THEORY AND METHODS

Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice

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Study objective: Education, income, and occupational class are often used interchangeably in studies showing social inequalities in health. This procedure implies that all three characteristics measure the same underlying phenomena. This paper questions this practice. The study looked for any independent effects of education, income, and occupational class on four health outcomes: diabetes prevalence, myocardial infarction incidence and mortality, and finally all cause mortality in populations from Sweden and Germany.

Design: Sweden: follow up of myocardial infarction mortality and all cause mortality in the entire population, based on census linkage to the Cause of Death Registry. Germany: follow up of myocardial infarction morbidity and all cause mortality in statutory health insurance data, plus analysis of prevalence data on diabetes. Multiple regression analyses were performed to calculate the effects of education, income, and occupational class before and after mutual adjustments.

Setting and participants: Sweden (all residents aged 25–64) and Germany (Mettman district, Nordrhein-Westfalen, all insured persons aged 25–64).

Main results: Correlations between education, income, and occupational class were low to moderate. Which of these yielded the strongest effects on health depended on type of health outcome in question. For diabetes, education was the strongest predictor and for all cause mortality it was income. Myocardial infarction morbidity and mortality showed a more mixed picture. In mutually adjusted analyses each social dimension had an independent effect on each health outcome in both countries.

Conclusions: Education, income, and occupational class cannot be used interchangeably as indicators of a hypothetical latent social dimension. Although correlated, they measure different phenomena and tap into different causal mechanisms.

In the literature on health inequalities there is a lack of clarity around concepts such as social position, social class, social status, or socioeconomic group. For outcomes such as self rated health, illness, cause specific or total mortality, differences are typically reported for educational groups, income groups, or occupational classes. Such studies constitute a large part of the growing literature on health inequalities, although there is increasing awareness that indicators should not be used interchangeably.[1–7] Reference is often made to one of these dimensions to support research into one of the others. Thus, educational differences in circulatory disease found in one study can be quoted as support in another study that finds income based differences in circulatory disease[8] or adjustment for social class can be made by entering education into the regression.[2]

Thus, in studies of health inequalities, education, income, and occupational class are frequently interchanged, although the differences in what they ought to measure have been subject to theoretical analyses.[9 10] Sometimes it is justified by the belief that all three depict the same underlying dimension, for instance ''material deprivation''[11] or ''social status''.[12] A famous paper by sociologist Paul Lazarsfeld, entitled ''On the interchangeability of indices'', published in 1937 in the *Psychological Bulletin*[13] contributes to this time honoured practice. He found that in studying the relation between a determinant and an outcome variable, many social indicators caused a similar distribution of this outcome, thus one social indicator could readily be replaced by another. In sociology, psychology, and epidemiology many have followed Lazarsfeld's cue. This is done despite the awareness that education, income, and occupational class should not be used interchangeably,[1–4] because they may relate to (at least partly) different causal processes.[3 14–16] Finally, in review studies the different latent content of these indicators have been carefully elaborated.[9 10 17–19]

We question the practice of using indices interchangably on several grounds. Firstly, it brings theoretical confusion as it is unlikely that education, income and occupational class are related to the same underlying dimension[20]; secondly, the extent to which their relation with health is identical, or even similar, is unclear; thirdly, even if education, income, and occupational class do arrange health outcomes in similar distributions, it does not follow that all three represent the same causal processes.

Accordingly, we studied the relations between education, income, and occupational class (seen as three distinct social dimensions) and four health outcomes, using data from two countries. With this approach we want to show that our conclusions are applicable to different health outcomes, countries, and data sources.

We asked if education, income, and occupational class are each independently linked to health, once the other two are taken into account. Where they are, this casts doubt upon Lazarsfeldt's thesis about ''the interchangeability of indices'' as well as upon the assumption that they all express the same underlying dimension or ''fundamental cause''.[21] Any independent influence of education, income, or occupational class suggests that each is part of a different aetiological mechanism.

