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Marie-Josèphe Saurel-Cubizolles, Jean-François Chastang, Gwenn Menvielle, Anette Leclerc, Daniele Luce, Edisc Group

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Saurel-Cubizolles Marie-Josèphe [1 2 *], Chastang Jean-François [3], Menvielle Gwenn [3], Leclerc Anette [3], Luce Daniele [3], Group Edisc

[1] *Comité consultatif sur le traitement de l'information en matière de recherche dans le domaine de la santé CCTIRS, Paris,FR*

[2] *Recherches épidémiologiques en santé périnatale et santé des femmes INSERM : U149, INSERM : IFR69, Université Pierre et Marie Curie - Paris VI, Centre de Recherche Inserm 16, Avenue Paul Vaillant-Couturier 94807 VILLEJUIF CEDEX,FR*

[3] *Santé publique et épidémiologie des déterminants professionnels et sociaux de la santé INSERM : U687, IFR69, Université Paris Sud - Paris XI, Université de Versailles-Saint Quentin en Yvelines, Hôpital Paul Brousse 16, av Paul Vaillant Couturier 94807 VILLEJUIF,FR*

* Correspondence should be adressed to: Marie-Josèphe Saurel-Cubizolles <saurel@vjf.inserm.fr>

Abstract

Background

The aim of this study was to compare inequalities in mortality (all causes and by cause) by occupational group and educational level between men and women living in France in the 1990s.

Methods

. We analysed data from a permanent demographic sample currently including about one million people. The French Institute of Statistics (INSEE) follows the subjects and collects demographic, social and occupational information from the census schedules and vital status forms. Causes of death were obtained from the national file of the French Institute of Health and Medical Research (INSERM). A relative index of inequality (RII) was calculated to quantify inequalities as a function of educational level and occupational group. Overall all-cause mortality, mortality due to cancer, mortality due to cardiovascular disease and mortality due to external causes (accident, suicide, violence) were considered.

Results

Overall, social inequalities were found to be wider among men than among women, for all-cause mortality, cancer mortality and external-cause mortality. However, this trend was not observed for cardiovascular mortality, for which the social inequalities were greater for women than for men, particularly for mortality due to ischaemic cardiac diseases.

Conclusions

This study provides evidence for persistent social inequalities in mortality in France, in both men and women. These findings highlight the need for greater attention to social determinants of health. The reduction of cardiovascular disease mortality in low educational level groups should be treated as a major public health priority.

People in lower socio-economic status groups experience poorer health and have shorter lives than those in higher status groups 1–3 and these differences have increased in both sexes in recent years 4–7. Published data suggest that social differences are greater for men than for women 8–11. Comparative studies have shown these social differences in mortality to be wider in France than in other European countries 12–14.

The indicators of socio-economic position used in these studies included occupational group, educational level, income or indices based on the characteristics of the residential area. These different indicators show strong mutual associations and are proxy measures of " socio-economic status".

The aim of this paper was to compare the magnitude of social inequalities in mortality between men and women aged 30 to 74 years, in the 1990s, based on two complementary indicators of socio-economic status: educational level and occupational group as reported in 1990. We considered all-cause mortality and mortality due to cancer, mortality due to cardiovascular disease and mortality due to external causes (mainly violent causes) — these three causes being the three leading causes of death in this population.

Methods

The data were obtained from a permanent demographic sample currently including about one million people, corresponding to about 1 % of the population, randomly selected on the basis of date of birth (four days in the year). Subjects are included at the time of birth, marriage (for foreigners with the appropriate birthday if they marry a French national and live in France with them), or at a census, particularly for immigrants. Data are updated at each successive census (1968, 1975, 1982, 1990). A person remains in the sample until death. The French National Institute of Statistics (INSEE) follows the subjects of this sample and collects demographic, social and

occupational information from different census schedules and from vital status forms. For the national census, data are collected by trained investigators, who distribute the forms to each household: the respondents fill in the census form and return it to the investigator. In special cases, if necessary, the investigators may fill in the forms themselves, using answers provided orally by the respondents. Causes of death were obtained from the national file of the French Institute of Health and Medical Research (INSERM).

