Article

36-year trends in educational inequalities in self-rated health among Finnish adults

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ABSTRACT

Health inequalities exist across countries and populations, but little is known about their long-term trends and even less about factors shaping the trends. We examined the magnitude of absolute and relative educational inequalities in self-rated health over 36 years among Finnish adults, considering individual covariates and macro-economic fluctuations. Our data were derived from representative annual cross-sectional surveys in 1979–2014 conducted among adult men and women. Participants aged 25–64 were included and nine periods used (n = 8870–14235). Our health outcome was less-than-good self-rated health (SRH) and our socioeconomic indicator was completed years of education as a continuous variable. Educational inequalities in self-rated health were analysed using the relative index of inequality (RII) and the slope index of inequality (SII). Nine time-variant sociodemographic and health-related covariates were included in the analyses. Linear trends suggested stable or slightly curvilinear overall trends in both absolute and relative health equalities over 36 years. Among men, absolute and relative inequalities narrowed immediately after economic recession in Finland in 1993–1994. Among women, inequalities narrowed during financial crisis in 2008–2009. Adjusting for most covariates reduced the magnitude of inequalities throughout the nine periods, but affected little the temporal patterning of health inequalities. Educational inequalities in self-rated health remained during 36 years in Finland. While among men and women health inequalities narrowed during and after recessions, they widened soon back to the pre-recession level. The perseverance of the trends calls for novel and powerful measures to tackle health inequalities.

Introduction

Socioeconomic inequalities in health have turned out to be a scourge much tougher than thought some decades ago. Nationwide egalitarian health programmes have been launched in countries like the UK, the Netherlands, Sweden and Finland to tackle health inequalities (Hu, van Lenthe, Judge et al., 2016; Khang, Lynch, Yun, & Lee, 2004; Mackenbach 2012). Despite these efforts, health inequalities have persisted across populations, including our focus country Finland (Bouchard et al., 2015; Hu, van Lenthe, Borsboom et al., 2016; Mackenbach et al., 2018; MSAH, 2008; Palosuo et al., 2009; Townsend, Davidson, 1982; WHO, 1985; WHO, 2008). Less is known about time trends in inequalities in self-rated health and even less about longer time trends covering several decades. It is vital for scientific progress as well as practical policies to

understand the long-term trends in health inequalities, i.e. whether inequalities widen or narrow, and whether there are period-specific turns. Long-term trends also help distinguish random and short-term variation from major changes in underlying secular trends, shaped by micro and macro level factors.

Studies on health inequalities have often focused on relative inequalities and overlooked absolute inequalities, although methodological reviews suggest that both should be considered when studying the magnitude, direction, significance, determinants and implications of health inequalities (Mackenbach, Kunst, 1997; King, Harper, & Young, 2012; Mackenbach, 2015). The two measures of inequalities are particularly important when factors associated with trends in health inequalities are examined. Focusing on relative inequalities emphasises inequality per se, irrespective of the levels of ill health. Focusing on

absolute inequalities emphasises a more pragmatic approach suggesting that levels of ill health matter most for those in lowest socioeconomic groups. Thus, the choice between absolute and relative measures of health inequalities is not only a methodological but also a moral and political one.

We follow the methodological recommendations and use both relative and absolute measures of health inequalities when studying 36-year trends in the magnitude of educational inequalities in self-rated health among Finnish adults.

Prior Finnish studies have reported shorter, i.e. 10-20-year trends in inequalities in self-rated health from the late 1970s until early 2000s (Heistaro, Vartiainen, & Puska, 1996; Rahkonen et al., 2009). This evidence confirms that educational inequalities in self-rated health have remained mostly stable over time and even narrowed somewhat towards the end of the last millennium. Studies report descriptive prevalence data whereas analytic measures are limited to odds ratios. The Finnish trend studies cover neither long-term trends nor current health inequalities.

Studies from further countries have examined trends in inequalities in self-rated health. A German study among middle-aged men and women spanned over 21 years from 1994-2014 and examined the magnitude of educational inequalities in self-rated health using the relative index of inequality (RII) for relative and the slope index of inequality (SII) for absolute inequalities (Moor et al., 2018). Overall, the magnitude of relative as well as absolute health inequalities remained and there was no increasing or decreasing trend. Two studies using the same Japanese survey data examined occupational class inequalities in self-rated health among middle-aged men and women over 27 years (Hiyoshi, Fukuda, Shipley, & Brunner, 2013; Sugisawa, Harada, Sugihara, Yanagisawa, & Shinmei, 2016). Both relative and absolute inequalities remained stable, and high unemployment rate was associated with smaller health inequalities. Studies from the USA (Liu, Hummer, 2008) and Britain (Maheswaran, Kupek, & Petrou, 2015) showed stable or slightly widening relative educational inequalities in self-rated health over 11-21-year trends. A South Korean study reported widening relative educational inequalities in self-rated health among men and women over an 11-year trend (Khang et al., 2004). A comparative European study covering 17 countries examined educational inequalities in self-rated health over two decades (Hu, van Lenthe, Borsboom et al., 2016). Taking all countries together absolute inequalities remained largely stable, with minor country-specific deviations. However, relative inequalities showed a widening trend among men and women, in particular, in England, the Netherlands and Switzerland.

Summarising the evidence suggests that trends in absolute educational inequalities in self-rated health have remained mostly stable, whereas relative inequalities have remained stable or widened. It is striking that even minor narrowing in relative or absolute inequalities is practically non-existent. Few studies examine the magnitude of health inequalities using both relative and absolute measures. Individual covariates are included in a couple of studies only. Focusing on macroeconomic fluctuations, a number of studies have suggested that economic downturns would lead to worsening health and widening health inequalities (Edwards, 2008; Karanikolos et al., 2013; Bacigalupe, Escolar-Pujolar, 2014; Sugisawa et al., 2016; Thomson, Niedzwiedz, & Katikireddi, 2018). However, a number of other studies have suggested a divergent picture, as health inequalities have remained or narrowed even during economic downturns (Hiyoshi et al., 2013; Khang et al., 2004; Liu, Hummer, 2008; Maheswaran et al., 2015; Sugisawa et al., 2016).

Finally, as the prior trends cover about two decades at maximum, they are not ideally suited for examining long-term changes in health inequalities and their period-specific individual level and macroeconomic covariates.

Context and purpose

Our study represents Finnish adult men and women over a 36-year time period. Finland is a Nordic welfare state, with institutional welfare arrangements and universal social policies (Beckfield et al., 2015). Among European countries, inequalities in mortality in Finland have been relative large (Mackenbach et al., 2018), whereas inequalities in self-rated health have been intermediate (Hu, van Lenthe, Borsboom et al., 2016). The overall social and economic development for indicators like life expectancy and Gross Domestic Product (GDP) has been favourable during our study period (Statistics Finland, 2014a). The country, nevertheless, underwent two economic downturns, i.e. a labour market crisis in 1993–1994 and the global financial crisis in 2008–2009, which led to cuts in social services and benefits. Over the last few decades, employment participation in Finland has shown relative gender equality, as men and women have taken full-time jobs almost as often, and recessions have hit both genders in terms of high unemployment and worsening financial resources (Statistics Finland, 2014b). Thus, our study offers an interesting case study of long-term trends in health inequalities and their individual level covariates in a Nordic welfare state under economic and political pressures.

Our aim was, firstly, to examine 36-year trends in 1979–2014 in the magnitude of absolute and relative educational inequalities in self-rated health among Finnish adult men and women. Secondly, we aimed to examine the bearing of sociodemographic and health-related covariates on the inequalities and their trends over time.

Data and methods

Data sources

The data were derived from the study on Health Behaviour and Health among the Finnish Adult Population by the National Institute for Health and Welfare in Finland, collected annually in 1979–2014 using cross-sectional mail surveys (Helldán & Helakorpi, 2015). The data are representative of Finnish men and women aged 15–64. We included ages from 25 to 64 years. Participants below age 25 may not yet have completed their education. The upper age limit in the data is 65 years. The annual data were pooled to nine periods: 1979–1982, 1983–1986, 1987–1990, 1991–1994, 1995–1998, 1999–2002, 2003–2006, 2007–2010 and 2011–2014. The periodisation helps smoothen the annual random variation and allows the examination of economic fluctuations in Finland during 1979–2014. The period-specific number

Table 1
Number of participants, prevalence (%) of self-rated health (SRH) below good and average years of completed education in study periods.