METHODS

German data

The German data were provided by a statutory health insurance, the Allgemeine Ortskrankenkasse Mettmann, covering the entire Mettman district in Nordrhein-Westfalen. The material had been collected for accounting purposes and includes information on age, sex, income (individual income before tax), occupational position and education, as well as inpatient treatment with accompanying diagnoses, and type of medication. It includes all insured women and men 1987–1996. A more detailed description had been published earlier.[22]

The analyses of myocardial infarction morbidity and of total mortality are based on 147 264 women and men aged 25–65. In the observation period (1987–1996) there were 2038 cases of myocardial infarction and 2473 deaths (all causes).

Type 2 diabetes was identified by medication data as for this disease the medication is unequivocal. Medication was prescribed for 1700 people, who we classified as having diabetes. As the less severe form of type 2 diabetes does not require medical treatment, our results refer to the more severe forms. Medication data were available for one year only, 1995, and refer to the 97 707 insured people aged 25–74 that year. Thus, this part of the study is cross sectional using prevalence data.

Education, income, and occupational class were defined as described previously,[15] and grouped according to the definitions in the Swedish data (see below) as far as possible.

Swedish data

The Swedish Censuses of 1980 and 1990 were linked to the national Cause of Death Registry for the follow up period 1 November 1990 to 31 December 1995 for all people aged 25–64 in 1990.[23] Those who were self employed in 1990 (232 086 persons), or economically inactive in 1990 and self employed in 1980 (45 869 persons) were excluded. Persons who emigrated in the follow up period were also excluded. Thus analyses are based on follow up of 4 009 938 people during 50 months.

There were 75 231 deaths (all causes). Deaths from acute myocardial infarctions (10 368) were classified by principal cause of death using version 9 of the *International Classification of Diseases* (ICD-9, 410).

Occupational class was grouped into upper and other non-manual workers, skilled manual workers, and semi or unskilled manual workers, according to a collapsed version of the Swedish socioeconomic classification[24]; education level was classified as unknown, basic, lower secondary, upper secondary, tertiary; own gross income from work before tax (includes earnings, sick leave and parental leave benefits) into quintile groups. Education level and income are taken from national registries (1990); occupational class is based on self reported current occupation in the 1990 census, or the 1980 census if information is missing for 1990.

Statistical analyses

Rank order correlations were estimated and Cox and logistic regressions performed. Rank order correlations require variables to be at ordinal level while for the regressions nominal level is sufficient. We however assume the socio-economic variables to be ordinal as education is assumed to measure varying cognitive resources,[9] occupational position ought to depict (varying control over) working conditions,[9 26] and income is related to variations in material conditions.[9] Ordinality is assumed because the differences between categories cannot be determined.

Cox regression[25] was applied (tables 3–6) because it takes time (here: age) into consideration, and can cope with observation periods of differing lengths. Cross sectional data

Table 1 Descriptive data from the study populations

Swedish data Study of total mortality and myocardial infarction mortality		German data		
			Study of type 2 diabetes	Study of total mortality/ myocardial infarction
Variables	**%**	**Variables**	**%**	**%**
Age	47.8* (11.1)	Age	46.2† (12.8)	42.5* (11.8)
Sex		Sex		
Men	49.3	Men	67.6	72.4
Women	50.7	Women	32.4	27.6
Occupational position		Occupational position		
Unclassified	10.3	Unclassified	25.5	13.0
Unskilled workers	28.6	Unskilled/semi-skilled	41.9	42.1
Skilled workers	16.3	Skilled manuals	19.5	20.7
Lower non-manuals	15.7	Skilled non-manuals	10.4	17.9
Upper non-manuals	29.1	Intermediate pos/professionals	2.7	6.4
Education level		Education level		
Unknown or incomplete	4.8	Unclassified	28.1	16.6
Basic (7–9 years)	36.5	Max 10 years without apprenticeship	29.2	28.0
Lower secondary (9–11 years)	25.8	9 or 10 years of school and completed apprenticeship	38.3	47.4
Upper secondary (11–12 years)	10.5	13 years of school with or without having completed apprenticeship	2.0	2.9
University (12+ years)	22.5	University	2.5	5.1
Income		Income		
Missing	8.6	Unclassified	30.7‡	29.6
Lowest 20%	18.3	Lowest 20%	20.6‡	14.7
Second 20%	18.3	Second 20%	17.6‡	14.6
Third 20%	18.3	Third 20%	13.6‡	14.2
Fourth 20%	18.3	Fourth 20%	10.4‡	14.2
Highest 20%	18.3	Highest 20%	7.1‡	12.7
Number	4009938		97707	147264

