[Changing social disparities and mortality in France (1968-1996): cause of death analysis by educational level]

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Temporal trends in socioeconomic inequality in mortality in France between 1968 and 1996. Study of educational differences by cause of death.

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Abstract

Background: Little information is available on temporal trends in socioeconomic inequalities in mortality by cause of death in France. The aim of this paper was to study educational differences in mortality in France by cause of death and their temporal trend.

Methods: We used a representative sample of 1% of the French population and compared four periods (1968–1974, 1975–1981, 1982–1988, 1990–1996). Causes of death were obtained from the French national death registry. Education was measured at the beginning of each period, and educational disparities in mortality were studied among men and women aged 30–64 at the beginning of each period. Analyses were conducted for all deaths and for the following causes of death: all cancers, lung cancer (in men), upper aerodigestive tract cancers (in men), breast cancer (in women), colorectal cancer, other cancers, cardiovascular diseases, ischemic heart diseases, cerebrovascular diseases, other cardiovascular diseases, external causes, and other causes of death. Socioeconomic inequalities were quantified with relative risk and relative index of inequality. The relative index of inequality measures socioeconomic inequalities across the population and can be interpreted as the ratio of mortality rates of those with the lowest to those with the highest socioeconomic status.

Results: Analyses showed an increase in educational differences in all-cause mortality among men (the relative index of inequality increased from 1.96 to 2.77 from the first to the last period) and among women (the relative index of inequality increased from 1.87 to 2.53). Socioeconomic inequalities increased for all causes of death studied among women, and for cancer and cardiovascular diseases among men. The contribution of cancer mortality to the difference in overall mortality between the lowest and the highest levels of education sharply increased over the entire study period, especially for women.

Conclusion: This study shows that large socioeconomic inequalities in mortality exist in France, and that they have increased over time in both men and women.

Key words

Education level. Mortality. Cause of death. France. Men. Women.

Résumé

Position du problème : Il existe actuellement peu d'information sur l'évolution temporelle des inégalités sociales de mortalité par cause de décès en France. L'objectif de cet article est de décrire les inégalités sociales de mortalité en fonction du niveau d'étude par cause de décès en France et leur évolution temporelle.

Méthodes : Les données sont issues de l'Echantillon Démographique permanent de l'Insee, un échantillon représentatif de 1% de la population française, auquel ont été couplées les causes de décès du CepiDc de l'Inserm. La mortalité a été étudiée sur quatre périodes (1968-74, 1975-81, 1982-88, 1990-96) parmi les personnes âgées de 30 à 64 ans en fonction du niveau d'études déclaré au recensement en début de chaque période. Les analyses ont été conduites pour la mortalité toutes causes et pour les causes de décès suivantes : tous cancers, cancer du poumon et des voies aérodigestives supérieures (chez les hommes seulement), cancer du sein (chez les femmes seulement), cancer colorectal, autres cancers, maladies cardiovasculaires, cardiopathies ischémiques, maladies cérébrovasculaires, autres maladies cardiovasculaires, causes externes, autres causes de décès. Les inégalités sociales de mortalité ont été quantifiées à l'aide de risques relatifs et d'indices relatifs d'inégalité, qui s'interprètent comme le rapport des taux de mortalité entre ceux ayant le niveau d'études le plus faible et le plus élevé.

Résultats : Les inégalités sociales de mortalité toutes causes ont augmenté chez les hommes (l'indice relatif d'inégalité varie de 1.96 à 2.77 entre la première et la dernière période) et chez les femmes (l'indice relatif d'inégalité varie de 1.87 à 2.53). Les inégalités sociales augmentent pour l'ensemble des causes de décès chez les femmes, et pour les décès par cancer et maladies cardiovasculaires chez les hommes. Le poids de la mortalité par cancer dans la surmortalité des personnes sans diplôme augmente avec le temps, en particulier chez les femmes.

Conclusion : Cette étude met en évidence l'importance des inégalités sociales de mortalité en France et leur accroissement au cours du temps pour l'ensemble des causes de décès, à la fois chez les hommes et les femmes.

Mots-clé

Niveau d’études. Mortalité. Cause de décès. France. Hommes. Femmes.

INTRODUCTION

Highly substantial socioeconomic inequalities in premature mortality (before 65 years) have been observed in men in France. Comparative studies have shown that these inequalities are greater in France than what is observed in other European countries [1-3]. The situation has been less well described for women. In addition, an increase in socioeconomic inequalities in mortality over time has been observed in most countries in both men and women for the main causes of death [4-14].