Period	N	SRH below good %	Average years of education
Men			
1979–1982	7428	40	9.6
1983–1986	5707	38	10.1
1987–1990	5820	39	10.7
1991–1994	5344	36	11.4
1995–1998	5354	36	11.8
1999–2002	4976	37	12.4
2003–2006	4902	38	12.9
2007–2010	4445	35	13.2
2011–2014	3842	34	13.8
Women			
1979–1982	6807	39	9.6
1983–1986	6380	36	10.4
1987–1990	6470	36	11.0
1991–1994	6119	31	11.8
1995–1998	6086	33	12.3
1999–2002	5893	33	13.0
2003–2006	5882	34	13.5
2007–2010	5686	34	14.0
2011–2014	5028	32	14.5

of respondents ranged from 8870 to 14235 (Table 1). Annual response rates varied among men from 44% to 83% and among women from 58% to 86%, with a declining trend over time (Helldán & Helakorpi, 2015). Identical questions were asked with minor deviations to allow reliable examination of temporal trends.

Measures

Our health outcome was self-rated health (SRH), measured by a question asking whether the respondent's current health status is good, fairly good, average, fairly poor or poor. Following common practice, we collapsed categories poor, fairly poor and average to indicate less-than-good self-rated health (Mackenbach et al., 2018; Subramanian, Huijts, &

Avendano, 2010). Self-rated health is a broad measure of ill health and health-related well-being, much used in population studies (Manderbacka, 1998).

Our socioeconomic indicator was education measured by years of completed education. For background information we categorised education into thirds and in the main analyses we used years of education as a continuous variable. Education is a key indicator of socioeconomic position, which forms an ordinal scale, and can be assigned to each person irrespective of employment status (Lynch, Kaplan, 2000; Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006; Lahelma, 2010). Education is typically completed by early adulthood and it contributes to occupational class and income. Average years of education increased among men from 9.6 years in period 1979–1982 to 13.8 years in period
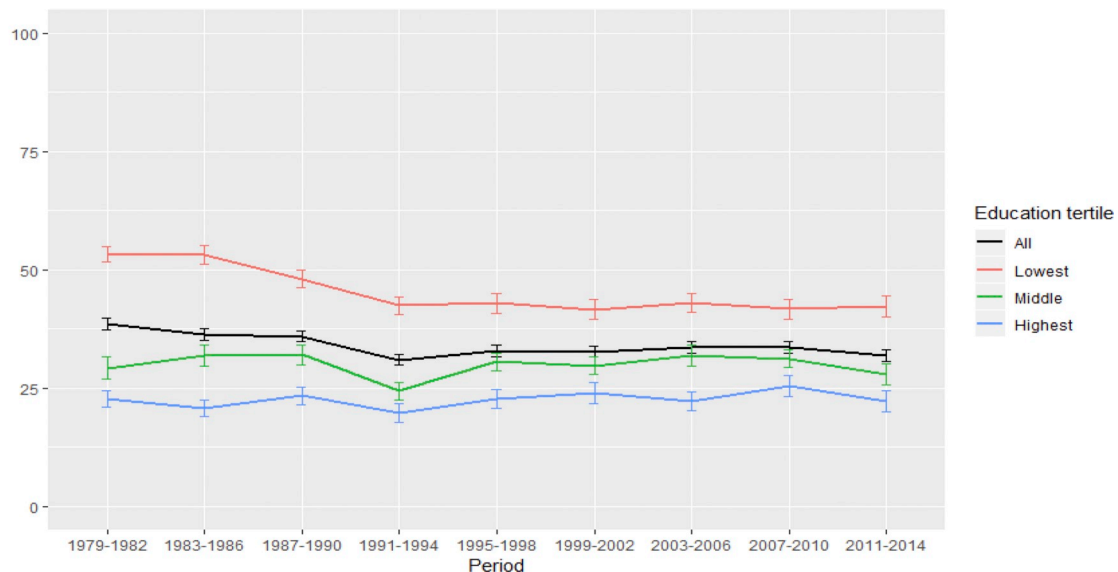
(a) Men
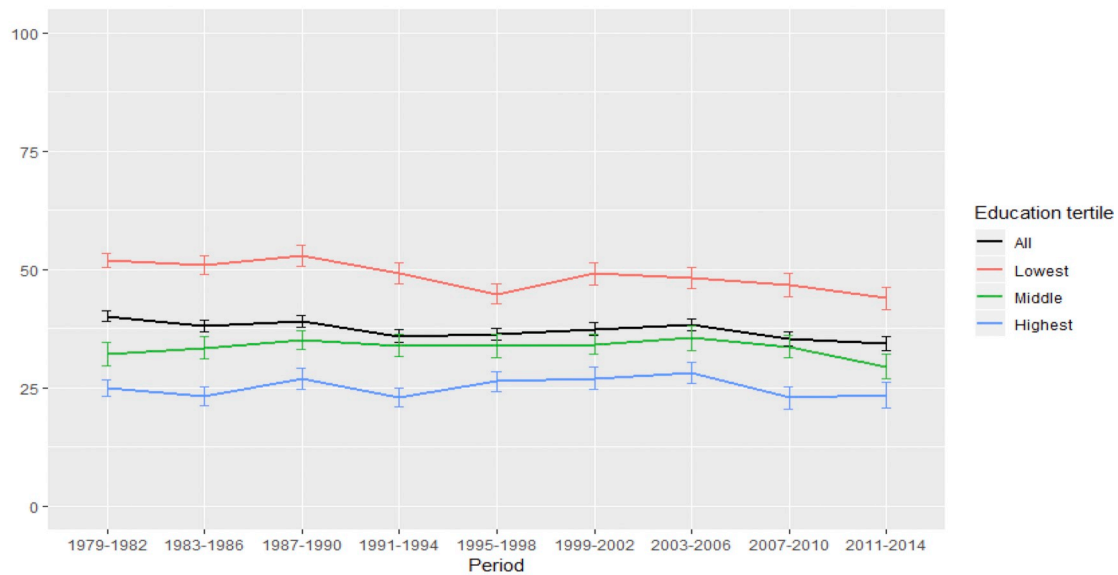
(b) Women

Fig. 1. Prevalence (%) of less-than-good self-rated health with 95% confidence intervals by education tertile from period 1979–1982 to period 2011–2014, (a) men, (b) women (%).

2011–2014 and among women from 9.6 to 14.5 years (Table 1).

Covariates

We included individual-level time-variant sociodemographic and health-related covariates as they have been associated with health inequalities in previous trend studies (Dieker et al., 2019; Granström et al., 2015; Moor et al., 2018; Sugisawa et al., 2016). Marital status was categorised into married including cohabiting, unmarried, divorced and separated, employment status into employed, unemployed, retirees and others, and region of residence into Southern Finland, Western Finland, Middle Finland, South-eastern Finland, Eastern Finland, and Northern Finland. Smoking was categorised into current daily smoking and non-smoking (not available for period 1979–1982), vegetable use into using fresh vegetables daily and less often during the past week, alcohol drinking into 8 units or more and less at one occasion among men and 5 units or more and less among women (not available for period 1979–1982), and body mass index (BMI) into below 25, 25–30 or above 30.

Statistical methods

All analyses were stratified by gender as health and its background factors vary between men and women. For descriptive purposes we, firstly, calculated period-specific averages for the prevalence of less-than-good self-rated health (Table 1). Secondly, we classified years of education into tertiles and calculated for each tertile period-specific prevalence percentages of self-rated health with 95% confidence intervals (95% CI) (Fig. 1).

