Transitional processes and gender differences in cause-specific mortality and their role in the emergence of mortality inequalities, 1971–2008

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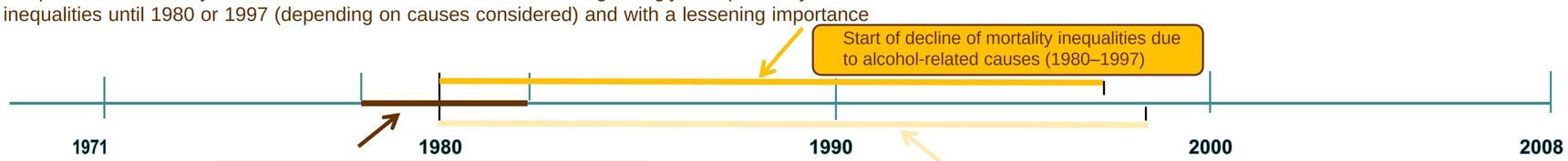
INTRODUCTION

The primary goal of our investigation is to understand the formation of inequalities in mortality in Hungary by examining the dynamic of cause and education-specific mortality for the period between 1971 and 2008. Inequalities in all-cause mortality by education were virtually non-existent during the 1970s but stated to grow from about 1980 and continued to do so until the early 2000's. In the second part of the 2000's mortality inequalities stagnated at that extreme high level.

In an earlier **gender blind** investigation we identified nutrition-related causes of death together with most cardiovascular causes which were the major drivers of the evolvement of mortality inequalities in the whole population. For clearly nutrition related causes of death we found a well-defined turning point at around 1980 from which time trends in mortality differentiated strongly by education. In contrast important moments in the history of inequalities in mortality due smoking related causes of death did not cluster so clearly: they changed their dynamic between 1980 and 1998. Finally, inequalities in mortality due to alcohol-related causes contributed growingly and positively to the widening mortality inequalities until 1980 or 1997 (depending on causes considered) and with a lessening importance after.

In the present study we consider the **gender-specific aspects** of the dynamics of education, sex- and cause-specific mortality. We examined 55 causes of death from which 24 displayed definitive turning points for the four distinguished social groups (highly educated men, less educated men, highly educated women, less educated men) using the method outlined below. We present gender specific analysis here only for causes of death which are strongly related to three major risk factors: nutrition, smoking and alcohol consumption. Other processes which also shaped inequalities in mortality such as declining tendencies of most infection related causes of death and consequently their descending contribution to overall inequalities in mortality and the role of improving health care are not considered here. For the causes of death of interest we performed joint point analysis in order to compare the dynamics of mortality trends in the four distinguished populations groups.



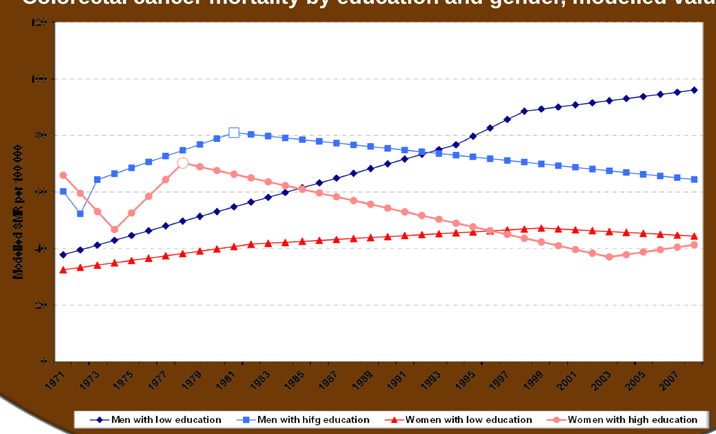
GENDER BLIND MODEL

Change in the relation of education-specific mortality trends for causes related to nutrition (1978–1982)

Changes in the relation of education-specific mortality trends for causes related to smoking (1980–1998)

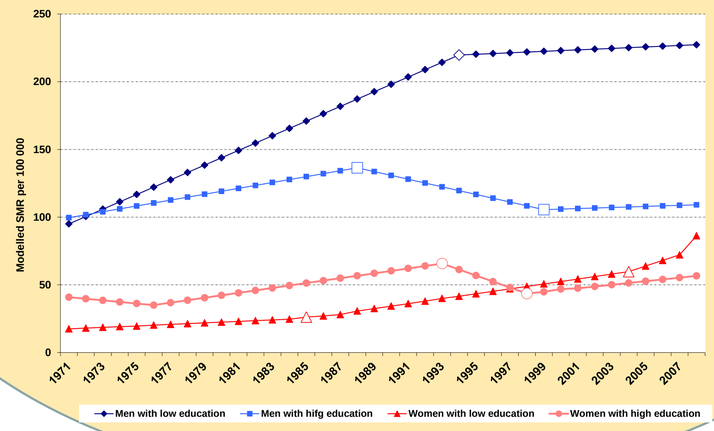
Results

NUTRITION-RELATED CAUSES OF DEATH
Principally education-specific dynamics:
Colorectal cancer mortality by education and gender, modelled values