The results available by cause of death have until recently been incomplete in France, mainly because the INSEE's mortality samples and the INSERM's causes of death records had never been directly linked . Recently individual data on socioeconomic status at the time the census was taken and data on causes of death in a representative sample of the French population were combined, making it possible to study socioeconomic inequalities in mortality by cause of death in France and how these inequalities evolved over time, while avoiding the numerator/denominator bias that can be observed when the data on socioeconomic status of living and deceased individuals come from two different data sources [15]. Studies on temporal trends in socioeconomic inequalities by socioprofessional category have already been conducted. They demonstrated an increase in socioeconomic inequalities in all causes of mortality for the major causes of death over time [16]. A detailed study of cancer mortality in men showed that this increase has been observed for all cancer sites (lung, head and neck, esophagus, colorectum, and other cancers), even if the level of socioeconomic inequalities seems to have stabilized since the beginning of the 1980s [17]. There are no results available on temporal trends of socioeconomic inequalities of mortality by cause of death in France by educational level, with the exception of breast cancer mortality [18]. However, contrary to socioprofessional category, which can be difficult to measure in people who do not work (retired and nonworking populations), in particular for women, the educational level is available for the entire population. Studies based on education level are particularly useful to document the socioeconomic inequalities in mortality for women [19].

For France, an increase in socioeconomic disparity over time is clearly observed when the comparisons are based on mortality in the period that follows a population census, defining

socioeconomic status at the time of the census [16]. By taking education level as the socioeconomic status indicator, the results may be different. More specifically, we hypothesized that the differences would be less distinct because education level for a given person is defined early in life and does not change as a result of the economic situation, contrary to employment, for example.

This article reports the temporal trends in socioeconomic inequalities in mortality in France between 1968 and 1996. The main causes of death for men and women were analyzed separately. Socioeconomic inequalities were quantified for the most part on relative measurements, but a few results are based on absolute measurements.

MATERIAL AND METHODS

DATA

The Permanent Demographic Sample (PDS) is an INSEE sample that groups all individuals born on four given days of the year, approximately 1% of the French population [20]. It was started during the 1968 census and has since been augmented (by birth or immigration) by including all individuals born on one of the four days designated by the PDS. The data used in this study are part of the PDS and include socioeconomic data from the 1968, 1975, 1982, and 1990 censuses. This sample was then extended by the medical cause of death by combining it with the CepiDc (INSERM) data.

Mortality was studied for four consecutive periods, each one beginning with the census year: 1968–1974, 1975–1981, 1982–1988, and 1990–1996. For each period, individuals aged 30–64 years at the census were included in the analyses. Those born outside of metropolitan France were excluded because their vital status was incomplete, particularly for foreign-born residents who died abroad. The number of men and women included in the analyses as well as the number of deaths observed for each period are presented in Table 1. Mortality was studied for the education level declared in at the census, at the beginning of the period, in four categories: incomplete elementary education; completed elementary education; general and vocational qualifications (grouping vocational school certificate, technical school certificate, general studies certificate awarded after middle school) with

no other degree; and high school diploma or higher (technical or general). Mortality was studied for the following causes of death as delineated by the International Classification of Diseases (ICD): cancer (ICD8–9: codes 140–239), lung cancer (for men only) (ICD8–9, 162), head and neck cancer (for men only) (ICD8–9, 140–9, 161, 160.8), colorectal cancer (ICD8–9, 153–154), breast cancer (for women only) (ICD8–9, 174), other cancers (definition different for men and women), cardiovascular diseases (ICD8 390-441.1, 444.3-458, 782.4; ICD9 390-459) , ischemic heart disease (ICD8–9 410–414), cerebrovascular disease (ICD8–9 430–438), other cardiovascular diseases, external causes (ICD8–9 800–999), and other causes of death (other than cancer, cardiovascular disease, and external cause).

ANALYSIS

The data were analyzed using Cox proportional hazards models and taking age as the time variable. Subjects were excluded when they had died of a cause other than those studied in the analysis. Inequalities were quantified using relative risk (RR) with the highest educational category as reference. Socioeconomic inequalities were also quantified using the relative index of inequality (RII) [5, 21, 22]. Contrary to the relative risks calculated for one or several education level categories, the relative index of inequality is calculated from the entire population and takes into account both the size of the different socioeconomic groups and their relative position. The RII is the theoretical relative risk that compares the person with the lowest educational level in the population to the person with the highest level. This index can take into account changes in the relative size of the different socioeconomic groups and therefore is particularly well adapted to temporal comparisons. The calculation is based on a relative measurement of socioeconomic status, defined in percentiles. This requires ranking socioeconomic categories on a scale from 0 (highest level of education) to 1 (lowest level of education), with each socioeconomic category covering a zone of the scale proportional to its size in the population. The order from the bottom of the scale is the following: incomplete elementary education, complete elementary education, general and vocational qualifications, and high school diploma or higher. The socioeconomic situation of each category was then defined by the percentage of the population that had a higher level of education

than its own. The socioeconomic situation therefore became a continuous variable with the value of 0 at the top of the socioeconomic scale and 1 for a person at the bottom of the scale. The values 0 and 1 do not correspond to the lowest and the highest categories of educational level, but to the extremes of these categories and therefore represent extreme, hypothetical situations. The relative index of inequality was calculated using a Cox proportional hazards model taking age as the time variable, with this new variable as the indicator of socioeconomic status. The relative index of inequality provides a synthetic measurement of inequality by cause of death. It is interpreted as the relative risk associated with a change in a unit of the socioeconomic status defined from the level of education. The higher the index, the greater the socioeconomic inequalities within the population.