Two indicators of social position were used. Educational level was defined as the highest of five categories achieved: 1) no diploma, 2) primary school level, 3) vocational or technical level, 4) secondary school level and 5) university level. Occupational group was coded into 10 classes, according to the standard classification of occupations in France: 1) professionals and managers, 2) intermediate white-collar workers, 3) farmers, 4) shop keepers and craftsmen, 5) office and sales employees, 6) skilled manual workers, 7) unskilled manual workers, 8) retired or early retired, 9) unemployed job-seekers and 10) others not in the labour force, including housewives.

For educational level, the order of the classes, in terms of frequency, was similar for men and women. For occupational group, the order of the classes depended on all-cause mortality adjusted for age. The first group was “intermediate white-collar workers” and the second group was “professionals and managers” for women, whereas the order of these two groups was reversed for men.

Calculations were carried out for overall mortality rates and for mortality rates for the three leading causes of death: cancer (international classification of diseases (ICD-9) codes 140–209), cardiovascular diseases (CVD; codes 390–459), and external causes (codes E800–E999).

Cox models were used to calculate relative risks, with age as the time variable to control for age, occupational group or educational level being treated as qualitative variables. The model with the occupational group was not adjusted for the level of education, and this with educational level was not adjusted for the occupational group.

We calculated relative index of inequality (RIIs) to obtain quantitative global estimates of the magnitude of inequalities in mortality. This index is a regression-based summary measure used in research into social inequalities4,15,16. It is calculated by ranking socioeconomic categories on a scale from the highest (0) to the lowest (1). Each category covers a range on the scale proportional to its population size and is given on the scale corresponding to the midpoint of its range16. These data are fitted with a Cox regression model giving mortality estimates for the entire social distribution. The calculation of RIIs made it possible to take into account the number of subjects in each category and the differences in the distribution of socio-economic status between men and women. The analysis has been performed also for three age subgroups: 30–54, 55–64 and older than 64 years.

This analysis was limited to French men and women born in France, aged 30 to 64 years at the beginning of the 1990–1999 period. It therefore concerned 104 109 men and 109 765 women, and included all deaths occurring between January 1st 1990 and December 31st 1999 (8 148 men and 3 576 women).

Results

Educational level was similarly distributed in men and women, although there tended to be more less educated (without diploma or primary level) women than men (table 1). By contrast, the distribution of occupational groups differed considerably between men and women. There were far more professionally inactive women than men, with almost a third of all women not working. Office and sales personnel accounted for the largest number of employed women, with a quarter of all women working in these sectors. Skilled and unskilled workers were more numerous among men than among women, as were professionals and managers.

For this population aged between 30 and 64 years, the probability of dying during the 1990–1999 period was more than twice as high for men than for women. Crude mortality rates varied from 3.3% for men educated to university level to 13.1% for men without a diploma, and from 1.6% for women educated to university level to 5.5% for women without a diploma. In the analysis of overall mortality rates by occupation, mortality rates of 2.9% for men working as professionals or managers men and 6.5% for male unskilled manual workers were recorded. For women, mortality rates were lowest for professionals or managers (1.5%) and for intermediate white-collar workers (1.4%) and highest among farmers (2.9). For both men and women, the probability of dying was much higher among professionally inactive individuals, particularly those who were retired, reaching more than 20% for men and 8.4% for retired and 4.8% for otherwise inactive women.

After adjustment for age, the relative risk of all-cause mortality clearly depended on educational level, with the risk of dying increasing with decreasing educational level (Table 2). For men, the relative risks for all educational level classes were significantly higher than 1, the reference value corresponding to men educated to university level. For women, no differences were found between women educated to university and secondary levels, whereas relative risks significantly greater than one were found for women with a technical or primary education only and for women without a diploma. RII was slightly higher for men (2.96) than for women (2.62) and was significantly higher than 1 for both sexes.

The social inequalities tend to be slightly smaller for the oldest persons. For men the RII related to the educational level was 3.16 (2.73 –3.66) for subjects aged from 30 to 54 years, 3.32 (2.87–3.83) for those between 55 and 64 years and 2.44 (2.10–2.83) for men older than 64. The difference between these three RIIs was significant. For women, the RIIs were respectively 2.69 (2.15–3.35), 2.65 (2.11–3.33) and 2.51 (1.97–3.19) and this difference was not significant.

Similarly strong social differences in mortality were observed if occupational group was used as the indicator. Relative risks were particularly high for the three classes of inactive people: retired, unemployed jobseekers and other inactive people. The RII was much higher for men, at 6.08 (5.54–6.68), than for women, for whom a value of 3.42 (2.96–3.96) was obtained.

