RESEARCH REPORT

Lifelong socioeconomic trajectory and premature mortality (35–65 years) in France: findings from the GAZEL Cohort Study

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Background: Studies conducted in the UK and Scandinavia show an inverse association between lifetime socioeconomic position and adult mortality. However, there are virtually no data from other countries and few investigations have examined non-cardiovascular mortality in men and women.

Methods: Lifelong socioeconomic trajectories (father's occupation, own occupation in young adulthood and in mid-life) and premature ($\leqslant$65 years) mortality (all-cause, smoking-related cancer, diseases of the circulatory system and external causes) in the French GAZEL Cohort Study (14 972 men and 5598 women, followed up between 1990 and 2004) were studied. Hazard ratios (HRs) were estimated using Cox's regression models adjusted for age, marital status, tobacco smoking, alcohol consumption, body mass index, and fruit and vegetable consumption.

Results: Men and women who experienced lifelong disadvantage or downward intergenerational mobility were at high risk of dying prematurely compared with those with a favourable trajectory (age-adjusted HRs for all-cause mortality: cumulative disadvantage: HR 1.61, 95% confidence interval (CI) 1.26 to 2.06 in men and HR 1.95, 95% CI 1.10 to 3.47 in women; downward mobility: HR 1.87, 95% CI 1.35 to 2.58 in men and HR 2.05, 95% CI 1.12 to 3.75 in women). Associations were strongest for mortality due to chronic diseases (smoking-related cancers and diseases of the circulatory system). These associations were partly explained by marital status, body mass index, alcohol consumption, cigarette smoking, and fruit and vegetable consumption.

Conclusions: In France, where the leading cause of premature death is cancer, lifelong socioeconomic position is associated with the risk of dying before the age of 65 years. Adult factors seem more relevant than childhood socioeconomic circumstances.

In studies conducted in Scandinavia, the UK and the US, lifelong socioeconomic circumstances have been shown to predict adult mortality, particularly that due to cardiovascular causes.[1–8] However, only a few of these examined non-cardiovascular causes of death.[3 4 7] Yet, in OECD countries, cancer, suicide and injury account for 50% of deaths before the age of 70; therefore, additional data are needed on non-cardiovascular causes of death.[9]

To date, few studies in this area have included women. A recent investigation from the US reported that the degree of association between lifelong socioeconomic position and cardiovascular mortality in women is similar to that observed in men[6]; however, this may not be the case for other causes of death, and particularly for mortality due to cancer. Across industrialised countries, premature mortality due to cancer in men (aged 35–65 years) is primarily due to lung cancer,[10] the rates for which are highest in socioeconomically disadvantaged groups.[11] Among women, the leading cause of mortality due to cancer is breast cancer, and although incidence rates are generally higher in affluent groups,[12] data on mortality across socioeconomic groups seem inconsistent.[13 14]

Our aim was to investigate the association between lifelong socioeconomic circumstances and premature mortality in France, where premature mortality in men, and particularly premature mortality due to cancer, is among the highest in Europe (mortality among French men is especially high for cancers of the lung and the upper aerodigestive airways).[15] Using data from the GAZEL Cohort Study, we studied all-cause and cause-specific mortality in men aged <65 years over a 15-year follow-up period.

METHODS

Study population

The GAZEL Cohort Study is an occupational cohort of 15 015 men and 5623 women employed by the French national gas and electricity company (Electricité de France–Gaz de France (EDF-GDF)). In 1989, all male employees aged 40–50 years and all female employees aged 35–50 years were asked to participate in this long-term epidemiological study (women represent 20% of employees, which is why they were oversampled): 45% of those eligible agreed to participate. Since baseline, participants complete a questionnaire mailed yearly (average response rate 75%). In addition, certain data on sociodemographics and health are available from company records. As in other large cohorts, study participants were healthier than eligible non-respondents.[16]

EDF-GDF is a large public-sector company and guarantees all employees job security and opportunities for upward mobility. Most employees are hired at approximately 20 years of age, and stay with the company until retirement (very few leave voluntarily and they are never downgraded). After retirement, the company pays pensions to the former employees. Overall, the GAZEL cohort's follow-up is very thorough—less than 1% have been lost to follow-up since 1989.