Using a Cox proportional hazards model to estimate the RII assumes that the relation between the educational level, considered as a quantitative variable, and mortality is log-linear. In a preliminary step, we verified the validity of this hypothesis, both for general mortality and for mortality by cause of death, and for both sexes.

For all-cause mortality, RIIs were calculated in two ways: considering the educational level of a person compared to the population of the same sex for the same calendar period and considering the education level in relation to the population of the same sex and same age bracket (5-year age brackets) for the same calendar period. The second calculation method differs from the first in that it considers as a reference the distribution of education levels specific to an age group. For the sake of brevity, in the rest of the analyses, only the results based on the first calculation method are given.

In this study, quantification based on the relative index of inequality was preferred over a quantile approach used in other studies consisting in classifying subjects by the decile (or quartile, or tertile) they belong to [23, 24]. This quantification method is well adapted if the measure of the socioeconomic status is a quantitative variable such as income (individual income or wealth of a geographic zone). The variable “educational level” does not lend itself well to this type of calculation because it is not possible to choose a threshold (in percentage of the population) that is

common to all the periods while keeping all those that have a single educational level at a given period in the same category.

A trend test was carried out to test the hypothesis that socioeconomic inequality in mortality evolves over time for all causes of death for each sex. This requires that mortality for the entire period, from 1968 to 1996, be analyzed using a Cox proportional hazards model, with age always the time variable and the following explanatory variables:

- the period, with a four-mode qualitative variable, to take into account mortality that is generally decreasing over time. Coding in this way avoids having to make a linearity hypothesis of this progression;
- the socioeconomic status, measured by the quantitative variable defined previously for each subject, at the beginning of the period for each period;
- an interaction term between the period (0, 1, 2, 3) and the socioeconomic status. This interaction term measures the linear trend of the progression over time of the relative index of inequality.

Mortality rates were calculated with direct standardization on age, taking as the reference population the distribution of all of the person-years out of the four periods studied. From the mortality rates, the contribution of the different causes of death to the inequalities of all-cause mortality between the two extremes of education level was measured by calculating the following ratios: to the numerator the difference in the mortality rate between "incomplete elementary education" and "high school diploma or higher" for a given cause of mortality, and to the denominator the same difference for all-cause mortality. This measurement combines both the level of socioeconomic inequalities and mortality rates for a given cause of death.

RESULTS

The educational level increased substantially over time in men and women (Table 1). The percentage of subjects with incomplete elementary education was divided by two, whereas the percentage who had a high school diploma or higher was multiplied by three in men and by five in women.

In men, all-cause mortality rates remained stable until the end of the 1980s and then decreased during the 1990s. In women, all-cause mortality rates have dropped since 1968 (Figures 1 and 2). Depending on the education level, mortality increased in men until the end of the 1980s and then decreased during the 1990s for all education levels considered, except, for men, for the "high school diploma or higher" category, where mortality rates have been decreasing since 1968. In women, the mortality rates dropped for all education levels, but in a more pronounced fashion for the most educated women. Between 1968–1974 and 1990–1996, the absolute deviations of mortality between the extremes of education level grew in men (from 456 for 100,000 person-years to 615) and in women (from 89 to 143). This increase results essentially from a greater drop in mortality rates in those with the highest degrees. By cause of death (results not presented), in both men and women, mortality decreased for cardiovascular diseases and causes other than cancer, cardiovascular disease, and external causes; it remained globally stable for deaths by external causes. For cancer mortality, the rates have increased regularly since 1968 in women; in men, the mortality rates began to decrease slightly during the 1990s, after a strong increase.

RELATIVE RISKS AND RELATIVE INDEX OF INEQUALITY IN MEN

Socioeconomic inequalities of all-cause mortality increased from the first to the second period, then were stable between the second and third period, and increased again, but less markedly, between the last two periods (Table 2). The relative risks for mortality were significant for all education levels, whatever the period considered, with the exception of general and vocational qualifications, for men, for the 1968–1974 period. Taking as the reference the population of the same age in the RII calculation, the inequalities seemed slightly less pronounced; on the other hand, progression over time had greater statistical significance with this approach.

The time progression of socioeconomic inequalities in mortality differed depending on the cause of death (Table 3). For all-cancer mortality, we observed a rise in socioeconomic inequality, mainly because of lung cancer, and less clearly for head and neck cancers. A rise in socioeconomic inequalities in mortality was also noted for cardiovascular diseases, with this trend sharper for cerebrovascular diseases and other cardiovascular diseases than for ischemic heart diseases. Greater

socioeconomic inequalities in mortality, but with no clear time trend, were noted for external causes and other causes of death.