The magnitude of educational inequalities in self-rated health was examined using the relative index of inequality (RII) and the slope index of inequality (SII) (Asada, 2010; King et al., 2012; Mackenbach, Kunst, 1997; Mackenbach, 2015; Moor et al., 2018). Both RII and SII are regression-based indices that take into account both the steepness of the gradient and the sizes of the groups compared. Years of education were converted to a relative rank indicator by taking the midpoint of the range in the cumulative distribution at that level of education. RII measures the magnitude of relative inequalities and reflects the prevalence ratio. RII was calculated with log-binomial regression models by using the rank indicator as an independent variable (Ernstsen, Strand, Nilsen, Espnes, & Krokstad, 2012). RII values above 1.0 indicate inequalities, and the higher the value, the larger the relative inequalities. SII measures the magnitude of absolute inequalities and reflects the prevalence difference. SII was calculated with binomial regression models with identity link function. SII values above 0.0 indicate inequalities, and the higher the value, the larger the absolute inequalities. RII and SII values and their 95% confidence intervals were calculated for each period.

Firstly, Figs. 2 and 3 present the age adjusted RII values and Figs. 4 and 5 the age adjusted SII values for each period, men and women separately (solid line). Secondly, models were fitted adjusting for age and each covariate, one at a time, and the effects of the adjustments are reported in the text. The precise point estimates for RII and SII values, adjusted for each covariate with 95% confidence intervals, can be found in Appendices 1 and 2. Thirdly, we fitted linear trend lines for the whole 36-year period to see the overall development of health inequalities. The linear trends are reported in Figs. 2–5 (dashed line) and p-values for the slope being non-zero are given in the text. We also checked the curvi-linearity of the trends and report this in the Results.

Results

The overall prevalence of less-than-good self-rated health over 36-years from period 1979–1982 to period 2011–2014 declined steadily from 40% to 34% among men and from 39% to 32% among women (Table 1, Fig. 1). The decline was primarily due to the first half of the

Fig. 2. Relative educational inequalities in self-rated health among Finnish men aged 25–64 from period 1979–1982 to period 2011–2014. Relative Index of Inequality (RII) and 95% confidence intervals adjusted for age (solid line), and linear trend line (dashed line).

Fig. 3. Absolute educational inequalities in self-rated health among Finnish men aged 25–64 from period 1979–1982 to period 2011–2014. Slope Index of Inequality (SII) and 95% % confidence intervals adjusted for age (solid line), and linear trend line (dashed line).
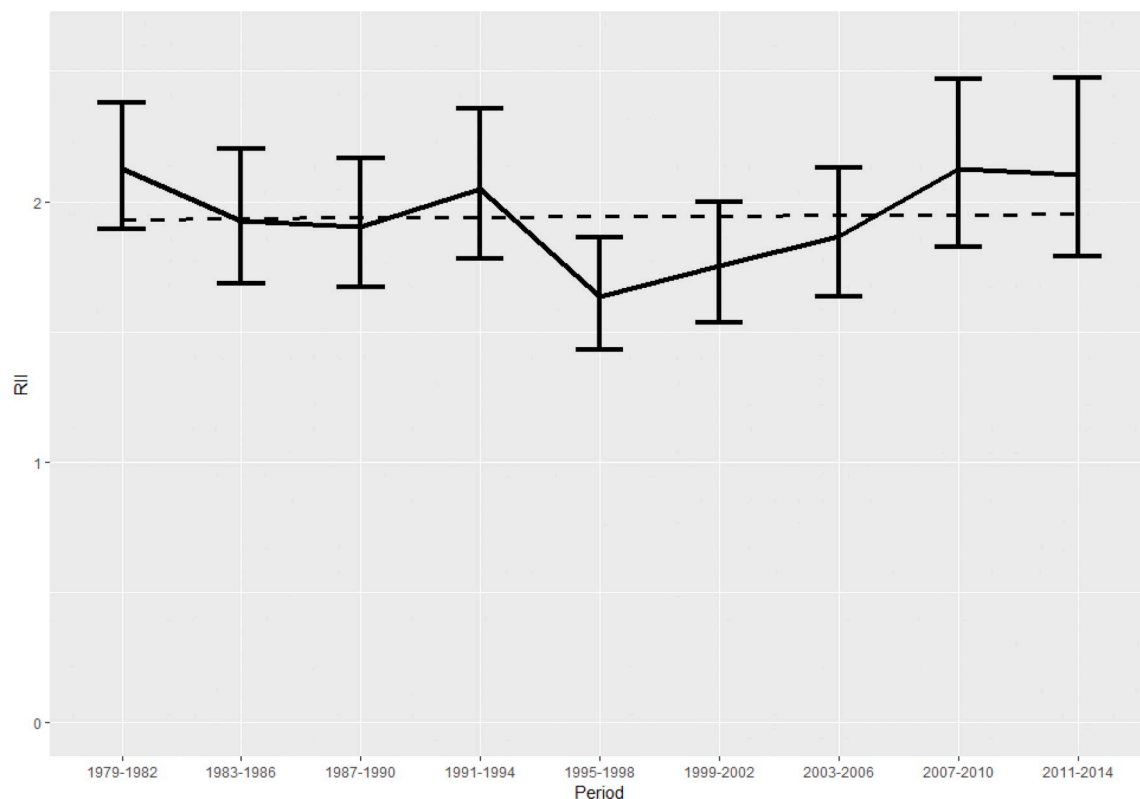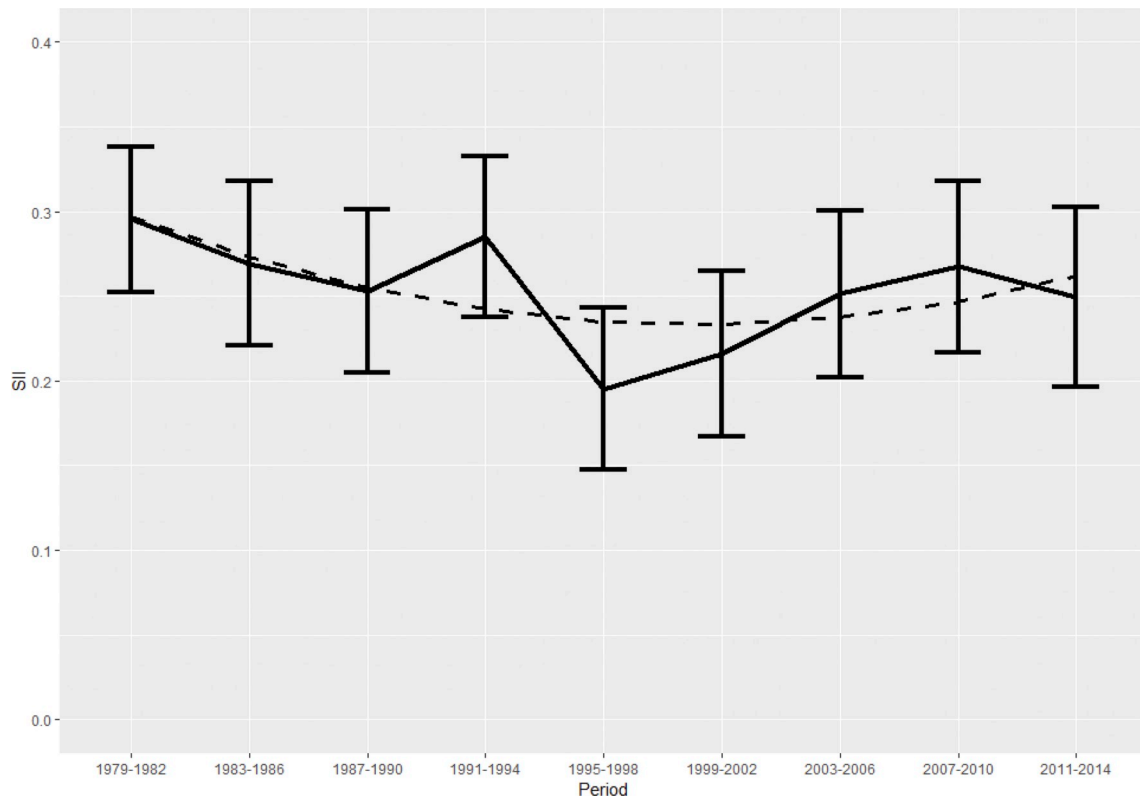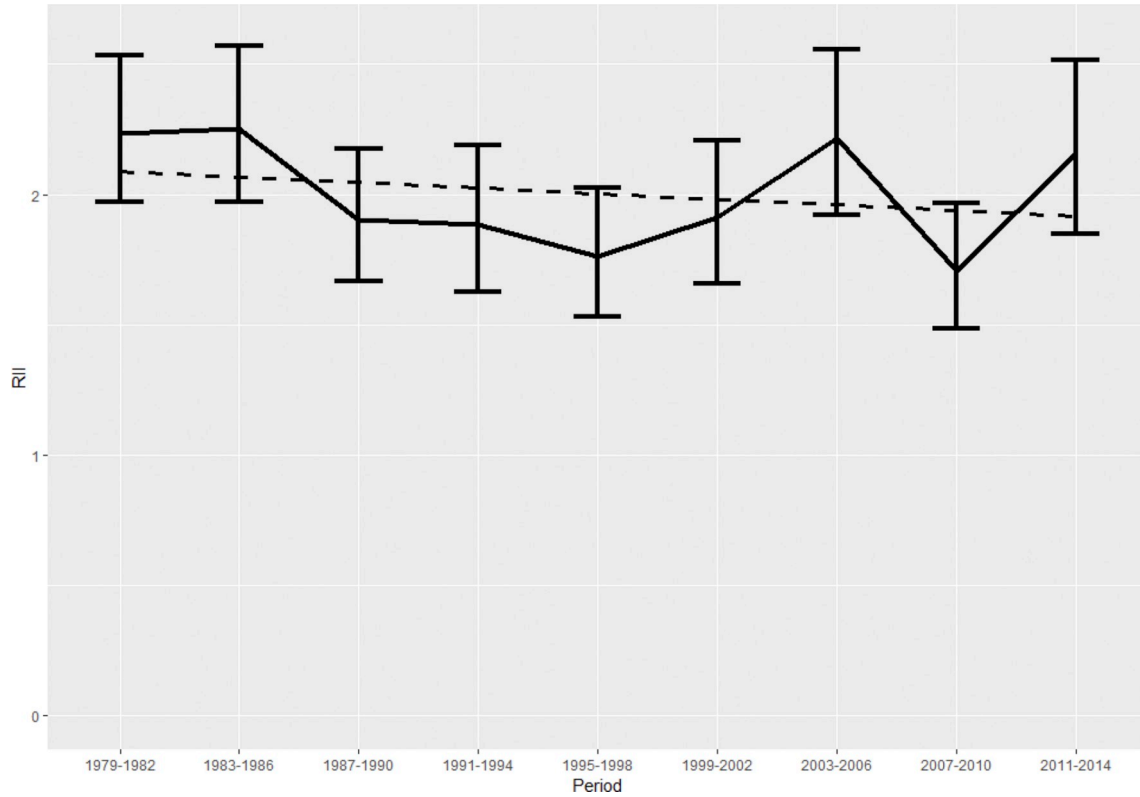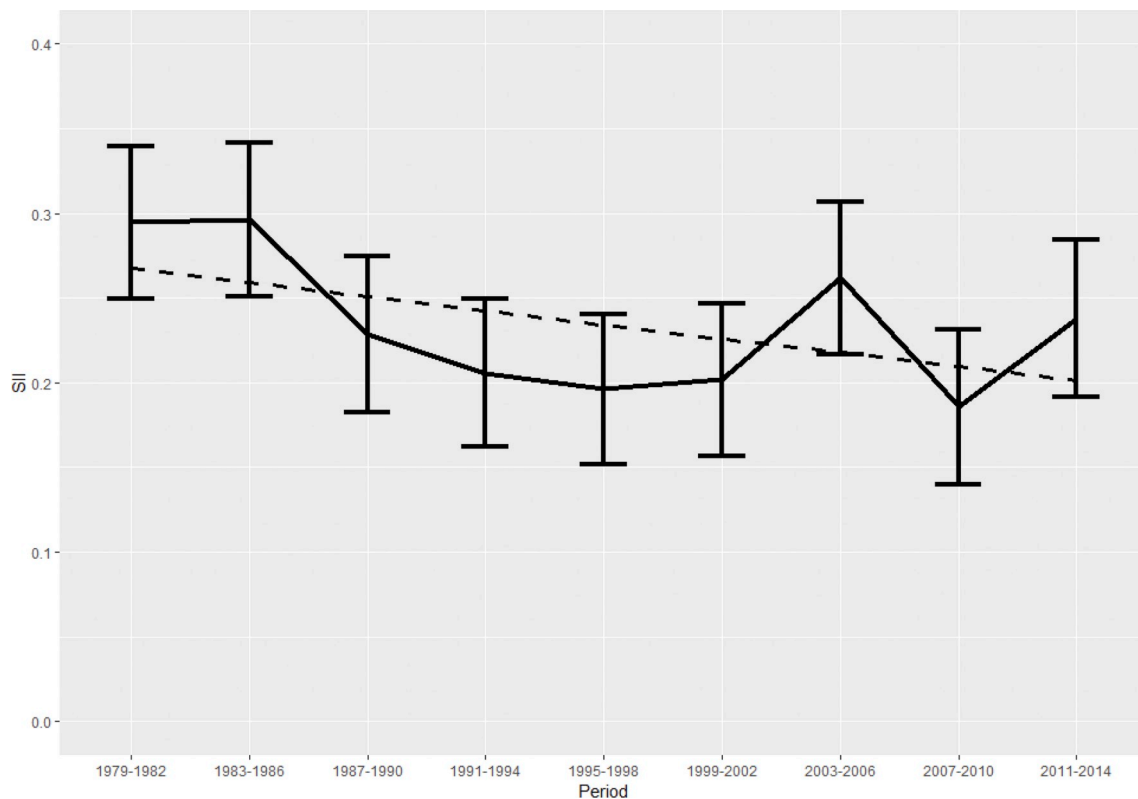