*Age mean (SD) upon exit. †Age mean in 1995. ‡Income quintiles are defined in the source population of all insured 1987–1996, while diabetes prevalence is based on 1995 data only.

Table 2 Relative risks of morbidity attributable to type 2 diabetes by income, education, and occupational position (German study population, 1700 diabetes cases, controlled for age and sex) as estimated by means of logistic regression

	Model 1		Model 2 (mutually adjusted)	
	Odds ratio	95% CI	Odds ratio	95% CI
Income				
Income: highest 20% (reference category)	1	–	1	–
Income: higher 20%	1.28	0.96 to 1.70	1.22	0.92 to 1.64
Income: mean 20%	1.31	0.99 to 1.73	1.23	0.93 to 1.62
Income: lower 20%	1.38	1.06 to 1.79	1.29	1.00 to 1.69
Income: lowest 20%	1.34	1.03 to 1.74	1.33	1.02 to 1.73
Not classified for income	1.54	1.22 to 1.95	1.66	1.29 to 2.12
Occupational position				
Intermediates/professionals (reference category)	1	–	1	–
Skilled non-manuals	2.53	1.27 to 5.02	1.83	0.90 to 3.73
Skilled manuals	3.40	1.75 to 6.62	2.49	1.24 to 4.99
Unskilled/semi-skilled	3.79	1.96 to 7.35	2.60	1.34 to 5.22
Not classified for occupational position	3.95	2.03 to 7.66	2.77	1.38 to 5.57
Education				
University education (reference category)	1	–	1	–
13 years of school with or without apprenticeship	7.82	2.22 to 27.6	5.65	1.56 to 20.44
9 or 10 yeas of school and completed apprenticeship	6.60	2.12 to 20.6	4.70	1.44 to 15.23
Max 10 years without having completed apprenticeship	8.54	2.74 to 26.25	5.86	1.80 to 19.13
Not classified for education	7.91	2.54 to 24.67	4.41	1.36 to 14.37

on diabetes prevalence were analysed by logistic regression. In all regression analyses, age and sex were controlled for.

In all estimations a two step procedure was applied. The results are initially reported for education, income, and occupational class, adjusted for age and sex only. We refer to these as ''gross effects'' below. In the second step, the effects are estimated simultaneously to examine whether each social dimension shows an effect when the other two are adjusted for as in similar studies.[4 11] We refer to these as ''net effects'', or ''effects after mutual adjustment''. Below findings from gross and net effect models are reported for the three social dimensions by the different health outcomes.

The Swedish data were analysed using SAS, the German data using STATA 8.0.