Measures

Socioeconomic position

We measured socioeconomic position at different points in time: in childhood (father's occupation), at entry into the job

Abbreviation: EDF-GDF, Electricité de France–Gaz de France

market (occupational grade at hire) and in mid-life (occupational grade at age 35–50). Father's occupation was reported in the 1989 GAZEL Study questionnaire (''What is, or was, your father's occupation?''); own occupational grade was obtained from EDF-GDF company records. Occupational grade, coded using France's national job classification, was dichotomised into high or low grade (managers, craftsmen, professionals and technicians *v* manual workers, clerks and farmers).[17] French farmers are a heterogeneous group, but their average income and educational levels are comparable to those of manual workers, which is why we included them in the low-grade group.[18] Among GAZEL cohort members, there were no farmers, craftsmen or self-employed, only among fathers. Adult occupational grade was available for the entire cohort, but 12% of participants did not report their father's occupation. Tables 1 and 2 show the sociodemographic characteristics of the entire sample (''father: job grade unknown''), but the analysis was restricted to those with valid data on father's occupation.

On the basis of these three measures, we identified six lifelong socioeconomic trajectories of father's job→own job at hire→job in mid-life[19]: (1) high→high→high, (2) high→low→high, (3) high→low→low, (4) low→high→high, (5) low→low→high and (6) low→low→low. Owing to their public-sector employee status, GAZEL cohort participants either remained in the same job or moved up. In cause-specific mortality analyses, to study a sufficient number of cases in each group, we used a summary measure based on father's and own mid-life occupational grade (four groups: (1) high→high, (2) high→low, (3) low→high and (4) low→low).

In additional analyses, we used three other measures of childhood socioeconomic circumstances: educational level (reported in 1989: ⩾high-school diploma *v* <high school diploma), height (reported in 1990 and dichotomised at the median: 1.73 m for men and 1.62 m for women) and birth during World War II (1939–45 *v* 1946–54).[1] We also investigated the relationship between premature mortality and participants' detailed job trajectory (six categories: stable manager, technician or professional→manager, manual worker or clerk→manager, stable technician or professional, manual worker or clerk→technician or professional, and stable manual worker or clerk).

Sociodemographic and health characteristics

Data on age, marital status (married or living with a partner *v* single, widowed or divorced), cumulative tobacco smoking (never smoker, <10, 10–19.9, 20–39.9, ⩾40 pack-years) and alcohol consumption (0, 1–2, 3–4, ⩾5 drinks/day for men; 0, 1, 2–3, ⩾4 drinks/day for women)[20] were obtained from the 1989 GAZEL survey. Data on the consumption of fruit and vegetable (daily *v* <daily), body weight and height were collected in 1990. Participants' body mass index (BMI; weight (kg)/(height^2 (m)^2) was studied in four categories: <20, 20–24.9, 25–29.9, ⩾30 kg/m^2. In secondary analyses, we additionally controlled for self-rated health in 1989 (good *v* poor), which had little effect on our overall results.

Study outcome

Mortality data were obtained from EDF-GDF company records (all causes: 1989–30 April 2004). The causes of death, recorded by the French national death registry (INSERM-CépiDC), were matched with GAZEL records for the period 1 January 1989 to 31 December 2001. Underlying diagnoses were coded using the International Classification of Disease, 10th version.[21] In men, we distinguished smoking-related cancers (oral cavity: C01–C14, oesophagus: C15, pancreas: C25, larynx: C32, lung: C34, respiratory airways: C39, bladder: C67) and diseases of the circulatory system (I00–I99) and external causes (V01–X84). In women, owing to the small number of cases, we grouped all deaths due to cancer together (C00–C97). To reduce the possibility that the association between lack of occupational mobility and premature mortality was due to pre-existing illness. Participants were aged 35–65 years during the study period and all deaths occurred before age 65 years (in France, deaths that occur before age 65 years are considered premature,[15] and we refer to it as ''premature mortality'' throughout the paper).

Statistical analysis

Mortality hazard ratios (HRs) were calculated using Cox's regression models, with age in 1989 as the time offset. The proportional hazards assumption was met. The fully adjusted models were controlled for marital status, cumulative tobacco smoking, alcohol consumption, BMI, and fruit and vegetable consumption. The following formula was used to estimate the difference between age and fully adjusted models: (% change = $(HR_{age}-1)-(HR_{fully\ \ adjusted}-1)/(HR_{age}-1)$). In additional analyses, we tested the main effect of childhood socioeconomic position (the full range of father's occupation, educational level, height and birth during World War II) and of career trajectories.

Data were analysed separately for men and women, using SAS V.8.02.[22]

The GAZEL Cohort Study was approved by France's national ethics committee (Commission Nationale Informatique et Liberté, CNIL). This study was also approved by the Human Subjects Committee of the Harvard School of Public Health, Boston, Massachusetts, USA.