Fig. 4. Relative educational inequalities in self-rated health among Finnish women aged 25–64 from period 1979–1982 to period 2011–2014. Relative Index of Inequality (RII) and 95% confidence intervals adjusted for age (solid line), and linear trend line (dashed line).

Fig. 5. Absolute educational inequalities in self-rated health among Finnish women aged 25–64 from period 1979–1982 to period 2011–2014. Slope Index of Inequality (SII) and 95% confidence intervals adjusted for age (solid line), and linear trend line (dashed line).

study period when less-than-good self-rated health declined most in the lowest education tertile and more so among women than men.

Health inequalities among men

Among men, the magnitude of relative educational inequalities in less-than-good self-rated health, measured by the relative index of inequality (RII), suggested a stable linear overall trend (p = 0.922) for the whole 36-year study period (Fig. 2, dashed line). However, there was variation in the age-adjusted RII values among the nine study periods (solid line). The overall trend showed slight curvilinearity and the model including curvilinearity was somewhat better than the linear model (p = 0.006). During the four first periods in 1979–1994, the RII values remained relatively stable between 1.90 (95% CI 1.67–2.16) and 2.12 (1.89–2.38) (Appendix 1). In period 1995–1998, immediately after the 1993–1994 recession in Finland, relative health inequalities narrowed by 40% to the lowest RII value 1.63 (1.43–1.86). After the narrowing, relative health inequalities widened again and peaked at RII value 2.12 (1.83–2.47) in period 2007–2010 when the global financial crisis burst out in 2008–2009.

Adjusting for each covariate one at a time did not change the age-adjusted period-specific pattern. Except for alcohol use, all other covariates reduced the magnitude of relative inequalities throughout the nine study periods. Vegetable use reduced the inequalities most, i.e. by 24%–40%, followed by employment status and smoking.

Absolute inequalities in self-rated health, measured by the slope index of inequality (SII), suggested also a stable linear overall trend (p = 0.317) for the whole study period, with no curvilinearity (Fig. 3, dashed line). The period-specific pattern for absolute inequalities among men was similar to that for relative inequalities (solid line). The first four periods again showed relative stability with SII values between 0.25 (0.20–0.30) and 0.29 (0.25–0.34) (Appendix 1). In the immediate post-recession period 1995–1998 absolute health inequalities declined by

32% to the lowest SII value 0.19 (0.15–0.24). After that, health inequalities widened again to the pre-recession level.

Also for absolute inequalities, adjusting for each covariate one at a time reduced the magnitude of inequalities but did not affect the period-specific pattern. Vegetable use reduced most the absolute inequalities, i. e. by 21%–26%, followed by employment status and smoking.

