Changing sex differences in socioeconomic gradients of mortality in wealthy countries 1970-2010: the role of smoking

Alyson A. van Raalte, Mark Hayward, Johan Mackenbach, Pekka Martikainen

Abstract

Socioeconomic inequalities in mortality are almost universally larger among men than among women. Stronger socially patterned behaviour among men is thought to be one of the primary reasons for this. Empirically, SES gradients in smoking prevalence are increasing in most countries at the same time that sex differences in smoking-attributable mortality are decreasing. Thus the overall impact of smoking on sex differences in SES gradients is unclear. In this paper we investigate whether smoking might be driving changing SES mortality gradients by sex in multiple European countries and the United States, from 1970 to the present. Preliminary results from Finland have uncovered higher SES inequalities among women than men for non-smoking attributable mortality in the 1970s, and strong temporal differences in trends by marital status. This suggests that the smoking -SES relationship might be driven in part by compositional effects and a substitution of behavioural risk factors over time.

Introduction

Socioeconomic inequalities in mortality are almost universally larger among men than among women (Mackenbach et al. 1999). A few reasons have been put forward for why this may be the case: (1) different cause of death structures between the sexes and higher SES gradients among causes more affecting men, (2) SES differences in occupational hazards might differ by gender, (3) socially patterned behaviour may be stronger among men and (4) women’s SES status is not always accurately captured by own education, income or occupation (Arber 1997; Heller, Williams and Sittampalam 1984; Huisman et al. 2005; Koskinen and Martelin 1994; Macintyre and Hunt 1997; Mackenbach et al. 1999).

Less remarked upon is that sex differences in SES gradients are narrowing in several developed countries including Norway and the USA, mostly due to steeply increasing gradients among women (Hendi 2015; Montez et al. 2011; Strand et al. 2014). Even in countries where sex differences in SES gradients in mortality continue to widen, the gap is growing more slowly in younger age groups (Tarkiainen et al. 2012). Part of the explanation for these changes may lie in women’s increased participation and attachment in the labour market, which may lead to all individual level measures of SES becoming more accurate indicators of social standing among women. However, another possibility – which is not

1 Correspondence to: vanraalte@demogr.mpg.de
*Authors currently ordered alphabetically
necessarily exclusive from the increased labour force participation explanation - is that SES is becoming a more important marker of behavioural norms, leading to converging SES gradients by sex.

Cigarette smoking remains the leading cause of preventable mortality in wealthy nations and is becoming increasingly socially patterned. For instance in the USA the absolute difference in smoking prevalence rates between the tertiary and up to high school educated increased from 18 to 26 percent from 1970 to 2012 (males) and from 6.5 to 24 percent (females) (Ho and Fenelon 2015), even though the level of smoking has declined rapidly. Relative rate differences also increased. Increasing SES differences in smoking prevalence (Giskes et al. 2005) and cessation (Bosdriesz et al. 2015) have also been observed in multiple European countries. Meanwhile, in many countries the sex gap in smoking-attributable mortality irrespective of SES is narrowing, although levels remain higher among men (Preston, Glei and Wilmoth 2011). Combining these two empirical observations, increasing SES gradients in smoking prevalence and decreasing sex differences in smoking-attributable mortality, the question remains whether smoking might also be contributing to converging SES mortality gradients by sex.

In this study, we intend to examine the effect of smoking attributable mortality on sex differences in socioeconomic gradients in total mortality in a multiple country setting. We will also stratify by marital status, given its observed importance in driving sex differences in SES mortality gradients (Montez et al. 2009). We will take advantage of differences in the timing of the smoking epidemic by sex and SES in different countries to measure the impact of these different smoking histories on changes to the SES mortality gradients by sex. Since the uptake of smoking by women generally lags that of men, we expect that any widening of socioeconomic gradients in mortality attributable to smoking to also differ in timing. We intend to test this hypothesis on multiple countries with long cause-of-death time series by socioeconomic status. Potentially this data set could go back to the 1970s for several European countries, and the 1980s for the USA.

Data and Methods

The minimal data requirements are lung cancer and all-cause death rates for a given age, period and SES group. We will also stratify by marital status when data is available.

We estimate smoking-attributable mortality using the Preston et al. (2011) indirect estimation method. This technique assumes that lung cancer death rates are a reliable marker of smoking damage for a given age and period. It estimates the smoking-attributable mortality at ages 50+ from all other causes using the macro-statistical relationship found between lung cancer and all-cause mortality among 20 high income countries from 1950 to 2006.

Socioeconomic gradients will be measured in two ways: first, we will calculate the difference between the lowest and highest groups in $e_{50}$, or potentially, the temporary life expectancy between ages 50 and 79 to minimize bias from surveys which omit the institutionalized population. In addition, we intend to calculate another absolute measure of inequality; the slope index of inequality (SII) for age-standardized death rates which also takes intermediate SES groups into account when calculating the gradient.
Moreover, the SII also takes the group size into account. This might give us a different perspective for SES categories that have undergone large changes to group membership over the study period.