RESULTS

A total of 14 972 men and 5598 women were followed up from January 1990 to April 2004. During this period, 697 men and 118 women died; the underlying cause of death was known for all 530 male and 93 female deaths that occurred before 31 December 2001. The leading cause of death was cancer (men: 46%, women: 63%). The most frequent cause of death in men was smoking-related cancer (22% of deaths); in women it was breast cancer (26% of deaths). Other major causes of death included diseases of the circulatory system (18% in men and 8% in women) and external causes (eg, traffic accidents, intentional self-harm: men: 16%, women: 15%). The overall mortality was 332 per 100 000 pack-years for men and 148 per 100 000 pack-years for women, roughly half the rates observed in the French general population of the same age.[15]

About 45% of study participants reported that their father worked in a job we classified as low grade (tables 1 and 2); 82% themselves worked in a low-grade job when hired by EDF-GDF, but, by mid-life 81% of men and 68% of women had moved up to a high-grade occupation. Those whose fathers worked in a low-grade job were on average shorter, less likely to have completed high school and more likely to report poor health than those whose fathers worked in a high-grade occupation. However, baseline characteristics were principally associated with adult circumstances: men with low mid-life occupational grade were most likely to have remained single, smoke cigarettes, drink more than four glasses of alcohol per day, be obese and report being in poor health; women in the same group were especially likely to be divorced. Participants with low-grade jobs were most likely to fail to respond to questions pertaining to alcohol and tobacco consumption, BMI or diet.

Father's occupation and own occupational trajectory

Figures 1 and 2 show that compared with participants with the most favourable socioeconomic trajectory (father's and

Table 1 Baseline characteristics of GAZEL cohort men according to father's and own mid-life occupational grade

	Father's job						
	High grade		Low grade		Unknown		
Own mid-life occupational grade	High →, n = 5587	Low ↓, n = 624	High ↑, n = 5678	Low →, n = 1467	High, n = 1273	Low, n = 342	p Value†
Age, years (mean, SD)	44.0 (2.80)	44.6 (2.72)	44.9 (2.85)	44.6 (2.89)	45.2 (2.80)	44.9 (2.96)	***
Height <1.73 m (%)	35.1	38.1	41.0	41.2	37.3	40.0	***
Missing data	12.6	19.0	12.1	20.9	13.3	24.8	
Educational level (%)							
<High school	61.4	94.2	79.5	97.9	74.4	97.1	***
⩾High school	38.7	5.8	20.5	2.1	25.6	2.9	
Years at EDF-GDF (mean, SD)	22.0 (5.33)	19.6 (6.64)	22.4 (5.50)	19.0 (6.64)	22.2 (5.37)	18.6 (6.82)	***
Low-grade job at hire (%)	70.6	100	85.4	100	80.5	100	***
Marital status (%)							
Married or with partner	93.3	90.4	93.9	92.1	91.6	89.2	***
Single	2.3	4.5	2.0	3.7	3.3	7.1	
Separated or widowed	4.4	5.1	4.1	4.2	5.1	3.7	
Cumulative smoking, pack-years (%)							
Never smoker	33.2	28.2	35.5	35.6	31.7	31.0	***
<10	17.7	14.1	16.6	14.7	16.1	16.4	
10–20	21.0	21.6	19.9	17.4	21.5	16.4	
20–40	20.6	25.6	19.8	22.9	20.7	24.0	
⩾40	5.1	6.2	5.2	5.4	6.2	6.4	
Missing data	2.2	4.1	3.0	4.0	3.8	5.8	
Alcohol consumption, drinks/day (%)							
0	1.5	4.3	1.6	3.1	2.3	3.8	***
1–2	67.9	56.4	67.6	56.6	67.8	55.5	
3–4	18.6	19.4	18.7	12.2	17.2	17.3	
⩾5	10.0	17.7	10.0	15.9	9.9	17.0	
Missing data	1.9	5.1	2.1	3.3	2.8	6.4	
BMI, kg/m^2 (%)							
<20	1.8	1.4	1.2	1.6	0.9	3.5	***
25–30	37.1	34.6	41.0	37.4	38.2	37.1	
>30	4.1	5.9	4.2	7.0	5.1	7.9	
Missing data	12.8	19.0	12.3	21.0	13.4	24.9	
Fruits and vegetables (%)							
<Daily	36.5	35.5	37.4	32.9	34.6	31.0	***
Missing data	11.1	18.2	10.8	19.7	12.2	23.7	
Poor self-rated health (%)	11.1	17.8	12.5	17.0	13.3	23.3	***
Deaths (n)†							
All-cause	221	44	241	91	64	35	
Smoking-related cancers	32	8	41	18	11	5	
Other cancers	41	6	42	15	14	3	
Circulatory system diseases	36	8	20	23	11	2	
External causes	27	6	34	7	7	2	