Health inequalities among women

Among women as among men, the magnitude of relative educational inequalities in self-rated health suggested a stable linear overall trend (p = 0.471) for the whole study period, with no curvilinearity (Fig. 4, dashed line). However, the period-specific variation differed from men as for women there was no immediate decline in relative inequalities after the 1993–1994 recession (solid line). Instead, there was a 38% gradual narrowing of inequalities during the five first periods from 1979-1982 (RII 2.5, 1.97–2.53) to 1995–1998 (RII 1.76, 1.53–2.02) (Appendix 2). After that, relative inequalities widened and peaked in 2003–2006 with RII value 2.22 (1.92–2.56), followed by an immediate 42% narrowing during the financial crisis period 2007–2010, and a final widening.

Adjusting for covariates reduced the magnitude of relative inequalities but did not affect the period-specific pattern. For women BMI reduced the inequalities most, i.e. by up to 42%, and employment status and smoking led to smaller reductions in the later study periods, in particular.

Like among men, also among women, absolute inequalities in self-rated health suggested a stable linear trend (p = 0.132) for the whole study period (Fig. 5, dashed line). The overall trend showed slight curvilinearity and the model including curvilinearity was somewhat better than the linear model (p = 0.027). The period-specific pattern in absolute inequalities followed that for relative inequalities among women (solid line), with inequalities narrowing by 31% during the six

periods from 1979-1982 (SII 0.29, 0.25–0.34) to 1999–2002 (0.20, 0.16–0.25) (Appendix 2). After that, inequalities widened, followed by an immediate 27% narrowing in the financial crisis period 2007–2010, and a final widening.

Adjustments again reduced the magnitude but did not contribute to the patterning of absolute inequalities. Adjusting for BMI, employment status and vegetable use reduced each inequalities by up to 20%.

Discussion

We examined the magnitude of relative and absolute educational inequalities in self-rated health among Finnish men and women over a 36-year study period. Our main findings were:

1. Linear trends over 36 years confirmed that clear relative and absolute health inequalities persisted over the whole study period among men as well as women. Overall, the trends suggested that inequalities remained stable over time.

2. Among men, the period-specific pattern was largely similar for both relative and absolute health inequalities. The conspicuous finding was a sudden narrowing of inequalities after deep economic recession in Finland peaking in 1993–1994.

4. Also among women, the period-specific pattern in both relative and absolute health inequalities was similar, but differed from men. The conspicuous finding was a sudden narrowing of inequalities during the global financial crisis period in 2007–2010.

5. Adjusting for sociodemographic and health-related covariates, in particular, vegetable use, BMI and employment status, reduced the magnitude of absolute and relative health inequalities largely in a similar way across the nine study periods.

Interpretation and comparison

Prior evidence confirms inequalities in self-rated health among national populations at least since the 1970s (Townsend, Davidson, 1982, Mackenbach et al., 2018). However, the evidence derives from 10-20-year trends compared to our 36-year trend. In a couple of countries, relative health inequalities have widened somewhat, whereas in most countries absolute inequalities have remained largely unchanged, with no country showing clearly narrowing inequalities (Hiyoshi et al., 2013; Hu, van Lenthe, Borsboom et al., 2016; Khang et al., 2004; Kondo, Subramanian, Kawachi, Takeda, & Yamagata, 2008; Maheswaran et al., 2015; Moor et al., 2018; Sugisawa et al., 2016). Our study suggests that in Finland the prior findings can be extended to cover a trend up to 36 years.

During our study period, two major economic recessions took place and these shaped the trends in health inequalities. The 1993–1994 recession in Finland led to a sudden decline in relative and absolute health inequalities among men, but not among women. The 2008–2009 global financial crisis, in turn, led to a sudden decline in relative and absolute health inequalities among women, but not among men. After the recessions, inequalities returned to the pre-recession level. One might have expected financially hard times to widen health inequalities, but our evidence points to the opposite. A number of earlier studies have equally shown narrowing health inequalities during economic downturns (Valkonen et al., 2000; Kondo et al., 2008; Hiyoshi et al., 2013; Sugisawa et al., 2016, Mackenbach et al., 2018; Thomson et al., 2018; van der Wel, Saltkjel, Chen, Dahl, & Halvorsen, 2018). However, our evidence is not fully consistent as during the first recession only men's health inequalities narrowed, whereas during the second recession only women's inequalities narrowed.

Our analyses adjusted for individual-level time-variant sociodemographic and health-related covariates. These reduced both relative and absolute health inequalities by about 20–40%. The largest reductions were due to vegetable use among men and BMI among women. Employment status, and further health behaviours also reduced the inequalities, except for alcohol, which showed no effects or minimal

widening. The negligible effects of alcohol may be due to difficulties in capturing alcohol use and its socioeconomic differences by survey measurement (Tolonen et al., 2010). Using register data, alcohol related causes accounted for a substantial part of inequalities in mortality, in particular, among Finnish men (Östergren, Martikainen, Tarkiainen, Elstad, & Brønnum-Hansen, 2019).

Our covariates reduced the magnitude of health inequalities in a similar way throughout the nine study periods and thus did not unravel any mechanisms behind the period-specific patterning of the inequalities and their gender differences. Prior studies have included similar sociodemographic and health-related covariates; these have equally reduced but not abolished health inequalities (Dieker et al., 2019; Granström et al., 2015; Maheswaran et al., 2015; Moor et al., 2018). In addition to the studied covariates, residual confounding is possible due to unmeasured covariates, such as housing, social support and working conditions (Dieker et al., 2019; Moor, Spallek, & Richter, 2017).

Like many prior trend studies, our study was also on educational inequalities in health. We used years of education as a continuous variable in the analyses. Compared to discrete educational classes, continuous education is advantageous as it allows a more sensitive analysis of long-term trends in health inequalities. The length of education has increased substantially across countries, in our study by about 4 years over 36 years. Such expansion of education may affect the trends in health inequalities and their interpretation. Education may have lost significance, as educational expansion has proceeded. A diminishing health returns hypothesis of education suggests that education may be losing its significance for the promotion of health and preventing health inequalities. There is evidence supporting such a development, as older cohorts have been found to gain more health benefits from an additional year of education than younger cohorts (Delaruelle, Buffel, & Bracke, 2015).

Macro-economic fluctuations provide important backgrounds for health inequalities and this was suggested also by our findings, which were shaped by the two recessions. A proposed macro-economic assumption has been that recessions contribute to worsening health and widening inequalities (Edwards, 2008; Bacigalupe, Escolar-Pujolar, 2014). We checked further, how macro indicators might be related to the period-specific variation of health inequalities in Finland. Unemployment rate increased from prior 3%–6% up to 17% during the 1993–1994 recession, whereas during the 2008–2009 financial crisis it was 6%–8%, i.e. at a level similar to that before and after the crisis (Statistics Finland, 2014b). Gross Domestic Product (GDP) per capita has increased steadily, except for decreases during both downturns. Trends in income inequalities remained unaffected by the downturns and the GINI coefficients were stably below 22 until 1997, with a subsequent increase to stable 25–26 (Statistics Finland, 2015). In our study, health inequalities narrowed among men by 32%–40% during the first downturn and among women by 31%–38% during the second one, with a subsequent return to the pre-recession level. Thus, the macro-economic indicators were not systematically associated with the trends in health inequalities in Finland. Instead, during the two downturns health inequalities narrowed and no widening was observed. The Finnish picture is in accordance to a European study across types of welfare regime, which examined trends in absolute and relative inequalities in self-rated health, and whether unemployment, GDP and GINI coefficients would affect the inequalities (Leão, Campos-Matos, Bambra, Russo, & Perelman, 2018). However, the effects were minor and the three macro-economic factors did not explain the trends in health inequalities.