During the 1968–1974 period, RIIs were nonsignificant for lung cancer, colorectal cancer, and ischemic heart diseases. For the 1990–1996 period, the RII was nonsignificant only for colorectal cancer. The highest RIIs were observed for head and neck cancers, cardiovascular diseases except for ischemic heart diseases, external causes, and the other causes of death.

The contribution of the different causes of death to all-cause mortality inequalities between people with incomplete elementary education and those having at least a high school diploma is presented in Figure 3. A rise in the contribution of cancer mortality to the socioeconomic inequalities in general mortality was observed, with this cause of death explaining approximately 40% of the socioeconomic inequalities of mortality since 1980. The percentage of socioeconomic inequalities of mortality explained by cardiovascular diseases was relatively stable over the four periods compared, with the increase observed for the RII for this cause of death compensated by a drop in mortality rates.

RELATIVE RISKS AND RELATIVE INDEX OF INEQUALITY IN WOMEN

In women, the RII increased over time for the majority of causes of death (all-cause mortality, all cancers, breast cancer, colorectal cancer, external causes, cardiovascular diseases, and cerebrovascular diseases), even if the trend test on time progression was nonsignificant for colorectal cancers and cerebrovascular diseases (Tables 2 and 3). The changes over time in the magnitude of the inequalities for all-cause mortality were, as for men, slightly less sharp when the RII was calculated by classing the subjects in relation to people of the same age.

For ischemic heart disease and other vascular disease mortality, a general rise in the socioeconomic inequalities in mortality was noted, despite a decrease between the second and third period.

For all-cancer mortality as well as for ischemic heart diseases and external causes, the RII was significant for the most recent period, whereas they were nonsignificant during the first period. The RII was particularly high (>4) for cardiovascular diseases, overall or by subgroup, and the other causes of death. Breast cancer showed a particular situation: social differences in mortality were observed for the first period, with a higher risk of mortality among women with a high education

level. These differences diminished little by little and no socioeconomic difference in mortality was observed for the last period.

As for the contribution of the different causes of death to inequalities in mortality between the two extreme education levels (Figure 3), a regular increase in the contribution of cancer mortality to these inequalities was noted: the contribution was negative during the first period (which means that the mortality rate was higher in the most educated women at that time), zero for the second period, then positive and rising for the last two periods. The percentage accounted for by cardiovascular diseases was high (approximately 50%) for the first two periods, and then decreased.

DISCUSSION

This study documents the socioeconomic inequalities in mortality by cause of death for France in relation to the education level as well as the progression over time for the period 1968–1996. Moreover, this analysis provides precise results for women, who have been the subject of few studies, whether in France or elsewhere.

The results show a rise in socioeconomic inequalities in mortality over time. This rise was observed for both men and women, whether the socioeconomic inequalities were quantified in relative or absolute terms. The results based on the relative situation (RII) were not particularly sensitive to the fact that the education level was evaluated in comparison to the distribution of the entire population (for the period studied) or by comparison to people of the same age. The increase was found in general mortality and all the causes of death in women, and for general mortality, death by cancer, and death by cardiovascular diseases for men. This study also demonstrates the increasing weight of cancer in socioeconomic inequalities for mortality, particularly for women.

The quality of the data used in this study should be emphasized. Socioeconomic status was measured based on census data and the cause of death was found in 97% of the cases (this high percentage was also partially accounted for by the study's excluding people born outside of metropolitan France).

The information available on the coding of educational level differs slightly between the successive census data. In 1968, 1975, and 1982, the item "no degree declared" was not on the census questionnaires. Non-responses therefore could not be distinguished from the absence of a degree. However, the "no degree declared" item appeared on the 1990 census questionnaires. In addition, in 1990, the various vocational degrees (usually obtained at 16 years of age) were grouped with the high school diploma, whereas most of them are classified as general or vocational degrees in the other censuses. This involves less than 3% of women and less than 5% of men during the first censuses. Cross-checking on the degrees declared by the same subjects during two successive censuses shows that the declarations are reliable and globally comparable from one census to another. Therefore, the slight differences in coding between successive censuses can only have a minimal effect on the results.

The coding of causes of death underwent changes between 1968 and 1996, which could have had an impact on the results. During the changes in International Classification of Diseases (ICD) classification, discontinuities in coding the causes of death for all diseases except specific cancers could indeed have occurred [25]. In our study, the causes of death were coded with the ICD8 until 1978, then with the ICD9 beginning in 1979. None of the study's results were directly related to this change in coding practices.

In addition, it is likely that certification of cause of death has improved for the most recent periods. The percentage of deaths whose cause was not found has decreased considerably over time in both men and women, from 6% during the first period to 1.6% during the last period. However, the proportion of deaths of undetermined cause has remained stable around 3.4% for both sexes and all periods considered.