BMI, body mass index; EDF-GDF, Electricité de France–Gaz de France.
→, stable socioeconomic circumstances; ↓, downward intergenerational mobility; ↑, upward intergenerational mobility.
***p<0.001, comparing baseline characteristics across life-course trajectories.
†The causes of death were coded using the 10the version of the International Classification of Diseases: smoking-related cancers (C01–C14, C15, C25, C32, C34, C39, C67), circulatory system diseases (I00–I99) and external causes (V01–X84).

own entire career, both high grade), the risk of mortality was increased among men and women who experienced lifelong socioeconomic disadvantage (father's and own entire career, both low grade, age-adjusted HRs: men: HR 1.93, 95% CI 1.38 to 2.71; women: HR 1.63, 95% CI 0.65 to 4.07) or downward intergenerational mobility (father's occupation high grade, own entire career low grade, age-adjusted HRs: men: HR 2.24, 95% CI 1.15 to 3.34; women: HR 1.71, 95% CI 0.67 to 4.35). Among men, we observed a similar pattern among those who did not report their father's occupation (compared with participants with the most favourable trajectory, the age-adjusted HR for father's occupation unknown and entire low-grade career: HR 3.24, 95% CI 2.02 to 4.96).

In additional analyses, father's occupation was not associated with premature mortality in men; in women, this association was not significant (age-adjusted HRs for low compared with high grade: 1.09, 95% CI 0.93 to 1.28 for men; 1.41, 95% CI 0.95 to 2.09 for women). Educational level was associated with mortality in men but not in women (compared with ⩾high school, age-adjusted HRs for <high school: 1.47, 95% CI 1.20 to 1.79 for men and 1.33, 95% CI 0.80 to 2.21 for women) and this effect disappeared after adjusting for mid-life occupational grade. Height and birth during World War II did not predict premature mortality (data not shown).

By contrast, premature mortality was associated with participants' career trajectory: compared with stable managers, men who worked in non-managerial jobs since they were hired were at increased risk: age-adjusted HRs 2.28 (95% CI 1.23 to 4.20) for stable technicians and professionals,

Table 2 Baseline characteristics of GAZEL cohort women according to father's and own mid-life occupational grade

	Father's job						
	High grade		Low grade		Unknown		
Own mid-life occupational grade	High (→), n = 1 970	Low (↓), n = 630	High (↑), n = 1 512	Low (→), n = 771	High, n = 457	Low, n = 259	p Value
Age, years (mean, SD)	42.3 (4.21)	41.3 (3.98)	42.5 (4.14)	41.0 (4.06)	42.7 (4.06)	42.1 (4.08)	***
Height <1.62 m (%)	37.8	38.7	39.6	42.8	40.7	41.7	***
Missing data	14.8	21.1	16.6	21.5	18.8	21.6	
Educational level (%)							
<High school	65.6	84.1	81.7	91.6	79.0	89.9	***
⩾High school	34.4	19.9	18.3	8.4	21.0.	10.1	
Years at EDF-GDF (mean, SD)	18.8 (7.09)	15.4 (7.49)	19.5 (6.73)	14.7 (7.45)	19.7 (7.02)	15.1 (8.20)	***
Low-grade job at hire	79.9	100	90.5	100	90.6	100	***
Marital status (%)							**
Married or with partner	78.6	77.4	79.2	75.8	75.4	70.8	
Single	8.0	5.2	7.2	6.3	8.5	6.6	
Separated or widowed	13.4	17.4	13.6	17.8	16.1	22.6	
Cumulative smoking, pack-years (%)							**
Never smoker	62.5	62.5	69.1	69.0	65.0	62.6	
<10	17.4	18.9	14.1	13.4	13.8	13.1	
10–20	10.7	9.2	7.7	7.9	8.1	10.8	
⩾20	6.2	5.4	5.9	5.7	7.2	7.7	
Missing data	3.1	4.0	3.2	4.0	5.9	5.8	
Alcohol consumption, drinks/day (%)							***
0	4.2	5.4	3.6	5.6	6.1	5.0	
1	84.1	79.5	85.1	81.4	79.4	83.8	
2–3	7.9	9.8	8.4	7.5	8.9	3.5	
⩾4	2.0	1.8	1.2	1.7	2.2	1.9	
Missing data	1.8	3.5	1.7	1.7	3.4	5.8	
BMI, kg/m^2 (%)							**
<20	17.6	15.0	15.7	15.6	14.6	13.9	
25–30	10.3	10.7	10.0	12.2	11.3	13.1	
>30	2.6	3.0	2.8	3.0	3.5	1.9	
Missing data	15.0	21.6	16.8	21.7	19.0	21.6	
Fruits and vegetables (%)							***
<Daily	23.9	24.2	21.6	21.6	24.5	22.4	
Missing data	11.6	18.8	14.2	18.6	16.9	19.3	
Poor self-rated health (%)	14.1	14.3	10.9	18.2	15.6	21.4	***
Deaths (n) †							
All causes	28	17	35	20	13	4	
Cancer	11	8	17	11	6	3	