Potential reasons for narrowing inequalities, instead of widening, during recessions include a drop in smoking, drinking, work strain, accidents and cardiovascular diseases that concern disproportionately the lower educated (Edwards, 2008; Valkonen et al., 2000). The reasons suggested for widening inequalities during recessions include austerity, poverty, lack of social protection and services (Hiyoshi et al., 2013; Bacigalupe, Escolar-Pujolar, 2014; Thomson et al., 2018). Country

differences are potentially important as social and economic structures as well as health and welfare policies vary. Prior theoretical approaches have emphasised materialist, cultural-behavioural and psychosocial factors as determinants of health inequalities and their changes over time (Beckfield et al., 2015). We were able to examine individual level sociodemographic and behavioural factors as covariates for the trends of health inequalities. To have a fuller picture of the individual level factors these should be examined within the context of broader institutional arrangements in society. Welfare state policies and institutional arrangements, e.g. in the Nordic countries, may act as buffers against widening health inequalities as some studies suggest (Bacigalupe, Escolar-Pujolar, 2014; Edwards, 2008; Lahelma et al., 2002; Thomson et al., 2018; van der Wel et al., 2018).

While the evidence on the associations between economic downturns and health inequalities among men and women may seem mixed and even contradictory, it rather shows the complexity of the interplay between the micro and macro determinants in the production of health inequalities over longer periods. In our study, adjusting for vegetable use, BMI and employment status, in particular, narrowed health inequalities. Some other individual level determinants may contribute to widening inequalities, and in our analyses adjusting for alcohol use showed minor signs for wider health inequalities. It has been suggested that macro determinants, like recessions, may initially lead to narrowing health inequalities, but subsequent austerity may turn the trend to widening (Thomson et al., 2018; van der Wel et al., 2018). With regard to the complex production of health inequalities, it is unlikely that any single explanation would be suitable for different populations and their spatial and temporal contexts.

Methodological considerations

A major advantage of our study was the 36-year period allowing relative and absolute health inequalities to be examined using similar annual surveys with similar methods and data representative of Finnish adults.

The opposite side of the long study period is that there was a secular downward trend in the participation rate from round 80% to round 50%. To assess the potential effect of increasing non-response on the trends in self-rated health, we calculated adjusted weights for each study year based on age and gender distribution in the corresponding national population. However, the weighted self-rated health prevalence was throughout only slightly lower than the non-weighted prevalence, and weighting did not contribute to the magnitude of differences in self-rated health by education and gender. Thus, weighting was not used in our analyses of relative and absolute health inequalities. Prior analyses of these data have shown that young people, men, lower educated and those with poor health are overrepresented among the non-respondents (Tolonen et al., 2006Tolonen et al., 2010). While non-response is a source of bias, its effects are likely conservative and the health inequalities reported in our study may be an underestimate.

We used self-rated health indicator, which may be susceptible to reporting bias. However, the indicator is well established, commonly used and recommended by the WHO (de Bruin, Picavet, & Nossikov, 1996; Subramanian et al., 2010). It has proven reliable and valid, predicting subsequent disability retirement and mortality (Lundberg, Manderbacka, 1996; Burström, Fredlund, 2001; Pietiläinen et al., 2011) . Further health indicators, in particular more objective ones, would have strengthened our study, but such were unavailable.

Our socioeconomic indicator was education, which reflects, in particular, non-material resources, cognitive capabilities as well as attitudes and values. Education is a well established and broad socioeconomic indicator, commonly used in studies on health inequalities. We lacked information on occupational class and income, which is a limitation, but education is correlated with these two other socioeconomic indicators. Further limitations include that education is attained by early adulthood and does not indicate directly the current socioeconomic position, and that early life health may influence later educational attainment (Lynch, Kaplan, 2000; Galobardes et al., 2006; Lahelma, 2010).

Conclusions

Relative and absolute educational inequalities in self-rated health remained during the whole 36-year study period. Adjusting for individual level covariates, including health behaviours and employment status, reduced the health inequalities throughout the study period. Among men, inequalities narrowed suddenly after the 1993–1994 recession and, among women, a similar narrowing took place during the 2008–2009 recession. However, health inequalities widened soon back to the pre-recession level. Despite the variations in the association between education and health, health inequalities remained even during recession periods and after considering the covariates.

Future trend studies would benefit from even longer study periods, further covariates, such as material and work-related factors, as well as objective health indicators. An updated comparative picture of long-term trends in health inequalities is equally needed. Macro-economic and labour market fluctuations should be systematically analysed as potential reasons for health inequalities. Finally, designs allowing causal analysis of proximal and distal reasons would add our understanding of the complex production of trends in health inequalities.

The perseverance of the trends calls for powerful policies to stop and narrow health inequalities. International and national health programmes have suggested many micro and macro level measures for promoting egalitarian health development and public health at large.

Ethical considerations

No formal ethical approval is available for our study. The work done is secondary analysis of survey data collected by the Finnish National Institute for Health and Welfare. We have no access to original data. Individuals cannot be identified in the data. All analyses are made at the group level. We follow ethical guidelines of ICMJE, STROBE and University of Helsinki, as well as Finnish data protection legislation. There are no conflicts of interest. All co-authors have contributed substantially to the study and its reporting.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100504.

Appendix 1. Men. Period-specific estimates for relative index of inequality (RII) and slope index of inequality (SII) with 95% confidence intervals (95% CI). (a) Age-adjusted models and (b) models adjusting for age and each covariate, one at a time

Model	Period	RII	95% CI low high	
RII, men				
(a)				
Age	1979–1982	2.12	1.89	2.38
Age	1983–1986	1.93	1.68	2.20
Age	1987–1990	1.90	1.67	2.16
Age	1991–1994	2.05	1.78	2.36
Age	1995–1998	1.63	1.43	1.86
Age	1999–2002	1.75	1.53	2.00
Age	2003–2006	1.87	1.63	2.13
Age	2007–2010	2.12	1.83	2.47
Age	2011–2014	2.10	1.79	2.47
(b)				
Marital status	1979–1982	2.06	1.83	2.31
Marital status	1983–1986	1.87	1.63	2.14
Marital status	1987–1990	1.85	1.62	2.11
Marital status	1991–1994	1.98	1.72	2.28
Marital status	1995–1998	1.56	1.37	1.78
Marital status	1999–2002	1.68	1.47	1.92
Marital status	2003–2006	1.80	1.57	2.04
Marital status	2007–2010	2.00	1.72	2.33
Marital status	2011–2014	1.97	1.68	2.32
Employment status	1979–1982	1.95	1.74	2.19
Employment status	1983–1986	1.77	1.55	2.03
Employment status	1987–1990	1.70	1.49	1.94
Employment status	1991–1994	1.82	1.58	2.10
Employment status	1995–1998	1.50	1.32	1.71
Employment status	1999–2002	1.58	1.39	1.81
Employment status	2003–2006	1.63	1.43	1.86
Employment status	2007–2010	1.82	1.56	2.11
Employment status	2011–2014	1.88	1.601	2.21
Region of residence	1979–1982	2.08	1.85	2.34
Region of residence	1983–1986	1.89	1.65	2.16
Region of residence	1987–1990	1.88	1.65	2.14
Region of residence	1991–1994	2.02	1.75	2.32
Region of residence	1995–1998	1.59	1.39	1.81
Region of residence	1999–2002	1.74	1.52	1.99
Region of residence	2003–2006	1.84	1.61	2.11
Region of residence	2007–2010	2.06	1.77	2.40
Region of residence	2011–2014	2.02	1.72	2.38
Smoking	1979–1982	NA		
Smoking	1983–1986	1.84	1.61	2.11
Smoking	1987–1990	1.78	1.57	2.03
Smoking	1991–1994	1.96	1.70	2.25
Smoking	1995–1998	1.55	1.36	1.76
Smoking	1999–2002	1.61	1.41	1.84
Smoking	2003–2006	1.75	1.53	2.00
Smoking	2007–2010	1.90	1.64	2.21
Smoking	2011–2014	1.88	1.60	2.21
Alcohol drinking	1979–1982	NA		
Alcohol drinking	1983–1986	1.98	1.73	2.26
Alcohol drinking	1987–1990	1.94	1.71	2.21
Alcohol drinking	1991–1994	2.07	1.80	2.38
Alcohol drinking	1995–1998	1.67	1.47	1.91
Alcohol drinking	1999–2002	1.81	1.58	2.07
Alcohol drinking	2003–2006	1.89	1.66	2.16
Alcohol drinking	2007–2010	2.15	1.85	2.50
Alcohol drinking	2011–2014	2.12	1.80	2.49
Physical activity	1979–1982	1.94	1.73	2.18
Physical activity	1983–1986	1.84	1.60	2.10
Physical activity	1987–1990	1.71	1.50	1.94
Physical activity	1991–1994	1.90	1.66	2.19
Physical activity	1995–1998	1.52	1.34	1.73
Physical activity	1999–2002	1.59	1.39	1.81
Physical activity	2003–2006	1.62	1.43	1.85
Physical activity	2007–2010	1.85	1.60	2.15
Physical activity	2011–2014	1.75	1.50	2.04
Vegetable use	1979–1982	1.85	1.64	2.08
Vegetable use	1983–1986	1.67	1.45	1.92
Vegetable use	1987–1990	1.68	1.47	1.92
Vegetable use	1991–1994	1.76	1.52	2.03
Vegetable use	1995–1998	1.38	1.20	1.58
Vegetable use	1999–2002	1.56	1.36	1.79