It is difficult to say to what extent this improvement may have had consequences on the socioeconomic inequalities observed. It is likely that this effect, if it does indeed exist, is minimal.

It is important to emphasize the sharp rise in education level between 1968 and 1990, particularly in women. With the percentage of men and women with a high school diploma or higher increasing, the socioeconomic status of this group in terms of mortality should have come closer to the mean. However, the observations tell a different story: the gap between this group and the

closest group (vocational qualification) was not reduced, but on the contrary increased, particularly in men, for whom the relative risk associated with "general or vocational qualification" increased from 1.14 to 1.43, compared to the reference group made up of people with a high school diploma. Moreover, the substantial increase in educational level suggests that there may have been changes in the role and meaning of educational level. Since 1968, socioeconomic differences in mortality have appeared in women for nearly all causes of death. To explain this result, the hypothesis that education level was not as relevant an indicator of socioeconomic status during the 1970s as in the most recent periods cannot be excluded. It is likely that the education level currently determines the socioeconomic status more closely in adulthood compared to past periods when social promotion, especially for those without degrees, was more frequent.

The fact that the increase in socioeconomic inequalities in mortality was observed for nearly all causes of death suggests that the results do not have a single cause or a single explanation in terms of a "proximal" factor, particularly in terms of a risk factor related to lifestyle or healthcare quality. This study is highly global, and the role of only a few factors will be put forward [26]. Since the results concern mortality, the aspects related both to the disease's risk factors and to healthcare (availability, quality) should be taken into account. Two major risk factors for many causes of death are tobacco and alcohol consumption, which are unevenly distributed over the social spectrum, but a few data are available on the social differences in the progression of this consumption over time in France. A few studies show an increase in the socioeconomic differences in tobacco and alcohol consumption between 1980 and 1991 [27, 28], in a general context of a decrease in alcohol and tobacco consumption [29, 30]. In addition, since 1968, screening practices have improved, particularly for cancer. However, this overall improvement, which is not limited to cancer screening, may have increased the socioeconomic inequalities in mortality. Two other general explanations can be put forward to account for the disparity increasing between the most and the least educated. The first involves the messages on prevention and a healthy lifestyle, whose impact may have differed depending on education level. The second is based on the effects of the economic situation and the increase in unemployment, which may have more strongly affected the

lower education levels, people who were thus made more vulnerable in terms of employment. However, there are no data or studies available to substantiate these hypotheses.

The results observed in this study cannot be easily compared to other studies on changes over time because the methods used were different [7, 9, 10, 12]. Comparisons show, however, that in France cancer continues to play a specific role that contributes greatly to the socioeconomic inequalities in men and that is also becoming one of the components of the comparatively high death rate in the least educated women.

The same data analyzed for the changes in socioeconomic inequalities in mortality over time according to socioprofessional category showed a rise in socioeconomic inequality in terms of mortality in men as well as in women when premature mortality was analyzed [16, 31]. Socioeconomic inequalities measured with education level are less substantial than those observed by socioprofessional category. Generally speaking, if education level and socioeconomic category are considered two measures of socioeconomic status, it is accepted that these variables do not reflect the same dimensions of socioeconomic status [32-34]. Education level partly indicates the socioeconomic status during childhood and it partly determines the profession and the socioprofessional category in adulthood; it represents the resources in knowledge that can be used later in terms of the ability to adapt, less vulnerability, and prevention [35]. Education level can have a direct effect on mortality as well as indirect effects, through the socioprofessional category in the sense that the socioprofessional status is partly determined by education level [36]. It is possible that mortality is more closely related to a measure of the socioeconomic status of adulthood, closer to the time of death, than a measure taken at a more distant time, even if that measure (education level) is more general.

CONCLUSION

The increase in socioeconomic inequalities in mortality in both men and women for nearly all causes of death shows how great and how current the problem of socioeconomic inequalities in mortality is in France. An important research question would be to know whether the changes observed in this study will continue for the most recent periods, given that the education level has

continued to rise since 1990. In addition, these results show that the overall improvement in the population's health can go with an increase in inequalities, an increase that is far from involving solely the populations suffering from social exclusion. The relevant question here could be determining what resources should be applied so that the entire population joins the situation of the highest socioeconomic groups.

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TABLE 1 - Characteristics of the population during the four periods studied.

od	Men						Women				
	N[a]	No. of deaths	Education level (%)				*N*[a]	No. of deaths	Education level (%)		
			Incomplete elementary education	Complete elementary education	Gen. & vocational education[b]	≥ High school			Incomplete elementary education	Complete elementary education	Gen. & vocational education[b]
8–4	82,534	5,114	40.8	32.4	18.2	8.6	88,830	2,531	44.8	35.0	15.2
5–1	84,490	5,061	33.6	29.8	24.9	11.7	89,822	2,354	36.8	35.7	18.4
2–8	93,251	5,648	31.2	23.6	29.4	15.8	98,673	2,297	34.0	30.0	22.5
0–6	104,037	5,329	20.5	20.0	34.3	25.2	109,706	2,304	22.1	26.6	28.2

a: Number of subjects included in the analysis, b: professional degree

TABLE 2 - Relative risk and relative index of inequality by education level during the four periods studied. All-cause mortality. Men and women.