BMI, body mass index; EDF-GDF, Electricité de France–Gaz de France.
→, stable socioeconomic circumstances; ↓, downward mobility over life course; ↑, upward mobility over life course.
***p<0.001, **p<0.01, comparing baseline characteristics across life-course trajectories.
The causes of death were coded using the 10the version of the International Classification of Diseases: cancer (C00–C97).

and 2.93 (95% CI 1.93 to 4.44) for stable manual workers and clerks (results not shown).

Father's and own adult occupational grade

Table 3 shows that compared with those with a favourable socioeconomic position throughout life, men who experienced lifelong disadvantage (father's and own mid-life occupation low grade) were at high risk of dying from smoking-related cancers and diseases of the circulatory system. For mortality due to smoking-related cancers and external causes, the risk was also increased among men who experienced downward intergenerational mobility (for external causes, the associated HRs did not reach statistical significance).

Adjusting for marital status, tobacco smoking, alcohol consumption, BMI, and fruit and vegetable consumption reduced the association between total mortality and cumulative disadvantage by 33%, and total mortality and downward intergenerational mobility role by 43% (tobacco smoking and alcohol consumption played the most important role).

In further analyses, men's mortality due to chronic diseases was related to career trajectory: compared with career-long managers, age-adjusted HRs for stable manual workers or clerks were 4.54, 95% CI 1.95 to 10.58 for smoking-related cancers and 2.18, 95% CI 1.39 to 3.40 for mortality due to diseases of the circulatory system.

Among women, both cumulative disadvantage and downward intergenerational mobility were associated with a high risk of mortality due to all causes and cancer (table 4).

In additional analyses, compared with stable managers, both stable clerks and women who were promoted to

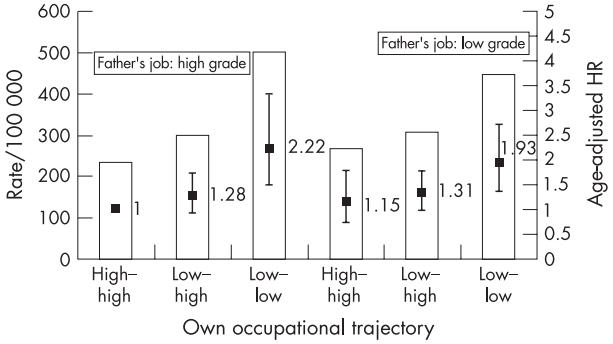

Figure 1 Father's occupational grade, own occupational trajectory and all-cause premature mortality: men of the GAZEL Cohort Study (40–65 years of age; 1990–2004). Rate per 100 000 people and age-adjusted hazard ratios (HRs; 95% confidence interval).

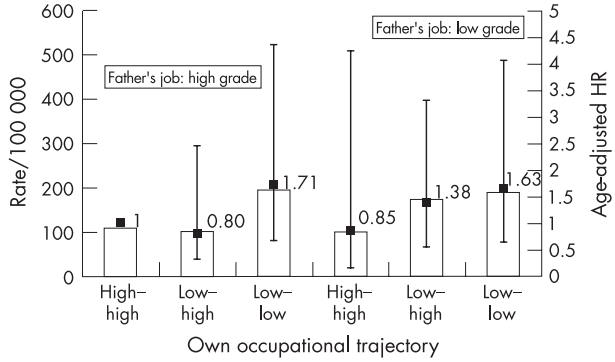

Figure 2 Father's occupational grade, own occupational trajectory and all-cause premature mortality: women of the GAZEL Cohort Study (35–65 years of age; 1990–2004). Rate per 100 000 people and age-adjusted hazard ratios (HRs; 95% confidence interval).

managerial jobs seemed to be at high risk of premature mortality, but the associated HRs did not reach statistical significance (data not shown).