(*continued*)

Model	Period	RII	95% CI low high	
RII, men				
Vegetable use	2003–2006	1.62	1.41	1.87
Vegetable use	2007–2010	1.80	1.54	2.10
Vegetable use	2011–2014	1.69	1.43	1.99
BMI	1979–1982	2.07	1.84	2.32
BMI	1983–1986	1.85	1.62	2.12
BMI	1987–1990	1.77	1.55	2.01
BMI	1991–1994	1.92	1.67	2.21
BMI	1995–1998	1.52	1.34	1.73
BMI	1999–2002	1.63	1.43	1.86
BMI	2003–2006	1.66	1.46	1.89
BMI	2007–2010	1.83	1.58	2.13
BMI	2011–2014	1.75	1.50	2.05

Model	Period	SII	95% CI low high	
SII, men				
(a)				
Age	1979–1982	0.29	0.25	0.34
Age	1983–1986	0.27	0.22	0.32
Age	1987–1990	0.25	0.20	0.30
Age	1991–1994	0.28	0.24	0.33
Age	1995–1998	0.19	0.15	0.24
Age	1999–2002	0.22	0.17	0.26
Age	2003–2006	0.25	0.20	0.30
Age	2007–2010	0.27	0.22	0.32
Age	2011–2014	0.25	0.20	0.30
(b)				
Marital status	1979–1982	0.28	0.24	0.32
Marital status	1983–1986	0.26	0.21	0.31
Marital status	1987–1990	0.24	0.20	0.29
Marital status	1991–1994	0.27	0.23	0.32
Marital status	1995–1998	0.18	0.14	0.23
Marital status	1999–2002	0.20	0.16	0.25
Marital status	2003–2006	0.23	0.18	0.28
Marital status	2007–2010	0.25	0.20	0.30
Marital status	2011–2014	0.24	0.18	0.29
Employment status	1979–1982	0.27	0.22	0.31
Employment status	1983–1986	0.23	0.18	0.28
Employment status	1987–1990	0.21	0.16	0.25
Employment status	1991–1994	0.23	0.18	0.28
Employment status	1995–1998	0.16	0.11	0.20
Employment status	1999–2002	0.17	0.12	0.22
Employment status	2003–2006	0.20	0.15	0.25
Employment status	2007–2010	0.21	0.16	0.27
Employment status	2011–2014	0.21	0.15	0.26
Region of residence	1979–1982	0.29	0.24	0.33
Region of residence	1983–1986	0.26	0.21	0.31
Region of residence	1987–1990	0.25	0.20	0.30
Region of residence	1991–1994	0.28	0.23	0.32
Region of residence	1995–1998	0.18	0.13	0.23
Region of residence	1999–2002	0.21	0.16	0.26
Region of residence	2003–2006	0.25	0.20	0.30
Region of residence	2007–2010	0.26	0.21	0.31
Region of residence	2011–2014	0.24	0.18	0.29
Smoking	1979–1982	NA		
Smoking	1983–1986	0.24	0.19	0.29
Smoking	1987–1990	0.23	0.18	0.28
Smoking	1991–1994	0.26	0.21	0.30
Smoking	1995–1998	0.17	0.12	0.21
Smoking	1999–2002	0.19	0.14	0.24
Smoking	2003–2006	0.22	0.17	0.27
Smoking	2007–2010	0.23	0.17	0.28
Smoking	2011–2014	0.21	0.16	0.27
Alcohol drinking	1979–1982	NA		
Alcohol drinking	1983–1986	0.28	0.23	0.33
Alcohol drinking	1987–1990	0.26	0.21	0.31
Alcohol drinking	1991–1994	0.29	0.24	0.34
Alcohol drinking	1995–1998	0.20	0.15	0.25
Alcohol drinking	1999–2002	0.22	0.17	0.27
Alcohol drinking	2003–2006	0.26	0.21	0.31
Alcohol drinking	2011–2014	0.25	0.20	0.30
Physical activity	1979–1982	0.27	0.23	0.31
Physical activity	1983–1986	0.25	0.20	0.30
Physical activity	1987–1990	0.23	0.19	0.28

(*continued*)

Model	Period	RII	95% CI low high	
RII, men				
Physical activity	1991–1994	0.27	0.21	0.32
Physical activity	1995–1998	0.19	0.14	0.23
Physical activity	1999–2002	0.20	0.15	0.25
Physical activity	2003–2006	0.22	0.17	0.26
Physical activity	2007–2010	0.24	0.19	0.29
Physical activity	2011–2014	0.22	0.17	0.27
Vegetable use	1979–1982	0.23	0.18	0.28
Vegetable use	1983–1986	0.20	0.15	0.25
Vegetable use	1987–1990	0.21	0.15	0.26
Vegetable use	1991–1994	0.23	0.18	0.28
Vegetable use	1995–1998	0.14	0.09	0.19
Vegetable use	1999–2002	0.17	0.12	0.22
Vegetable use	2003–2006	0.20	0.15	0.25
Vegetable use	2007–2010	0.21	0.15	0.26
Vegetable use	2011–2014	0.18	0.13	0.24
BMI	1979–1982	0.28	0.24	0.33
BMI	1983–1986	0.26	0.21	0.31
BMI	1987–1990	0.23	0.18	0.28
BMI	1991–1994	0.27	0.22	0.32
BMI	1995–1998	0.18	0.13	0.23
BMI	1999–2002	0.21	0.16	0.25
BMI	2003–2006	0.22	0.17	0.27
BMI	2007–2010	0.23	0.18	0.28
BMI	2011–2014	0.22	0.17	0.27

Appendix 2. Women. Period-specific estimates for relative index of inequality (RII) and slope index of inequality (SII) with 95% confidence intervals (95% CI). (a) Age-adjusted models and (b) models adjusting for age and each covariate, one at a time

Model	Period	RII	95% CI low high	
RII, women				
(a)				
Age	1979–1982	2.23	1.97	2.53
Age	1983–1986	2.25	1.97	2.57
Age	1987–1990	1.90	1.66	2.18
Age	1991–1994	1.89	1.63	2.19
Age	1995–1998	1.76	1.53	2.02
Age	1999–2002	1.91	1.66	2.20
Age	2003–2006	2.22	1.92	2.56
Age	2007–2010	1.71	1.48	1.96
Age	2011–2014	2.16	1.85	2.52
(b)				
Marital status	1979–1982	2.22	1.96	2.52
Marital status	1983–1986	2.25	1.97	2.57
Marital status	1987–1990	1.93	1.69	2.20
Marital status	1991–1994	1.92	1.65	2.22
Marital status	1995–1998	1.77	1.54	2.04
Marital status	1999–2002	1.91	1.65	2.20
Marital status	2003–2006	2.23	1.93	2.57
Marital status	2007–2010	1.70	1.48	1.96
Marital status	2011–2014	2.13	1.82	2.48
Employment status	1979–1982	2.00	1.75	2.25
Employment status	1983–1986	2.04	1.78	2.33
Employment status	1987–1990	1.72	1.50	1.97
Employment status	1991–1994	1.74	1.50	2.02
Employment status	1995–1998	1.58	1.37	1.82
Employment status	1999–2002	1.74	1.50	2.01
Employment status	2003–2006	1.96	1.70	2.26
Employment status	2007–2010	1.57	1.36	1.81
Employment status	2011–2014	1.89	1.62	2.21
Region of residence	1979–1982	2.15	1.89	2.44
Region of residence	1983–1986	2.19	1.91	2.51
Region of residence	1987–1990	1.86	1.62	2.13
Region of residence	1991–1994	1.87	1.61	2.17
Region of residence	1995–1998	1.72	1.50	1.98
Region of residence	1999–2002	1.88	1.63	2.17
Region of residence	2003–2006	2.23	1.93	2.57
Region of residence	2007–2010	1.71	1.48	1.97
Region of residence	2011–2014	2.10	1.80	2.46
Smoking	1979–1982	NA		
Smoking	1983–1986	2.21	1.92	2.53
Smoking	1987–1990	1.90	1.66	2.18

