' mortality inequalities after the onset of control measures (i.e. lockdown) implemented in response to the COVID-19 pandemic. The counterfactual comparator will be inequalities estimated from pre-pandemic years 2015-2019. We will consider the lockdown from March 13th, 2020, as the intervention –interruption– in our model. Also, we will include indicator variables for three occupation categories. Additionally, we will include interaction terms with timing of intervention and, the period indicator to obtain the shift in the trend of cause-specific mortality immediately following the intervention.

Sensitivity analyses: (a) We will first test a lag effect, changing our intervention date to a future date to explore whether the effect is only observed at the moment of the intervention, or it is delayed in time by an induction period. (b) We will use a lead control, changing the intervention point to a previous date in 2019, to verify that the effect started at the moment of the intervention only, and not before. (c) We will also run separate models for the Swiss' regions to assess heterogeneity between French and German speaking cantons.

Expected findings and anticipated significance

This study will leverage nation-wide population-based data across more than 30 years to determine the extent to which socioeconomic inequalities in chronic diseases mortality have changed between 1995 and 2021, and due to COVID-19 related control measures. We expect to find changes in socioeconomic inequalities, specifically, broadening of the gaps between advantaged and disadvantaged groups due to the COVID-19 pandemic. Additionally, we expect to observe heterogeneity by sex, with higher increase of inequalities for women than men (19,20). While the impact of COVID-19 on mortality dynamics and socioeconomic position has been reported in other

countries, like Spain (21) and the United States(22) among others, this knowledge is currently missing for Switzerland. Findings will provide a valuable input for mitigating these inequalities. Additionally, this study will use a novel framework to assess mortality, shifting from the 'underlying cause of death' framework to a 'multiple causes of death' analysis. This approach allows a more accurate reflection of the complex interplay among co-existing conditions in chronic diseases. Finally, this study will highlight MC data as a valuable source of data to track relevant mortality trends.

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