RESULTS

Rank order correlations between education, income, and occupational class were weak to moderate for both countries. In the German data the correlation between occupational class and education is $r = 0.58$, for income and education it is $r = 0.13$, and for income and occupational class $r = 0.11$. For Sweden the same correlations are 0.55, 0.31, and 0.51. In the German data a comparatively large proportion of the study population cannot be classified. It is a heterogeneous group

Table 3 Relative risks of morbidity attributable to myocardial infarction by income, education, and occupational position (German study population, 2038 myocardial infarctions, controlled for sex) as estimated by means of Cox regression

	Model 1		Model 2 (mutually adjusted)	
	Relative risks	95% CI	Relative risks	95% CI
Income (quintiles)				
Income: highest 20% (reference category)	1	–	1	–
Income: higher 20%	1.20	1.03 to 1.41	1.15	0.98 to 1.35
Income: mean 20%	1.58	1.32 to 1.88	1.48	1.24 to 1.76
Income: lower 20%	1.58	1.29 to 1.93	1.43	1.17 to 1.75
Income: lowest 20%	2.35	1.89 to 2.92	2.25	1.80 to 2.80
Not classified for income	2.04	1.80 to 2.32	2.26	1.98 to 2.58
Occupational position				
Intermediates/professionals (reference category)	1	–	1	–
Skilled non-manuals	1.79	1.14 to 2.83	1.36	0.85 to 2.19
Skilled manuals	3.14	2.05 to 4.82	2.94	1.86 to 4.65
Unskilled/semi skilled	3.56	2.33 to 5.45	3.24	2.05 to 5.14
Not classified for occupational position	5.32	3.48 to 8.16	3.39	2.13 to 5.38
Education				
University education (reference category)	1	–	1	–
13 years of school with or without apprenticeship	2.28	1.00 to 5.16	1.49	0.64 to 3.44
9 or 10 years of school and completed apprenticeship	4.38	2.41 to 7.94	3.34	1.77 to 6.28
Max 10 years without having completed apprenticeship	5.14	2.83 to 9.33	3.49	1.84 to 6.62
Not classified for education	8.11	4.47 to 4.73	4.06	2.14 to 7.67

Table 4 Rate ratios of mortality attributable to acute myocardial infarction by income, education, and occupational position (Swedish study population 1990–95, 10368 deaths, controlled for sex) as estimated by means of Cox regression

	Model 1		Model 2 (mutually adjusted)	
	Rate ratios	95% CI	Rate ratios	95% CI
Income (quintiles)				
Income: highest 20% (reference category)	1	–	1	–
Income: higher 20%	1.42	1.32 to 1.54	1.21	1.11 to 1.31
Income: mean 20%	1.72	1.60 to 1.86	1.38	1.27 to 1.51
Income: lower 20%	2.03	1.87 to 2.21	1.63	1.49 to 1.79
Income: lowest 20%	2.44	2.26 to 2.63	1.89	1.74 to 2.06
Not classified for income	4.62	4.32 to 4.95	3.19	2.94 to 3.46
Occupational position				
Intermediates/executives (reference category)	1	–	1	–
Non-manuals	1.44	1.34 to 1.55	1.06	0.98 to 1.15
Skilled manuals	1.62	1.52 to 1.72	1.08	1.00 to 1.17
Unskilled/semi skilled	1.97	1.87 to 2.09	1.22	1.13 to 1.31
Not classified for occupational position	3.69	3.46 to 3.93	1.49	1.37 to 1.62
Education				
University degree (reference category)	1	–	1	–
Long secondary	1.34	1.22 to 1.47	1.16	1.06 to 1.28
Short secondary	1.71	1.57 to 1.86	1.28	1.16 to 1.41
Basic	2.24	2.09 to 2.40	1.45	1.33 to 1.57
Not classified for education	2.56	2.29 to 2.85	1.32	1.18 to 1.49

consisting of elderly people, but it also contains people receiving welfare, unemployed, and more single women than expected (this might have led to lower correlations in the German as compared with the Swedish data).

Diabetes (German study population)

Diabetes prevalence rates are lower in higher educational and income groups. Rates are lower among professionals, than among unskilled and manual workers (table 2). If the three social dimensions are compared, the gross effect of education is large, that of occupational class is of medium size, and that of income is smaller. The net effects of each social dimension are somewhat smaller. Also after mutual adjustment, belonging to the lower categories in each social dimension has a significant net effect on diabetes prevalence. For education there is no linearity in the gradient. Similarly, diabetes prevalence rates are significantly higher among the unclassified subjects in each dimension, before and after mutual adjustment.