The proportions of the male and female populations that were inactive differed considerably (4.9% of men inactive and 29.6% of women inactive). The heterogeneity of this group was therefore particularly great. Among inactive individuals, the risk of dying varied considerably with educational level, with more marked differences observed among women than among men. For example, the relative risk of dying was 1.83 (95% CI: 1.15–2.94) for men and 2.40 (95% CI: 1.68–3.43) for women without a diploma, taking the risk for individuals educated to university level as one; the RIIs were 1.62 (1.25–2.11) for men and 2.86 (2.28–3.59) for women.

We also carried out analyses by cause of death (Table 3). For cancer mortality, social inequalities were greater for men than for women, regardless of the social indicator used: RII of 2.47 (2.17–2.81) for men and 1.63 (1.35–1.96) for women if educational level was used – these two RIIs were significantly different-, and of 4.53 (3.94–5.21) for men and 2.09 (1.71–2.56) for women if occupational group was used. A similar pattern was observed for mortality due to external causes (accidents, suicides, violence). Conversely, for cardiovascular mortality, there tended to be larger inequalities among women than among men. The relative risk of dying from cardiovascular causes for people without a diploma was 4.31 (2.52–7.42) for women and 2.72 (2.17–3.41) for men, for example. The RII was significantly higher for women than for men. A similar pattern was observed for occupational group: the relative risks of dying from cardiovascular causes were higher for female skilled and unskilled manual workers than for men in the same occupational category. In both men and women, the relative risk was significantly greater than one.

For the three age subgroups and for the four groups of causes of mortality the RIIs were all significant. Concerning cardiovascular mortality the RIIs were higher for women than for men in the three age subgroups.

In the light of these results for cardiovascular mortality, a more detailed analysis was carried out, separating out different cardiovascular causes of death (table 4). For both indicators (educational level and occupational group) and for the three specific causes considered — ischaemic heart diseases, cerebrovascular diseases and other cardiovascular diseases — higher RIIs were obtained for women than for men. The RII values obtained were particularly high for ischaemic cardiac disease. For each detailed cardiovascular cause of death social inequalities were very large. Due to the small numbers of individuals in some classes, differences between occupational groups are not shown in table 4. The RII for ischaemic cardiac disease was 3.21(2.35–4.38) for men and 5.35 (2.43–11.8) for women; that for cerebrovascular disease was 5.28 (3.30–8.45) for men and 5.43 (2.69–11.0) for women and that for other cardiovascular mortality was 6.15 (4.32–8.76) for men and 6.43 (3.56–11.6) for women.

Discussion

This study provides evidence of strong social inequalities in mortality among French men and women at the end of the 1990s, based on an analysis of two indicators: educational level and occupational group. Overall, social inequalities were larger for men than for women, as observed for all-cause mortality, cancer mortality and mortality due to external causes (accidents, suicide, violence). However, the pattern was different for cardiovascular mortality, for which social inequalities seemed to be larger for women than for men, particularly for ischaemic cardiac diseases.

One of the strengths of this analysis is that it includes a very large amount of data, representative of the national situation in France. These data are of high quality, social status is assessed from census data and the cause of death was reported in 97% of cases.

We used the RII — relative inequality index — to obtain an overview of the inequalities in a global measure. This method overcomes the difficulties due to differences in the distributions of socio-economic categories between women and men. This indicator has been used in published papers on the topic of social inequalities5,17–21. This index corresponds essentially to a ratio of mortality rate for the lowest social class (or educational level) to that of the highest social class (or educational level). Higher values for this index indicate greater social inequality in the population. This indicator has already shown a strong increase in the magnitude of social inequalities between 1968 and 1996 for these data16.

Our results show that social inequalities in mortality were larger among men than among women for the study period. The magnitude of the differences between the sexes may be sensitive to the social measure: larger inequalities were observed with occupational group than with educational level, for both sexes. This finding is consistent with previous reports21. The analysis based on occupational group highlighted inequalities related to employment status and within the working population. In both men and women, not working was

associated with a higher risk of death. Inactivity is one of the major correlates of poor health, mainly due to the health selection process. Many women do not work, but this group is highly heterogeneous in terms of educational level.

Suggested explanations for the observed social differences in mortality include an uneven distribution of health risk behaviour (including smoking and alcohol consumption), material factors (such as financial difficulties), occupational exposure and psychosocial resources, and stress-related factors (insecure job, life events). These factors together probably account for much of the inequality in mortality rates22.