DISCUSSION

In this prospective study of French men and women, sustained socioeconomic disadvantage predicted premature mortality. Overall, occupational trajectory in adulthood played a greater part than socioeconomic circumstances in childhood. To our knowledge, this is one of only a few studies on this topic that has focused on non-cardiovascular causes of mortality and was based outside Scandinavia or the UK.[2 7 23]

Effect of childhood socioeconomic circumstances

Compared with previous studies, childhood socioeconomic circumstances were weak predictors of premature mortality in the GAZEL cohort.[2 6 19 23] Father's occupation was obtained retrospectively and without reference to a specific time period, and coded into low or high grade, rather than manual or non-manual worker as in several previous studies.[2 6 19] However, when we repeated the analyses using the ''manual versus non-manual'' classification, our results were unchanged, and other indicators of childhood socioeconomic circumstances[1 24] yielded similar null results—only educational attainment predicted mortality, but this effect disappeared after adjusting for mid-life occupational grade. It may well be that educational attainment affects health partly through occupational exposures and experiences in adulthood. Our measures of childhood socioeconomic circumstances were associated with one another, and we believe that they are valid. However, we acknowledge that we used broad indicators that may have lacked precision.[25]

The distribution of father's occupation in the GAZEL cohort is comparable with the distribution of occupations in France in the 1950s and 1960s as reported by the national census. Yet, our study population comprised only working men and women, and did not include people who were excluded from the job market and who may have experienced the harshest childhood circumstances. This is the case in all occupational cohorts; yet in some, such as the Whitehall Study of Civil Servants, associations between childhood socioeconomic circumstances and adult mortality have been reported.[26] Therefore, although the GAZEL Cohort Study is a selected population, our null findings with regard to father's occupation are probably not entirely due to selection effects.

The most plausible explanation has to do with mortality patterns. In the GAZEL Cohort Study, as in the French population, the leading cause of death in men was smoking-related cancer (cancers of the lung, upper aerodigestive airway, oesophagus, pancreas and bladder). Although there are reports of an association between childhood socioeconomic status and lung cancer,[25] our findings are consistent with the hypothesis that these tumours are principally associated with adult exposure to tobacco and alcohol, and a stressful environment.[27]

In women, our data suggest a possible, albeit not statistically significant, association between father's occupation and premature mortality. The leading cause of death in women was breast cancer (26%), and an association would be consistent with mounting evidence that breast cancer reflects early-life influences (eg, birth weight, birth length, age at menarche, age at birth of first child[28–32]). We plan to re-examine that hypothesis when data on a sufficient number of site-specific cancer deaths have accrued.

Occupational trajectories in adulthood and premature mortality

In our study, premature mortality from all causes was chiefly associated with occupational trajectories in adulthood: the risk of dying prematurely was highest in men and women who worked in low-grade occupations throughout their career. This was most apparent for mortality due to chronic diseases. Similar to other investigations based on occupational cohorts, our study was also influenced by the ''healthy worker'' effect (ie, participants were healthier than the general population, as shown by lower mortality). In addition, men and women who agreed to participate in the GAZEL Cohort Study were healthier than eligible non-respondents.[16]

The association between occupational trajectory and mortality probably reflects both the selection of less healthy people into lower-grade occupational groups and an increase in mortality risk as a consequence of a disadvantaged occupational position. GAZEL Cohort Study participants were probably healthy when they joined EDF-GDF, and health-related selection at job entry is unlikely. However, as shown by previous reports from this cohort, health characteristics and health behaviours (eg, excessive alcohol consumption) influenced later career progress.[20 33] The high risk of mortality from external causes among men employed in a lower-grade job than that of their fathers, which needs to be confirmed in studies with a larger number of cases, suggests shared common (and possibly omitted) causes of both a high risk of premature death and restricted socioeconomic attainment.

Health selection is unlikely to be the only explanation, however. People working in low-grade jobs are more likely to engage in health-damaging behaviours, to be exposed to physical and chemical hazards, stress and insufficient social support, and to have less access to quality healthcare, all of

Table 3 Father's and own mid-life occupational grade and premature mortality in the GAZEL Cohort Study: men (40–65 years old; 1990–2001)