**Preliminary Results**

To date we have conducted some preliminary analysis of the role of smoking on sex differences in SES gradients in mortality for Finland, using the difference in $e_{50}$ between upper non-manual and manual workers. We uncovered that in the 1970s and early 1980s Finnish women had larger occupational class inequalities in mortality not attributable to smoking. Over time, differences in this SES gradient first narrowed, and by the mid-1980s the SES-mortality gradients not attributable to smoking were larger among men (Figure 1). The pattern was similar when education was used instead of occupational class as a marker of SES.

Next, we stratified the population into currently married or not-married (combining single, divorced, widowed and cohabiting). Just as in the case for the whole population, married and unmarried men had higher SES mortality gradients than women for all-cause mortality (Figure 2, left panel). When smoking-attributable mortality was removed, however, it appeared that the large male increase in smoking non-attributable mortality gradients from Figure 1 was driven almost entirely by unmarried men (Figure 2, right panel). Marital status was not an important factor for women. At the start of the period, the SES mortality gradient was mostly caused by smoking inequalities among men, but by the end, non-smoking attributable causes were responsible for more than 2/3 of the male gradients. For women, excluding smoking-attributable causes did little to change the magnitude or trends in gradients.

**Discussion and future outlook**

Our preliminary results from Finland have uncovered two noteworthy findings: (1) women had higher occupational class inequalities in mortality not attributable to smoking in the 1970s and early 1980s, and (2) widening SES inequalities among men were driven almost entirely by unmarried men. However we did not find that smoking was causing increasing SES inequalities among men, only among women. This was at least in part because the level of male smoking, regardless of SES differentials, was declining rapidly.

That Finnish women had higher occupational class inequalities than men in mortality not attributable to smoking in the 1970s seems to run against much of the conventional theory postulating that inequalities should be stronger among men (Arber 1997; Heller et al. 1984; Huisman et al. 2005; Koskinen and Martelin 1994; Maclntyre and Hunt 1997; Mackenbach et al. 1999). On the one hand, our findings could signal that smoking is the only major driver of sex differences in SES mortality gradients. Another possibility, however, is that SES mortality gradients are driven by risk-takers who substitute different deleterious behaviour depending on the context. In the 1970s smoking-attributable mortality was high for men but near negligible for women. It could be that among men, the risk-takers were heavily
concentrated within the group of smokers, leaving a more select risk-averse group to die of non-smoking attributable causes. Women, however, would have been a more heterogeneous group of risk-takers and risk-averse individuals. If risk-takers were more heavily concentrated in low SES groups, this could explain both why women had higher inequalities than men among non-smoking attributable causes in the earlier periods and why this relationship changed as more risk-taking women took up smoking and became concentrated in the group of smokers.

Finland differs from the other countries in a number of important ways. First, Finnish women have relatively low lung cancer rates, which is reflective of a later initiation of smoking than in the United States and other Western European countries (Pampel 2011). Second, Finland is a country marked by stronger inequalities from alcohol-related causes than most other western European countries (Mackenbach et al. 2008). Third, changes in marital trends are not as strongly patterned by SES as in the United States (Martikainen et al. 2005). Finally, the period under observation was one of increasing sex differences in SES gradients, which was not the case in Norway or the United States (Hendi 2015; Montez et al. 2011; Strand et al. 2014).

It will thus be important to extend our analysis to the US and other European countries, taking advantage of country differences in the rate of male and female uptake of smoking and to see whether the direction of change in sex differences in overall smoking-attributable mortality is predictive of the direction in change in sex differences in SES mortality inequalities in smoking non-attributable mortality. Recently, Ho and Fenelon (2015) examined the role of smoking on changes in educational gradients among white non-Hispanic Americans, measured as differences in $e_{50}$ between those with completed high school or less and those with a college degree, using data from the NHIS (1986-2006) and the NLMS (1980s). The two surveys came to different conclusions regarding sex differences in SES mortality gradients that was not attributable to smoking. The NHIS results showed a similar pattern to Finland, suggesting that women in the United States may have initially had larger SES gradients in mortality not attributable to smoking, but by the 2000s, the gradient was larger among men. The NLMS data from the 1980s, however, already showed a larger gradient for men in smoking non-attributable mortality, but the smaller sample size hamper efforts to estimate a time trend. The NHIS data excludes the institutionalized population. In the future, we would like to re-estimate these gradients over a younger age range to lessen the bias of differences in the institutionalized population, to see whether we can get better agreement between surveys. Thus, the future outlook is to see whether we can replicate our main findings from Finland in other countries with different smoking histories.

References


Figures

Figure 1: Trends in the Finnish occupational class gradients (upper non-manual worker e50 – manual worker e50) for observed all-cause mortality and mortality not attributable to smoking.

Figure 2: Trends in the Finnish occupational class gradient (upper non-manual workers e50 – manual worker e50) by marital status for all-cause mortality (left) and smoking non-attributable mortality (right).