Huisman et al.23, based on data for eight European countries, reported higher educational inequalities for cardiovascular mortality among women (for 45- 59-year-old women, the rate ratio was 1.74 (1.60–1.90)) than among men (1.51 (1.45–1.57)) whereas the reverse was observed for cancer mortality (for individuals aged 45 to 59 years, the rate ratio was 1.08 (1.03–1.13) for women and 1.46 (1.40–1.52) for men) and total mortality. Our results are consistent with those of this previous study. Similarly, in Norway, Naess et al.24 reported stronger educational inequalities for death due to coronary heart disease in women than in men. From a nationally representative sample in the United States, Thurston et al 25 showed also that coronary heart disease risk associated with low education was stronger among women than amon men. Women with low levels of education had more concurrent social and psychological risks than did men.

It is difficult to explain why the pattern of cardiovascular mortality differs from that of cancer mortality and all-cause mortality. In mortality studies, it is difficult to elucidate the social differences operating at each step: preventive behaviour, exposure to risk factors, incidence, medical care and survival. Davey Smith et al 21 observed that cardiovascular disease was the cause of death most strongly associated with education, possibly reflecting the particular importance of the role played by socio-economic circumstances in childhood in determining the risk of coronary heart disease and stroke. Obesity is a risk factor for cardiovascular disease. In France, as in other countries, the prevalence of obesity and overweight has increased in recent years26. The differences in the frequency of obesity between social groups increased between 1981 and 2003 and were greater among women than among men: obesity rates for men ranged from 10% in the poorest households (the first quartile of living standards) to 9% in the richest households (the last quartile), whereas it ranged from 13% in the poorest households to 6% in the richest households among women26. In the United States also, the body mass index shows a stronger educational gradient among women than among men25. These trends may partly account for social differences in cardiovascular mortality being greater among women than among men.

Other risk factors, such as diabetes and hypertension, seem be more strongly related to coronary heart disease (CHD) in women than in men. For example, women with diabetes have a much higher relative risk of coronary heart disease with respect to the non-diabetic population than do men with diabetes27. Data in Finland have demonstrated a strong impact of diabetes on CHD mortality, with relative death rates of 6.04 for women and 3.42 for men. CHD mortality followed systematic socio-economic trends, with rates higher among the poorest diabetic and non-diabetic individuals28.

Low social status is associated with arterial hypertension29, with greater differences observed among women than among men30. In a large Dutch sample, Hoeymans et al 31 observed that the association between hypertension and educational level was stronger among women than among men. Moreover, hypertension and type 2 diabetes increase CHD risk independently, but together, they increase the risk considerably, particularly in women32.

The prevalence of hypercholesteraemia differs considerably with educational level in both men and women33. The prevalence of hypercholesterolaemia and low HDL-cholesterol levels seem to be more strongly related to educational level among women than among men31.

Inequalities in medical care may also play a role. Dong et al 34 reported that women were less likely than men to undergo cardiac surgery in England, regardless of age group. Neither disease severity nor comorbidity could account for these differences. Other studies in the UK or United States have indicated that women are about half as likely to undergo surgery or to be otherwise treated for ischaemic heart disease than men, even if disease severity and comorbidity are taken into account35,36. Thus, women may be undertreated and deprived of effective intervention.

This study provides evidence for persistent social inequalities in mortality in France, in both men and women. These social differences are generally greater among men than among women. However, specific, large social inequalities were observed for mortality by cardiovascular disease in the female population. The reduction of cardiovascular disease mortality in low educational level groups should be treated as a major public health priority. Effective policies are required to decrease cumulative exposure to cardiovascular risk factors, such as smoking, being overweight, hypertension and diabetes. It would be necessary to further understand the different mechanisms involving in the link between educational level and health status.

What this paper adds ?

This study provides evidence for persistent social inequalities in mortality in France, in both men and women. These social differences are generally greater among men than among women, specially for cancers or violent deaths. However, specific, large social inequalities were observed for mortality by cardiovascular disease in the female population, even larger than in the male population.

Policy implications

The reduction of cardiovascular disease mortality in low educational level groups should be treated as a major public health priority. Effective policies are required to decrease cumulative exposure to cardiovascular risk factors, such as smoking, being overweight, hypertension and diabetes. Improving educational attainment may make it possible to reduce the accumulation of risk factors.