	Father's job			
	High grade†		Low grade	
Own mid-life occupational grade	High →, n = 5534	Low ↓, n = 618	High ↑, n = 5612	Low →, n = 1449
All causes				
Rate/100 000 pack-years (n)	282 (221)	503 (43)	303 (241)	447 (90)
Age-adjusted HR (95% CI)	1.0	1.87 (1.35 to 2.58)	1.07 (0.89 to 1.29)	1.61 (1.26 to 2.06)
Fully adjusted HR‡ (95% CI)	1.0	1.54 (1.11 to 2.13)	1.10 (0.92 to 1.32)	1.45 (1.13 to 1.85)
Smoking-related cancers				
Rate/100 000 pack-years (n)	46 (33)	101 (8)	56 (41)	96 (18)
Age-adjusted HR (95% CI)	1.0	2.76 (1.61 to 4.75)	1.03 (0.72 to 1.48)	2.09 (1.34 to 3.25)
Fully adjusted HR (95% CI)	1.0	2.25 (1.30 to 3.89)	1.09 (0.76 to 1.57)	1.92 (1.23 to 3.01)
Other cancers				
Rate/100 000, pack-years (n)	57 (41)	75 (6)	58 (42)	80 (15)
Age-adjusted HR (95% CI)	1.0	2.10 (1.20 to 3.69)	0.89 (0.63 to 1.27)	1.62 (1.04 to 2.54)
Fully adjusted HR (95% CI)	1.0	1.93 (1.10 to 3.40)	0.95 (0.65 to 1.30)	1.57 (0.99 to 2.47)
Diseases of the circulatory system				
Rate/100 000, pack-years (n)	50 (36)	102 (8)	27 (20)	124 (23)
Age-adjusted HR (95% CI)	1.0	2.08 (0.96 to 4.48)	0.54 (0.31 to 0.94)	2.56 (1.51 to 4.32)
Fully adjusted HR (95% CI)	1.0	1.73 (0.80 to 3.77)	0.57 (0.33 to 0.98)	2.35 (1.38 to 4.01)
External causes				
Rate/100 000, pack-years (n)	37 (27)	76 (6)	46 (34)	37 (7)
Age-adjusted HR (95% CI)	1.0	2.01 (0.83 to 4.89)	1.24 (0.74 to 2.05)	1.00 (0.44 to 2.32)
Fully adjusted HR (95% CI)	1.0	1.58 (0.64 to 3.88)	1.25 (0.75 to 2.08)	0.85 (0.36 to 1.97)
Other causes				
Rate/100 000, pack-years (n)	35 (25)	115 (9)	41 (30)	48 (9)
Age-adjusted HR (95% CI)	1.0	3.43 (1.60 to 7.36)	1.18 (0.69 to 2.01)	1.46 (0.68 to 3.14)
Fully adjusted HR (95% CI)	1.0	2.49 (1.14 to 5.44)	1.22 (0.71 to 2.08)	1.28 (0.59 to 2.77)

High-grade jobs: manager, technician, administrative associate (craftsman only for father); low-grade jobs: clerk, manual worker (farmer only for father).
→, stable socioeconomic circumstances, ↓, downward mobility over life course; ↑, upward mobility over life course.
Fully adjusted HR is adjusted for age, marital status, cumulative tobacco smoking, alcohol consumption, body mass index (kg/m^2), and fruit and vegetable consumption.

which increase premature mortality risks.[34–36] The extent to which health selection and social causation contribute to socioeconomic inequalities in premature mortality requires further research.[37]

Women

To date, few investigations on lifelong socioeconomic factors and mortality have included women and those that did primarily focused on cardiovascular mortality.[6 7 23] In our study, 54% of female deaths were due to cancer, 48% of which were attributable to breast cancer. Our cause-specific analyses were restricted by a limited number of deaths, but overall, our results provide support for the hypothesis that sustained socioeconomic disadvantage is associated with increased mortality due to breast cancer.[38] The underlying mechanisms are probably related to a worse prognosis, rather than a higher risk of occurrence, but incidence rates of breast cancer among socioeconomically disadvantaged women may be increasing over time, and require close monitoring.[32 39]

Overall, associations between occupational grade, educational level, and health and behavioural characteristics were weaker in women than in men. This could reflect a smaller number of deaths. In addition, occupational grade is probably a less salient indicator of socioeconomic position for women than for men. Even in our cohort of public-sector employees, women systematically work in lower-grade jobs, even accounting for age, educational attainment, the number of years with the company and part-time work. This is

Table 4 Father's and own mid-life occupational grade and premature mortality in the GAZEL Cohort Study: women (35–65 years old; 1990–2001)

