

Widening inequalities in myocardial infarction? Trends in life years free of myocardial infarction and after incidence based on health insurance data

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Introduction

Despite advances in prevention and treatment, acute myocardial infarction (MI) remains a frequent health event, which often causes disabilities and poor quality of life among the affected population and challenges health care systems worldwide. Although incidence and mortality rates have decreased substantially over the last decades, little is known on whether all socioeconomic groups benefitted equally from these achievements.

Against the backdrop of increasing life expectancy, the question whether the life years gained are spent in good or in ill health becomes an important public health issue. According to Fries, improvements in prevention lead to a postponement of disease onset, compressing morbidity into shorter periods towards the end of life. In contrast, Gruenberg put up the hypothesis that extended periods spent in ill health have to be expected as medical progress leads to prolonged survival after disease onset. With regard to MI, improvements in prevention, therapy and rehabilitation may have led to both a decrease in incidence and MI-related mortality over time.

Previous research had shown that social gradients can also be found in MI incidence and prevalence risks, leading to substantial health inequalities. Furthermore, low socioeconomic status is associated with a higher prevalence of risk factors (e.g. hypertension, smoking, high BMI, physical inactivity) fostering these inequalities. However, research on how the development of MI incidence and mortality risks differs between socioeconomic groups is still limited. Furthermore, evidence is lacking on how lifespan spent free of MI and those spent after MI changed over time and on whether these trends are socially patterned.

The study is guided by two research questions:

- Have MI incidence and mortality risks developed similarly between different income groups?
- Are there differing time trends between income groups in life years free of MI and life years after MI?

Methods

The study is based on the data of a large German statutory health insurance provider, the AOK Niedersachsen. The data were collected for accounting purpose and cover approximately one third of the population of the federal state of Lower Saxony. The dataset includes sociodemographic information and inpatient and outpatient diagnoses coded according to the International Classification of Disease 10th revision (ICD-10). Moreover, the dataset contains information on the date of death of all insured individuals deceased during the observation period. For this study the data of the insured individuals aged 60 years and older of the time periods 2006-2008 and 2015-2017 were used. Socioeconomic inequalities were assessed by using information on income. In our dataset, all income information is available as annual individual income. In these analyses, income groups were defined relative to the German average pre-tax income in a given year. As numbers of events are limited within income groups, income was classified into 2 groups: low ($\leq 60\%$ of the German average income) and higher ($> 60\%$).

Three types of events are considered: incidence of MI, death after MI, and death without MI. Incident cases of MI were identified using the data of inpatient diagnoses (I21.0-I21.9). Using these codes, incident cases in the two time periods 2006-2008 and 2015-2017 were defined by applying a look-back period free of MI of one year.

The estimates of life years free of MI and after incidence are based on multistate analyses using an illness-death model. To calculate the expected number of years spent free of MI and those after MI incidence, three transitions were analysed: 1) free of MI to MI (incidence), 2) MI to death (death after incidence), and 3) free of MI to death (death after MI). Time trends in incidence and mortality risks were estimated by fitting proportional hazard models. The analyses were performed separately for each type of transition and each model include the covariates age and observation period. The number of life years free of MI and after incidence were calculated using multistate life table analyses. For the life table calculations predicted age-specific hazard rates of the three types of transitions were used. These predictions are based on proportional hazard models fitted separately for each income group, observation period, and sex.

Results

In both periods, 35,037 incident MIs (with 4,120,195 person-years of exposure), 169,980 death without MI (with 4,120,227 person-years of exposure) and 12,771 deaths after MI (with 36,696 person-years of exposure) occurred.

With respect to changes between the two periods, significant decreases in the risk of all three types of transitions were found. This holds for both sexes and both income groups. However, while the decreases in mortality risks after MI were similar in both income groups, the decreases in incidence risks and mortality without MI were more pronounced in the higher income group. In both periods, men and women at age 60 with higher incomes could expect more of their remaining life years to be free of MI than individuals of the low income group. Significant increases in the number of life years free of MI could only be found among men (18.8 to 19.6 years) and women (23.1 to 23.9 years) belonging to the higher income group. While the number of life years after myocardial infarction increased among men of both income groups (both 0.8 to 1.0 years), no changes were observed among women.

Discussion

The analyses show that income differences in the incidence of MI and mortality are considerable, leading to inequalities in the length of life spent free of MI and in life years after MI incidence. The general trends point towards decreasing incidence rates and more life years free of MI, which may be driven by improved prevention and healthier lifestyles. However, not all groups benefitted equally. Both trends in incidence and in mortality differed between income groups as well as between sexes. Especially men having low incomes are disadvantaged. In this group life years after MI increased without any gains in MI-free life years, leading to a clear expansion of lifetime affected by the consequences of MI.

With respect to changes in social disparities in health-related behaviour, widening differences in smoking and physical inactivity were reported in the German population. These trends in health-related behaviour may partly explain the stronger gains in healthy years among individuals of the higher income group. As the dataset does not contain information on MI severity or disabilities, inequalities in disease-related consequences for patients' everyday life could not be analysed. Further research is needed on the development of MI severity and functional limitations caused by MI. Special attention should be paid to the question whether these developments differ between socioeconomic groups, causing widening or narrowing inequalities in impairments and in quality of life after the occurrence of MI.