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Table 1

Crude mortality rate (1990–1999) by level of education and occupational group among men and women

	Men			Women		
	N	**%**	**% deaths**	**N**	**%**	**% deaths**
Total	104 109	100	7.8	109 765	100	3.3
Educational level						
No diploma	21 340	20.9	13.1	24 224	22.1	5.5
Primary	20 758	20.3	10.8	29 221	26.6	3.8
Technical	35 674	33.0	5.7	30 935	28.2	2.3
Secondary	12 102	11.9	5.2	12 867	11.7	1.7
University	14 163	13.9	3.3	12 459	11.4	1.6
Occupational groups						
Farmers	5 219	5.1	5.1	3 542	3.3	2.9
Shop keepers, craftmens	9 039	8.8	5.0	4 355	4.0	2.2
Professionals, managers	13 666	13.3	2.9	5 521	5.1	1.5
Intermediate white collars	17 391	16.9	3.7	13 088	12.1	1.4
Office, sales employees	7 670	7.5	4.9	26 493	24.5	1.6
Skilled manual workers	19 821	19.3	4.8	2 108	2.0	1.6
Unskilled manual workers	7 443	7.2	6.5	5 156	4.8	2.0
Retired	12 993	12.6	20.8	8 802	8.1	8.4
Other inactive	5 018	4.9	22.5	31 933	29.6	4.8
Unemployed jobseekers	4 627	4.5	13.0	7 037	6.5	2.9

Aged 30–64 years at the beginning of the census year

Table 2

Age-adjusted relative risk of all-cause mortality by level of education and occupational group, among men and women

	Men		Women	
	RR	**95% CI**	**RR**	**95% CI**
Educational level				
No diploma	2.83	2.56 – 3.12	2.02	1.74 – 2.36
Primary	2.14	1.93 – 2.37	1.39	1.19 – 1.63
Technical	1.73	1.57 – 1.92	1.20	1.02 – 1.40
Secondary	1.42	1.26 – 1.61	0.95	0.78 – 1.15
University	1		1	
RII	2.96	2.72 – 3.23	2.62	2.29 – 2.99
Occupational groups				
Farmers	1.42	1.22 – 1.66	1.30	0.97 – 1.74
Shop keepers, craftmens	1.56	1.36 – 1.78	1.19	0.89 – 1.60
Professionals, managers	1		1	
Intermediate white collars	1.36	1.20 – 1.54	0.95	0.73 – 1.23
Office, sales employees	1.96	1.70 – 2.25	1.08	0.86 – 1.37
Skilled manual workers	1.85	1.64 – 2.08	1.00	0.67 – 1.50
Unskilled manual workers	2.50	2.19 – 2.85	1.32	0.99 – 1.76
Retired	3.82	3.41 – 4.28	2.36	1.86 – 2.99
Other inactive	5.43	4.83 – 6.11	2.16	1.73 – 2.71
Unemployed jobseekers	4.63	4.08 – 5.26	1.97	1.53 – 2.55
RII	6.08	5.54 – 6.68	3.42	2.96 – 3.96

Aged 30–64 years at the beginning of the census year

RII = Relative inequality index

Table 3

Age-adjusted relative risks of mortality by cancer, cardiovascular diseases or external causes by level of education and occupational group in men and women