(*continued on next page*)

(*continued*)

Model	Period	RII	95% CI low high	
RII, women				
Smoking	1991–1994	1.79	1.54	2.08
Smoking	1995–1998	1.69	1.46	1.95
Smoking	1999–2002	1.80	1.56	2.08
Smoking	2003–2006	2.11	1.82	2.43
Smoking	2007–2010	1.56	1.36	1.80
Smoking	2011–2014	2.09	1.79	2.45
Alcohol drinking	1979–1982	NA		
Alcohol drinking	1983–1986	2.25	2.00	2.57
Alcohol drinking	1987–1990	1.90	1.66	2.18
Alcohol drinking	1991–1994	1.89	1.63	2.19
Alcohol drinking	1995–1998	1.73	1.51	2.00
Alcohol drinking	1999–2002	1.91	1.65	2.21
Alcohol drinking	2003–2006	2.20	1.91	2.54
Alcohol drinking	2007–2010	1.71	1.49	1.97
Alcohol drinking	2011–2014	2.16	1.85	2.52
Physical activity	1979–1982	2.21	1.95	2.51
Physical activity	1983–1986	2.23	1.95	2.55
Physical activity	1987–1990	1.81	1.58	2.07
Physical activity	1991–1994	1.88	1.62	2.18
Physical activity	1995–1998	1.73	1.51	1.99
Physical activity	1999–2002	1.81	1.57	2.09
Physical activity	2003–2006	2.05	1.79	2.36
Physical activity	2007–2010	1.61	1.41	1.83
Physical activity	2011–2014	2.05	1.76	2.37
Vegetable use	1979–1982	2.07	1.81	2.36
Vegetable use	1983–1986	2.08	1.81	2.39
Vegetable use	1987–1990	1.70	1.47	1.95
Vegetable use	1991–1994	1.67	1.43	1.95
Vegetable use	1995–1998	1.61	1.39	1.86
Vegetable use	1999–2002	1.75	1.51	2.03
Vegetable use	2003–2006	2.00	1.73	2.32
Vegetable use	2007–2010	1.58	1.36	1.82
Vegetable use	2011–2014	2.01	1.72	2.36
BMI	1979–1982	2.13	1.87	2.41
BMI	1983–1986	2.00	1.75	2.29
BMI	1987–1990	1.70	1.48	1.94
BMI	1991–1994	1.66	1.44	1.93
BMI	1995–1998	1.58	1.38	1.82
BMI	1999–2002	1.63	1.42	1.88
BMI	2003–2006	1.78	1.55	2.04
BMI	2007–2010	1.41	1.23	1.61
BMI	2011–2014	1.79	1.55	2.08

Model	Period	SII	95% CI low high	
SII, women				
(a)				
Age	1979–1982	0.29	0.25	0.34
Age	1983–1986	0.30	0.25	0.34
Age	1987–1990	0.23	0.18	0.27
Age	1991–1994	0.21	0.16	0.25
Age	1995–1998	0.20	0.15	0.24
Age	1999–2002	0.20	0.16	0.25
Age	2003–2006	0.26	0.22	0.31
Age	2007–2010	0.19	0.14	0.23
Age	2011–2014	0.24	0.19	0.28
(b)				
Marital status	1979–1982	0.29	0.25	0.34
Marital status	1983–1986	0.31	0.25	0.35
Marital status	1987–1990	0.23	0.19	0.28
Marital status	1991–1994	0.21	0.16	0.25
Marital status	1995–1998	0.19	0.15	0.24
Marital status	1999–2002	0.20	0.15	0.24
Marital status	2003–2006	0.26	0.22	0.31
Marital status	2007–2010	0.18	0.14	0.23
Marital status	2011–2014	0.23	0.19	0.28
Employment status	1979–1982	0.26	0.21	0.30
Employment status	1983–1986	0.25	0.21	0.20
Employment status	1987–1990	0.18	0.14	0.23
Employment status	1991–1994	0.18	0.13	0.22
Employment status	1995–1998	0.15	0.11	0.20
Employment status	1999–2002	0.16	0.12	0.21
Employment status	2003–2006	0.21	0.17	0.26
Employment status	2007–2010	0.15	0.10	0.19

(continued)

Model	Period	RII	95% CI low high	
RII, women				
Employment status	2011–2014	0.20	0.15	0.24
Region of residence	1979–1982	0.29	0.24	0.33
Region of residence	1983–1986	0.29	0.24	0.33
Region of residence	1987–1990	0.22	0.17	0.27
Region of residence	1991–1994	0.21	0.162	0.25
Region of residence	1995–1998	0.19	0.14	0.23
Region of residence	1999–2002	0.20	0.15	0.24
Region of residence	2003–2006	0.26	0.22	0.31
Region of residence	2007–2010	0.18	0.14	0.23
Region of residence	2011–2014	0.23	0.18	0.28
Smoking	1979–1982	NA		
Smoking	1983–1986	0.28	0.23	0.33
Smoking	1987–1990	0.22	0.17	0.27
Smoking	1991–1994	0.18	0.14	0.23
Smoking	1995–1998	0.18	0.13	0.22
Smoking	1999–2002	0.18	0.14	0.23
Smoking	2003–2006	0.24	0.20	0.29
Smoking	2007–2010	0.16	0.11	0.20
Smoking	2011–2014	0.22	0.18	0.27
Alcohol drinking	1979–1982	NA		
Alcohol drinking	1983–1986	0.30	0.25	0.34
Alcohol drinking	1987–1990	0.23	0.18	0.27
Alcohol drinking	1991–1994	0.21	0.16	0.25
Alcohol drinking	1995–1998	0.19	0.15	0.24
Alcohol drinking	1999–2002	0.20	0.16	0.25
Alcohol drinking	2003–2006	0.26	0.21	0.31
Alcohol drinking	2007–2010	0.19	0.14	0.23
Alcohol drinking	2011–2014	0.24	0.19	0.28
Physical activity	1979–1982	0.29	0.25	0.34
Physical activity	1983–1986	0.29	0.25	0.34
Physical activity	1987–1990	0.23	0.18	0.27
Physical activity	1991–1994	0.21	0.17	0.25
Physical activity	1995–1998	0.20	0.15	0.24
Physical activity	1999–2002	0.21	0.16	0.25
Physical activity	2003–2006	0.25	0.21	0.29
Physical activity	2007–2010	0.19	0.14	0.23
Physical activity	2011–2014	0.22	0.18	0.27
Vegetable use	1979–1982	0.26	0.21	0.31
Vegetable use	1983–1986	0.26	0.21	0.30
Vegetable use	1987–1990	0.18	0.13	0.23
Vegetable use	1991–1994	0.17	0.12	0.21
Vegetable use	1995–1998	0.16	0.11	0.21
Vegetable use	1999–2002	0.18	0.13	0.22
Vegetable use	2003–2006	0.23	0.18	0.27
Vegetable use	2007–2010	0.15	0.11	0.20
Vegetable use	2011–2014	0.21	0.16	0.26
BMI	1979–1982	0.27	0.23	0.32
BMI	1983–1986	0.25	0.21	0.30
BMI	1987–1990	0.20	0.15	0.24
BMI	1991–1994	0.17	0.13	0.22
BMI	1995–1998	0.16	0.12	0.21
BMI	1999–2002	0.17	0.12	0.21
BMI	2003–2006	0.21	0.16	0.25
BMI	2007–2010	0.15	0.10	0.19
BMI	2011–2014	0.20	0.15	0.24

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