Incidence and mortality of myocardial infarction

In the German myocardial incidence data, the gross effects of education and occupational class are strong, while the effect of income is lower (table 3). The net effects of each social dimension are still considerable (highest RR from 2.3 to 4.1). People in the category of unclassified for education and occupational class have the highest relative risks, before and after mutual adjustment.

In the Swedish myocardial infarction mortality data, the gross effects are of a similar size for education, income, and occupational class (table 4). Unclassified persons had higher relative risks. Net effects are largest for income, particularly for not being classified by income, but there is also a net effect of education and occupational class.

German incidence and Swedish mortality data thus agree on the central point that each of the three social dimensions shows an effect on myocardial infarction, even when the effect of the other two dimensions is taken into account.

All cause mortality

For all cause mortality, in both countries, the highest gross as well as net effects are obtained for income, the highest risks being in the lowest quintile in Germany (table 5) and in those unclassified in Sweden (table 6). In both populations, the gross and net effects of educational position are lower than those of income. In the Swedish data, while the gross effects of occupational class are substantial, the net effects when we take education and income into account are very modest, except for those unclassified for occupation.

Again, in simultaneous estimation the (net) effects are smaller than for separate estimation (gross effects). After mutual adjustment, education, income, and occupational class all show some significant excess risks in both countries, although the magnitude varies.

DISCUSSION

Can the three most frequently studied social dimensions in the health inequalities literature, namely education, income, and occupational class, be used interchangeably? We think not, after having considered four health outcomes in populations from two countries and data sources as follows:

Representativeness and selection bias

The Swedish data are comprehensive and cover almost the entire population, while the German data are regional and less representative in several ways.[15 22] Moreover, occupational class was partly classified by previous occupation (if missing at baseline) in the Swedish but not in the German data. These limitations caution against comparing the size of health inequalities in Germany and Sweden, but are less problematic for our purposes here.

There is likely to be mobility of some persons of poor health into certain categories. Thus, the high relative risks of persons not classified for income or occupational class may in part be the result of ''reverse causation''. Such selection bias is most likely to effect health differences by income, as income tends to fall when someone gets chronically ill. It is less likely to affect health differences by occupational class, and least likely to influence educational differences. Selection bias will therefore tend to inflate income based health differences more than educational health differences. We share this problem with most of the previous literature. When one compares the size of health inequalities by education, income, and occupational class, these differential selection biases must be taken into account.

Table 5 Relative risks of all cause mortality by income, education, and occupational position (German study population, 2473 deaths, controlled for sex) as estimated by means of Cox regression

	Model 1		Model 2 (mutually adjusted)	
	Relative risks	95% CI	Relative risks	95% CI
Income (quintiles)				
Income: highest 20% (reference category)	1	–	1	–
Income: higher 20%	1.35	1.16 to 1.57	1.33	1.14 to 1.54
Income: mean 20%	1.89	1.61 to 2.21	1.85	1.58 to 2.17
Income: lower 20%	3.00	2.55 to 3.50	3.12	2.66 to 3.68
Income: lowest 20%	3.49	2.90 to 4.19	3.70	3.07 to 4.47
Not classified for income	2.76	2.44 to 3.12	3.41	3.01 to 3.87
Occupational position				
Intermediates/professionals (reference category)	1	–	1	–
Skilled non-manuals	1.31	0.98 to 1.77	1.13	0.83 to 1.56
Skilled manuals	1.80	1.36 to 2.37	2.05	1.51 to 2.77
Unskilled/semi skilled	1.92	1.46 to 2.52	2.04	1.50 to 2.79
Not classified for occupational position	1.34	0.99 to 1.81	1.40	1.01 to 1.94
Education				
University education (reference category)	1	–	1	–
13 years of school with or without apprenticeship	1.68	0.98 to 2.90	1.60	0.91 to 2.81
9 or 10 years of school and completed apprenticeship	2.50	1.71 to 3.67	2.45	1.61 to 3.71
Max 10 years without having completed apprenticeship	2.93	2.00 to 4.30	2.74	1.79 to 4.21
Not classified for education	2.60	1.75 to 3.85	2.41	1.57 to 3.73