	Cancer mortality				Cardiovascular mortality				Mortality by external causes				Mortality by others causes			
	Men		Women		Men		Women		Men		Women		Men		Women	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Educational level																
No diploma	2.78	2.37–3.26	1.38	1.12–1.70	2.72	2.17–3.41	4.31	2.51–7.42	3.60	2.69–4.81	2.10	1.37–3.22	2.70	2.25–3.23	2.95	2.12–4.09
Primary	2.25	1.92–2.64	1.15	0.94–1.42	2.14	1.70–2.68	2.71	1.57–4.67	2.79	2.07–3.76	1.57	1.02–2.42	1.76	1.46–2.12	1.53	1.09–2.14
Technical	2.01	1.71–2.36	1.06	0.86–1.31	1.59	1.26–2.00	2.13	1.22–3.73	2.15	1.61–2.87	1.07	0.69–1.66	1.31	1.09–1.58	1.31	0.93–1.85
Secondary	1.64	1.36–1.97	0.88	0.68–1.14	1.32	1.00–1.74	1.44	0.75–2.76	1.84	1.31–2.58	0.94	0.55–1.61	1.06	0.84–1.34	0.97	0.64–1.47
University	1		1		1		1		1		1		1			
RII	2.47	2.17–2.81	1.63	1.35–1.96	3.08	2.54–3.74	4.63	3.26–6.56	3.40	2.67–4.33	2.95	1.98–4.41	3.68	3.10–4.36	4.51	3.42–5.93
Occupational groups																
Farmers	1.11	0.87–1.41	1.02	0.71–1.46	1.80	1.28–2.53	1.98	0.70–5.64	2.09	1.42–3.07	2.74	1.16–6.49	1.39	0.98–1.96	1.78	0.78–4.07
Shop keepers, craftmens	1.43	1.17–1.75	0.88	0.61–1.28	1.86	1.37–2.54	2.91	1.06–7.94	1.69	1.19–2.40	1.53	0.60–3.88	1.46	1.09–1.97	1.96	0.87–4.40
Professionals, managers	1		1		1		1		1		1		1		1	
Intermediate white collars	1.37	1.14–1.65	0.76	0.55–1.04	1.59	1.19–2.14	0.89	0.31–2.61	1.28	0.93–1.76	1.38	0.62–3.05	1.24	0.95–1.63	1.84	0.89–3.81
Office, sales employees	1.85	1.50–2.29	0.82	0.62–1.09	2.18	1.56–3.04	1.98	0.79–4.96	1.79	1.25–2.56	1.38	0.66–2.91	2.16	1.61–2.89	2.08	1.05–4.12
Skilled manual workers	1.92	1.61–2.28	0.70	0.41–1.20	2.00	1.51–2.65	3.38	1.07–10.7	1.83	1.36–2.46	1.30	0.39–4.32	1.65	1.27–2.12	1.39	0.47–4.15
Unskilled manual workers	2.43	1.99–2.96	0.85	0.58–1.23	2.07	1.47–2.89	2.40	0.84–6.80	2.94	2.13–4.07	2.01	0.85–4.74	2.66	2.01–3.52	3.25	1.53–6.89
Retired	3.20	2.71–3.78	1.36	1.02–1.82	3.65	2.80–4.75	5.25	2.13–12.9	3.54	2.51–4.99	3.97	1.83–8.65	5.66	4.44–7.21	6.42	3.25–12.7
Other inactive	3.89	3.25–4.64	1.28	0.98–1.68	5.47	4.16–7.20	5.31	2.18–12.9	5.60	4.03–7.78	2.68	1.31–5.50	9.27	7.27–11.8	5.74	2.95–11.1
Unemployed jobseekers	3.71	3.05–4.51	1.15	0.83–1.59	3.29	2.37–4.56	3.94	1.51–10.2	4.52	3.25–6.28	3.96	1.85–8.47	7.79	6.06–10.0	4.64	2.29–9.40
RII	4.53	3.94–5.21	2.09	1.71–2.56	4.50	3.65–5.54	5.84	3.94–8.65	5.45	4.21–7.06	3.79	2.43–5.90	14.6	11.9–17.9	6.73	4.92–9.20

Aged 30–64 years at the beginning of the census year;

RII = Relative inequality index

Table 4

Age adjusted relative risks of mortality by detailed cardiovascular diseases by level of education and occupational group in men and women

	Ischaemic cardiac disease				Cerebro-vascular disease				Other cardiovascular mortality			
	Men		Women		Men		Women		Men		Women	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Educational level												
No diploma	1.82	1.31–2.52	4.14	1.29–13.3	3.39	1.97–5.81	3.22	1.39–7.49	3.81	2.57–5.64	5.75	2.34–14.2
Primary	1.79	1.30–2.48	2.49	0.77–8.05	2.56	1.48–4.42	2.17	0.93–5.08	2.46	1.65–3.67	3.51	1.42–8.71
Technical	1.39	1.00–1.93	2.17	0.65–7.21	1.98	1.14–3.44	1.61	0.67–3.86	1.70	1.13–2.56	2.72	1.08–6.87
Secondary	1.40	0.95–2.06	2.41	0.66–8.77	1.16	0.58–2.33	1.20	0.43–3.38	1.27	0.77–2.09	1.10	0.35–3.45
University	1		1		1		1		1		1	
RII	1.83	1.37–2.43	3.35	1.68–6.68	3.92	2.52–6.09	3.98	2.15–7.34	5.06	3.65–7.02	6.21	3.63–10.6

Aged 30–64 years at the beginning of the census year

RII = Relative inequality index