Education level	1968–1974		1975–1981		1982–1988		1990–1996		
				MEN					
	RR	IC 95%	RR	IC 95%	RR	IC 95%	RR	IC 95%	
Incomplete elementary education	1.76	1.55–2.00	2.20	1.95–2.48	2.12	1.91–2.35	2.27	2.08–2.48	
Complete elementary education	1.45	1.27–1.66	1.69	1.49–1.91	1.74	1.57–1.93	1.70	1.55–1.86	
Gen. & voc. education[a]	1.14	0.98–1.32	1.34	1.17–1.53	1.34	1.20–1.50	1.43	1.30–1.56	
≥ High school diploma	1		1		1		1		
	RII	IC 95%	RII	IC 95%	RII	IC 95%	RII	IC 95%	Trend
IRI 1 *	1.96	1.76–2.18	2.49	2.24–2.78	2.48	2.24–2.75	2.77	2.50–3.08	<0.001
IRI 2 *	1.86	1.67–2.07	2.31	2.08–2.56	2.26	2.05–2.49	2.57	2.33–2.84	< 0.0001
				WOMEN					
	RR	IC 95%	RR	IC 95%	RR	IC 95%	RR	IC 95%	
Incomplete elementary	1.60	1.26–2.04	1.72	1.42–2.07	1.86	1.57–2.21	2.03	1.77–2.34	

education									
Complete elementary education	1.23	0.96–1.58	1.26	1.04–1.53	1.30	1.09–1.55	1.36	1.18–1.57	
Gen. & voc. education[a]	1.09	0.83–1.42	1.13	0.91–1.40	1.20	0.99–1.46	1.22	1.05–1.42	
≥ High school diploma	1		1		1		1		
	RII	IC 95%	RII	IC 95%	RII	IC 95%	RII	IC 95%	Trend
RII 1 *	1.87	1.59–2.19	2.05	1.75–2.41	2.30	1.95–2.72	2.53	2.15–2.99	0.044
RII 2 *	1.77	1.52–2.07	1.92	1.64–2.24	2.11	1.81–2.47	2.31	1.99–2.69	0.0104

a: Professional degree

* RII 1, based on a classification of the population of the period, all ages together; RII 2, based on a classification of the population of the period of the same age

TABLE 3 - Relative risk of inequality by level for the four periods studied by cause of death. Men and women.

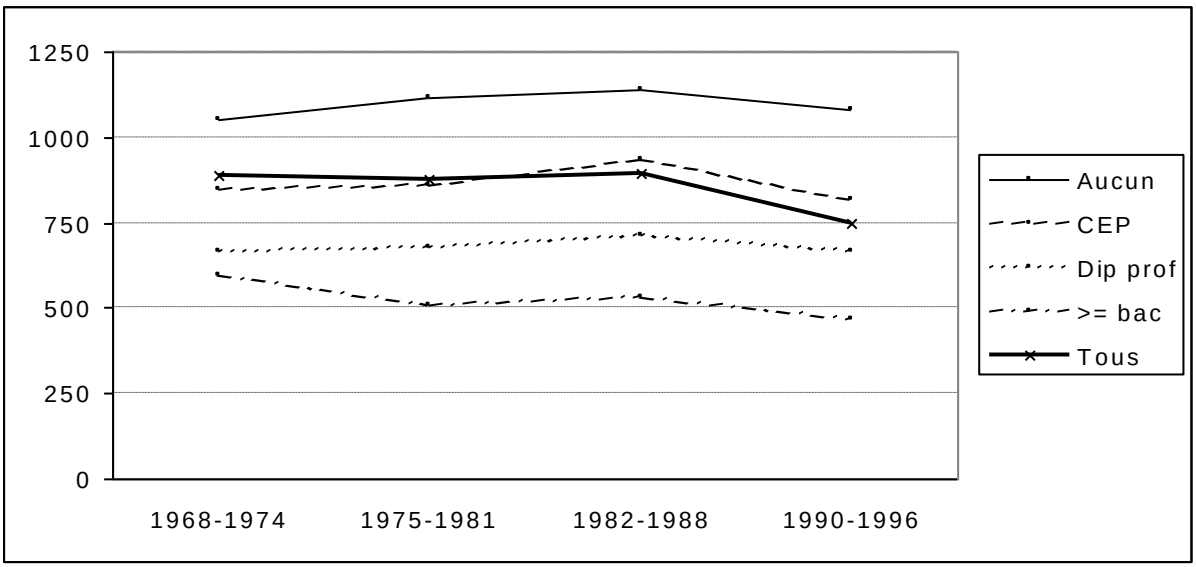
	1968–1974			1975–1981			1982–1988			1990–1996			Trend
	N	RII	IC 95%	*N*	RII	IC 95%	*N*	RII	IC 95%	*N*	RII	IC 95%	test
MEN													
Cancer	1434	1.52	1.24–1.87	1752	2.12	1.77–2.55	2229	2.20	1.87–2.59	2254	2.29	1.96–2.69	0.009
Lung cancer	271	1.08	0.68–1.70	409	2.03	1.39–2.98	564	2.22	1.60–3.08	607	2.31	1.70–3.14	0.041
Head and neck cancer	232	2.30	1.37–3.85	334	3.45	2.24–5.32	450	6.06	4.07–9.03	381	4.38	2.93–6.54	0.054
Colorectal cancer	123	1.06	0.54–2.10	138	2.46	1.26–4.79	127	1.50	0.76–2.93	165	1.63	0.91–2.90	0.759
Other cancers	808	1.62	1.23–2.12	871	1.77	1.37–2.29	1088	1.56	1.24–1.97	1101	1.93	1.54–2.42	0.354
Cardiovascular diseases	1437	1.61	1.31–1.98	1338	2.00	1.62–2.47	1302	1.94	1.56–2.39	1060	3.02	2.38–3.84	0.001