Status inconsistency

The correlations between education, income, and occupational class were low or moderate, although higher for the Swedish than for the German study population. This result shows that levels of education, income, and class often do not go together, something referred to as status inconsistency in the sociological literature.[27] Thus, considerable status inconsistencies are present in both countries. It has been suggested that status inconsistency carries its own health risks.[28] Treating education, income, and occupational class as indicators of the same underlying concept effectively ignores this hypothesis.

Previous practice

The practice of using indicators interchangeability that we criticise above is understandable. It is unusual to have access to data on education, income, and occupational class in the same study. Mortality studies in the UK, for instance, are often based on information from death certificates containing the registrar general's measure of social class,[11] while data on education and income are unavailable. Even when data on all three dimensions do exist, and even when the most common diseases are in focus, the number of cases may be a limiting factor. Broken down by three variables each with several categories, confidence intervals soon become large and estimates may become unstable, making detailed analyses futile. However, today a sufficient number of large databases exist to go beyond this practice.

Considering gross and net effects

We estimated the gross effect of each social dimension (adjusting for age and sex only). All three had effects on each outcome in both populations. As far as the effects had been statistically significant, the usual social gradient was found

Table 6 Rate ratios of all cause mortality by income, education, and occupational position (Swedish study population 1990–95, 75231 deaths, controlled for sex) as estimated by means of Cox regression

	Model 1		Model 2 (mutually adjusted)	
	Rate ratios	95% CI	Rate ratios	95% CI
Income (quintiles)				
Income: highest 20% (reference category)	1	–	1	–
Income: higher 20%	1.33	1.29 to 1.37	1.25	1.21 to 1.29
Income: mean 20%	1.69	1.64 to 1.74	1.54	1.50 to 1.59
Income: lower 20%	2.17	2.11 to 2.24	1.95	1.89 to 2.02
Income: lowest 20%	2.60	2.52 to 2.67	2.19	2.13 to 2.26
Not classified for income	4.90	4.77 to 5.03	3.53	3.42 to 3.65
Occupational position				
Intermediates/executives (reference category)	1	–	1	–
Non-manuals	1.40	1.36 to 1.43	1.06	1.04 to 1.10
Skilled manuals	1.42	1.38 to 1.45	1.02	0.99 to 1.05
Unskilled/semi-skilled	1.65	1.61 to 1.68	1.07	1.03 to 1.09
Not classified for occupational position	3.54	3.46 to 3.63	1.45	1.41 to 1.50
Education				
University degree (reference category)	1	–	1	–
Long secondary	1.21	1.17 to 1.25	1.05	1.02 to 1.09
Short secondary	1.44	1.40 to 1.48	1.13	1.09 to 1.16
Basic	1.78	1.74 to 1.83	1.20	1.17 to 1.24
Not classified for education	3.10	3.00 to 3.21	1.64	1.58 to 1.70

What is already known on this topic

Education, income, and occupational class are known to be associated with health outcomes, but their explanatory power has rarely been considered in comparison.

What this paper adds

The effects of education, income, and occupational class are rather outcome specific. They cannot be used interchangeably as indicators of a hypothetical latent social dimension. Although correlated, they measure different phenomena and tap into different causal mechanisms.

with the only exception being the effects of education on diabetes. This deviation from the general findings cannot be interpreted with sufficient clarity, because the confidence intervals are large, which again points to a problem arising out of having chosen the intermediates/professionals as reference group. This accords with the findings in most of the health inequalities literature, which frequently reports on gross effects, often taking the finding of a gross effect (say of income) as support for the existence of another (say of education).