	Father's job			
	High grade*		Low grade	
Own mid-life occupational grade	High† (→), n = 1965	Low (↓), n = 624	High (↑), n = 150	Low (→), n = 769
All causes				
Rate/100 000, pack-years (n)	100 (28)	192 (17)	164 (35)	186 (20)
Age-adjusted HR (95% CI)	1.0	2.05 (1.12 to 3.75)	1.61 (0.98 to 2.64)	1.95 (1.10 to 3.47)
Fully adjusted HR‡ (95% CI)	1.0	2.01 (1.09 to 2.76)	1.68 (1.01 to 2.76)	1.92 (1.07 to 3.43)
Cancer				
Rate/100 000, pack-years (n)	43 (11)	99 (8)	87 (17)	122 (12)
Age-adjusted HR (95% CI)	1.0	2.47 (1.00 to 6.16)	1.99 (0.93 to 4.26)	2.76 (1.19 to 6.37)
Fully adjusted HR (95% CI)	1.0	2.51 (1.00 to 6.31)	2.03 (0.95 to 4.35)	2.74 (1.17 to 6.39)
Other causes				
Rate/100 000, pack-years (n)	39 (10)	37 (3)	41 (8)	71 (7)
Age-adjusted HR (95% CI)	1.0	0.89 (0.09 to 8.01)	0.64 (0.11 to 3.53)	1.43 (0.26 to 7.89)
Fully adjusted HR (95% CI)	1.0	0.86 (0.09 to 8.08)	0.73 (0.12 to 4.16)	1.60 (0.27 to 9.38)

High-grade jobs: manager, technician, administrative associate (craftsman only for father); low-grade jobs: clerk, manual worker (farmer only for father).
→, stable socioeconomic circumstances; ↓, downward mobility over life course; ↑, upward mobility over life course.
Fully adjusted HR is adjusted for age, marital status, cumulative tobacco smoking, alcohol consumption, BMI, and fruit and vegetable consumption.

What is already known

- Studies from Scandinavia and the UK report an association between mortality and socioeconomic status in childhood and adulthood.
- Most of these studies focused on cardiovascular mortality.
- Data from other countries regarding non-cardiovascular causes of death are scarce.

What this paper adds

- In France, where cancer is the leading cause of death, cumulative disadvantage and downward intergenerational mobility predict the risk of premature death (age $\leqslant$65 years) in men and women.
- Adult factors have a stronger predictive effect than childhood circumstances, particularly for deaths due to smoking-related cancers.
- Additional research on socioeconomic status during life and mortality in settings with diverse mortality patterns is needed.

Policy implications

- This research implies that doctors need to be especially attentive to the health of men and women who experience lifelong disadvantage.
- Health inequalities still exist despite decreases in mortality, and should be specifically targeted by policy makers.

indicative of national trends in France, where despite strong female workforce participation (42% in 1990, 46% in 2000), occupational sex inequalities persist (in 1990, 7% of women worked as managers compared with 13% of men; in 2000, these figures were, respectively, 10% and 16%).[40 41] Thus, researchers studying socioeconomic health disparities in women should consider using multiple measures that take into account household characteristics (eg, multiple roles, division of labour), husband's socioeconomic position, as well as work–family relationships.[42 43]

Conclusion

In France, where the leading cause of premature mortality is cancer, men and women who experience unfavourable lifelong socioeconomic conditions, particularly in adulthood, are at high risk of dying before the age of 65 years. We studied employees of a large public-sector company who are healthier than the general population, and the associations we report probably underestimate the effects of lifelong socioeconomic disadvantage on mortality in the general population. Other studies in settings where cancer is the leading cause of premature mortality are needed.

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THE *JECH* GALLERY

Fernanda Giannasi: battling asbestos in Brazil

Figure 1 Fernanda Giannasi. Photograph by Raphael Falavigna.

Fernanda Giannasi (1958–) is a symbol of the struggle to ban asbestos in Brazil. As Labour Inspector for the Ministry of Labor since 1983, Giannasi defends the public interest as regards worker safety and health. Although Brazil still uses asbestos, it has been banned in more than 40 countries, including the European Union members. Asbestos is used in the production of roofing, water tanks and brake pads, and 3000 other products. It can cause severe respiratory disease and cancer.

Giannasi is a founding member of Associação Brasileira dos Expostos ao Amianto (ABREA), the association of asbestos-exposed workers in Brazil, and coordinator in Latin America of the Citizens' Virtual Network Against Asbestos. She leads the struggle of 3500 workers who have filed lawsuits against the industry. Criminal charges driven by economic interests have been filed against Giannasi for slander by Eternit, the biggest asbestos producer in Brazil, and by supporters of the French multinational Saint-Gobain. She has suffered pressure from the Canadian government, the world's largest exporter, and has been the subject of death threats. In the USA and Europe, her work is well known and respected.

Giannasi has successfully widened the world discussion. According to Giannasi, ''I defend an immediate world ban on the production, marketing and use of asbestos''.

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