Ischemic heart diseases	515	1.09	0.78–1.53	527	1.39	1.00–1.93	579	1.28	0.94–1.74	458	1.82	1.28–2.58	0.063
Cerebrovascular diseases	425	1.60	1.10–2.34	346	2.59	1.70–3.95	266	3.94	2.39–6.50	210	4.16	2.39–7.21	0.006
Other cardiovascular diseases	497	2.47	1.72–3.54	465	2.55	1.77–3.67	457	2.25	1.56–3.24	392	4.87	3.23–7.36	0.032
External causes	555	1.72	1.25–2.36	563	3.79	2.74–5.24	666	2.54	1.90–3.40	688	2.79	2.10–3.69	0.300
Other causes of death	1688	3.04	2.50–3.71	1408	3.16	2.56–3.90	1451	3.71	3.01–4.58	1327	3.59	2.90–4.44	0.416
WOMEN													
Cancer	820	1.00	0.77–1.31	879	1.06	0.82–1.37	963	1.21	0.94–1.54	1113	1.58	1.25–1.99	0.027
Breast cancer	181	0.34	0.20–0.59	203	0.55	0.33–0.93	242	0.73	0.45–1.17	316	1.23	0.81–1.89	0.001
Colorectal cancer	95	0.87	0.40–1.90	88	1.03	0.46–2.29	96	1.58	0.71–3.51	112	2.10	0.99–	0.103

												4.45	
Other cancers	544	1.51	1.08–2.12	588	1.35	0.99–1.85	625	1.42	1.05–1.94	685	1.70	1.27–2.29	0.753
Cardiovascular diseases	673	2.38	1.73–3.29	538	3.11	2.18–4.42	447	3.12	2.10–4.62	358	4.47	2.84–7.03	0.043
Ischemic heart diseases	135	1.65	0.82–3.33	134	3.72	1.80–7.72	115	2.60	1.21–5.59	95	4.35	1.75–10.8	0.168
Cerebrovascular diseases	274	1.86	1.14–3.04	194	2.10	1.19–3.71	141	3.60	1.78–7.29	105	4.34	1.91–9.84	0.110
Other cardiovascular diseases	264	3.80	2.22–6.46	210	4.06	2.28–7.22	191	3.13	1.71–5.71	158	4.62	2.34–9.14	0.712
External causes	168	0.94	0.53–1.68	208	2.23	1.31–3.77	230	2.14	1.30–3.54	256	3.02	1.87–4.88	0.009
Other causes of death	870	3.43	2.58–4.56	729	3.46	2.57–4.66	657	5.55	3.98–7.74	577	4.39	3.11–6.19	0.077

NB: RII calculated by taking as reference the population of the period, all ages combined.