We also considered the independent (net) effect of each of the three social dimensions by adjusting for the other two dimensions. For diabetes, education had the strongest net effect; for myocardial infarction incidence the net effects of education and occupational class were similar, in both cases stronger than the net effect of income. For myocardial infarction mortality the net effects were more similar in size. Finally, income tended to have the strongest net effects on all cause mortality in both countries.

Interestingly, another study[14] that simultaneously looked at the effect on all cause mortality of education and occupational class, concluded that occupational class was the more powerful discriminator; our results suggest that this priority may not exist when income is taken into account simultaneously.

A typical problem in health inequalities research is to explain why educational categories, income groups, or occupational classes differ in health. It is obvious that this problem may change completely if one moves from focusing only on the gross effects of each one of these dimensions to taking all of them into account simultaneously. Occupational classes, for instance, differ from each other in many ways, most obvious in income and education. The common idea that choosing an occupationally based social class measure in a study, shows a preference for the belief that occupational hazards are especially important is a misunderstanding, based on not distinguishing between unadjusted (gross) and adjusted (net) effects. However, the finding of a net effect of occupational class when education and income are adjusted for does indeed point to characteristics of the work itself.

Comparing the magnitude of gross effects with that of net effects is therefore informative. In our study gross effects are sometimes much larger than, sometimes almost similar to, net effects. If gross effects are twice as large as net effects, differences between compared groups are halved after mutual adjustment. Such a finding could be interpreted as meaning that differences by education, income, or occupational class are in roughly similar degrees dependent on (1) their mutual associations with each other and (2) the independent effect of each characteristic. Treating education, income, and occupational class as indicators of the same latent dimension or fundamental cause ignores their sometimes sizeable independent and distinct contributions to health.

The net effects of occupational class show that workplace organisation has longlasting effects. This primarily concerns the physical work environment as an important health determinant. Secondly, the way how work itself is organised matters. The imbalance of effort and reward and job control is often discussed in particular in relation to circulatory disease.[26 29–31] Taken together with earlier research on the effects of work on personality[32] one might suggest that the degree of work control in the long run may affect a person's perception of opportunities to influence one's own life, including health. However, a large segment of the literature on work environment factors examines work characteristics without taking into account income or educational differences between people with different jobs.

Net effects of income: income, particularly lifetime accumulated income, translates into material or immaterial resources for health, such as better housing, clothing, food, and resources for mastering stressful and demanding situations, for example, by seeking professional help. Income determines opportunity for health promoting lifestyles, although the effects of health related behaviours on health are not conditional on income.[33 34] As income provides resources to control one's circumstances it may be of more general health advantage than is a high occupational class.

Net effects of education: education can be taken as a marker of childhood social environment. It also shows differences in awareness among adults, in the ability to turn information into practical measures and behaviour, for instance how to avoid or manage a disease. Erikson, who asked ''why do graduates live longer''[35] suggested this was because they had more control over their own lives than others. The benefits of education for patients was shown in a study, which found that low health literacy was associated with low glycaemic control, poorer progress of the diabetes disease, and retinopathy.[36] Better education also facilitates the understanding of therapeutic measures, resulting in better compliance[37] and higher commitment to treatment.

All this said, we acknowledge that there are indeed structural links between education, income, and occupational class, a fact that has deep sociological significance and that permitted Lazarsfeldt to suggest that all three would give rise to a similar distribution of any specific (psychological) outcome. This fact has also become part of the justification today for looking for ''fundamental causes'' of health inequalities. However, we suggest it will be easier, rather than more difficult, to understand why health inequalities are reproduced in each new generation despite steadily falling mortality rates and changes in disease causing mechanisms,[38] if we can disentangle, rather than ignore, the respective contributions of education, income, and occupational class to this persistent pattern.

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