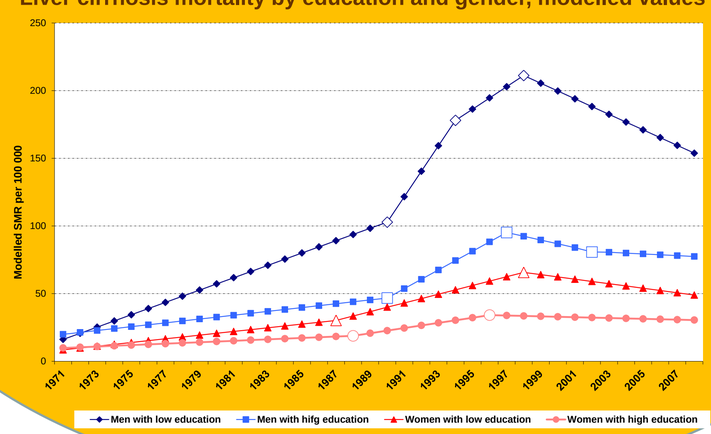
Causes of death showing similar pattern:
Chronic ischaemic heart disease, cardiomyopathy, arrhythmias, heart failure, diabetes, other diseases of the digestive system, colorectal cancer, pancreatic cancer, melanoma, other skin cancer

SMOKING RELATED CAUSES OF DEATH
Education and gender-specific dynamics:
Lung cancer mortality by education and gender, modelled values



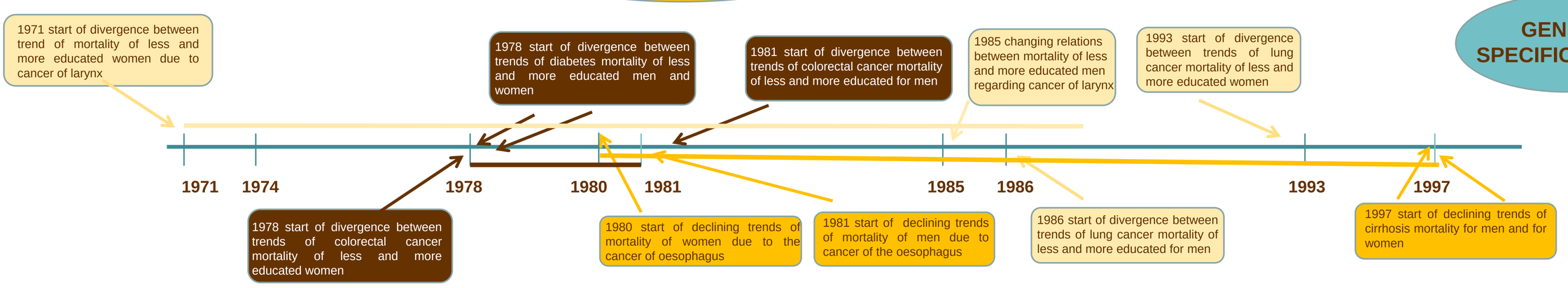
Causes of death showing similar pattern:
Cancer of larynx

ALCOHOL-RELATED CAUSES OF DEATH
Dynamic without gender or education specificity:
Liver cirrhosis mortality by education and gender, modelled values



Causes of death showing similar pattern:
Cancer of oesophagus

GENDER SPECIFIC MODEL



Conclusion

Inequalities in mortality due to causes with strong link to quality of nutrition together with most heart disease played supreme role in the formation of inequalities in mortality in Hungary. The timing of changes in trend of cause specific mortality is similar regarding both genders though the trend for less educated women are usually much moderated than for less educated men. Alcohol-related mortality regarding the dynamic of mortality inequalities is not gender specific, though the same scenario led to major inequalities among men than women. The dynamic of smoking related mortality is both education and gender specific. Causes of death influenced with more than one risk factor with similar weight of influence usually display some transitional pattern between the three just now distinguished patterns. In a gender-specific analysis the periods which characterize major changes influencing mortality inequalities did not widen for alcohol and nutritional related causes but they widen considerably for smoking related causes.

METHODS

Data and standardization

Yearly death numbers broken down by education and sex has been collected from the mortality register of the Hungarian Central Statistical Office. Population for the distinguished population group has been calculated by using census data for 1970, 1980 and 1990 and 2001, and estimation or forecasting for not census years. Directly standardized mortality ratios (SMR) were calculated for the distinguished four population groups using the European Standard Population. The resulting time series were not continuous, due to the changes in the coding systems. The introduction of ICD-9 coding system in 1979, the introduction of ICD-10 in 1986, and the application of the automatic coding (2005) all produced considerable discontinuity in some of the trends.

Fitting

In order to have continuous time series we fitted the values of standardized mortality around the years of code changes. Based on the values of standardized mortality taken in the five years prior to years with code system changes we predicted mortality for the subsequent year. The quotient of the predicted and the actual value provided the fitting coefficient for each causes of death considered.

The fitting coefficient was calculated for the whole population than applied to the mortality of the four distinguished social groups.

In the next step the time series with fitted values were analysed.

Determining turning points

Turning points between growing, stagnating or declining periods of mortality were determined by joint point analysis. The JointPoint software was provided by the National Cancer Institute of the United States The method first fits several combinations of sequences of linear phases which are connected by joint points. The combinations are tested against the null hypothesis (e.g. no joint point) using a test based on Monte Carlo Method. This method calculates not only the exact years of the appearance of a joint points but also theirs confidence intervals In case of more than 1-3 years of difference in the appearance of the joint points we considered joint points being the same for two different subpopulations. In the case of very wide confidence intervals the given cause of death was excluded from the analysis.

Mortality from diseases of the digestive system other than diabetes: modelled values, joint pints and their confidence intervals