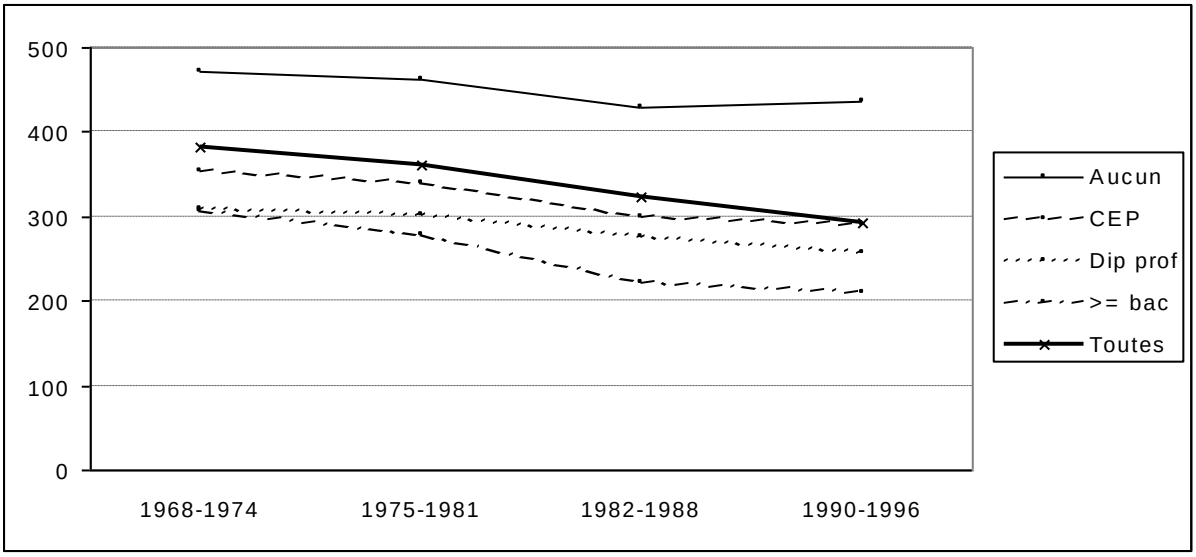
FIG. 1 - Mortality rate (for 10,000 person-years) standardized by age[a] compared to education level. All-cause mortality. Men.



a: Direct standardization, taking all person-years in men for the four periods studies as the reference population

Incomplete elementary education, Complete elementary education, General and vocational qualifications,, ≥High school, All

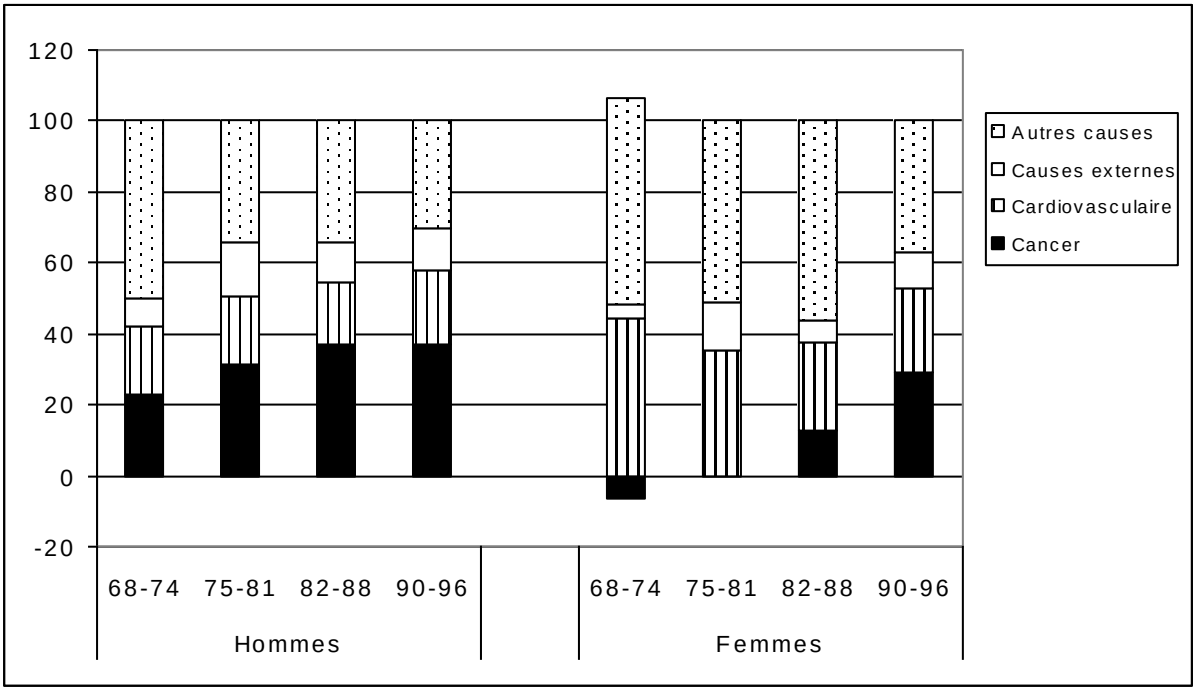
FIG. 2 - Mortality rate (for 100,000 person-years) standardized for age[a] compared to education level. All-cause mortality. Women.



a: Direct standardization, taking all person-years in women for the four periods studies as the reference population

Incomplete elementary education, Complete elementary education, General and vocational qualifications, ≥High school, All

FIG 3. - Contribution (%) of the different causes of death to excess mortality in people with incomplete elementary education (reference: high school degree or higher) per period. Men and women.



–20, Men, Women

Other causes, External causes, Cardiovascular, Cancer

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