Own education, current conditions, parental material circumstances, and risk of myocardial infarction in a former communist country

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Abstract

***Objective*—To study the association between own education, adult and parental circumstances and the risk of myocardial infarction in a former communist country.**

***Design*—Population based case-control study.**

***Setting*—General population of five districts of the Czech Republic in the age group 25–64 years.**

***Participants*—Random sample of population (938 men and 1048 women, response rate 77%) served as controls to 282 male and 80 female cases of non-fatal first myocardial infarctions.**

***Main outcome measures*—Myocardial infarction was defined by the WHO MONICA criteria based on ECG, enzymes and symptoms. The following socioeconomic indicators were studied: own education, crowded housing conditions (more than one person per room), car ownership, and education and occupation of mother and father.**

***Results*—There was a weak correlation between education and car ownership, and a strong association between own education and parental education and occupation. Crowding was not related to other socioeconomic factors. The risk of myocardial infarction was inversely related to education, and was unrelated to material conditions and parental education and occupation. The age-sex-district adjusted odds ratios for apprenticeship, secondary, and university education, compared with primary education, were 0.87, 0.74 and 0.46, respectively (p for trend 0.009); odds ratios for car ownership and crowding were 1.01 (95% confidence intervals 0.77, 1.34) and 0.92 (0.76, 1.12), respectively. Further adjustment for parental circumstances and adult height did not change these estimates but adjustment for coronary risk factors reduced the gradient. Increased height seemed, anomalously, to confer a small increased risk.**

***Conclusions*—In this population, the social gradient in non-fatal myocardial infarction is only apparent for own education. Materialist explanations for this gradient seem unlikely but behaviours seem responsible for a part of the gradient.**

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Studies in western populations have repeatedly found that rates of coronary heart disease (CHD) are higher in lower socioeconomic groups. Mortality differentials by socioeconomic status have been observed with different indices: education, housing tenure, car ownership, income, and characteristics of areas that relate to material deprivation (referred to here as the "gradient").[1–3] The debate as to whether the gradient is attributable to primarily material circumstances or psychosocial aspects of the social environment[4] is important for potential intervention strategies. Studies investigating this question in western populations have been inconsistent, mainly because of strong intercorrelations between these dimensions of the socioeconomic environment.[2 5–7]

One way to approach this problem is to study the effects of different socioeconomic factors in a population where they are not, or less strongly, mutually correlated. Such a situation occurred, at least by anecdotal accounts, in the former communist countries where the equity goals were not only proclaimed but also pursued. Available data suggest that income distribution in these countries was indeed substantially more egalitarian than in the west.[8 9] The issue of a gradient in these societies is important for at least one additional reason: it is of a practical interest whether the intensively followed programmes of income equalisation removed socioeconomic differences in health.

In addition to adult socioeconomic conditions, there has been growing interest in the role of childhood socioeconomic circumstances as determinants of cardiovascular disease in adulthood.[10–14] As it is possible that the change of the social gradient in CHD, which occurred in the west sometimes in the 1950s,[15 16] was delayed in eastern Europe, it is also interesting to compare the gradients in disease by childhood and adult circumstances in central and eastern European populations.

We have conducted a population based case-control study in the Czech Republic, a former communist country, to investigate these questions. The study was conducted in 1992–93; the assumption is that cases occurring in this period reflected the conditions that prevailed in the country up to the political changes that began in 1989.

Methods

In collaboration with the Czech MONICA Project,[17 18] we have set up a population based case-control study in five participating districts. All cases of first non-fatal myocardial

Table 1 Descriptive characteristics of cases and controls (percentages in parentheses)

	Men		*Women*	
	Cases	*Controls*	*Cases*	*Controls*
Number of subjects	279 (100)	938 (100)	79 (100)	1048 (100)
Age group				
25–34	5 (2)	208 (22)	0 (0)	234 (22)
35–44	34 (12)	308 (33)	6 (8)	310 (30)
45–54	120 (43)	238 (25)	22 (28)	276 (26)
55–64	120 (43)	184 (20)	51 (65)	228 (22)
Own education				
Primary	59 (21)	110 (12)	39 (49)	314 (30)
Apprenticeship	132 (47)	475 (51)	24 (30)	306 (29)
Secondary	70 (25)	253 (27)	16 (20)	370 (35)
University	18 (7)	100 (11)	0 (0)	58 (6)
Car ownership				
No	66 (24)	235 (25)	34 (43)	329 (31)
Yes	213 (76)	703 (75)	45 (57)	719 (69)
Crowding				
No	187 (67)	502 (54)	62 (79)	604 (58)
Yes	92 (33)	436 (46)	17 (22)	444 (42)
Mother's education				
Primary/vocational	250 (90)	805 (86)	72 (92)	892 (86)
Secondary	27 (10)	122 (13)	5 (6)	142 (14)
University	1 (0)	9 (1)	1 (1)	7 (1)
Father's education				
Primary/vocational	232 (84)	696 (75)	65 (88)	788 (76)
Secondary	36 (13)	206 (22)	7 (9)	216 (21)
University	8 (3)	28 (3)	2 (3)	30 (3)
Mother's occupation				
Industrial worker	74 (27)	333 (36)	20 (26)	377 (37)
Agricultural worker	67 (24)	206 (22)	19 (25)	229 (22)
Non-manual	24 (9)	103 (11)	6 (8)	109 (11)
Professional	26 (9)	139 (15)	3 (4)	168 (16)
Not working	86 (31)	147 (16)	28 (36)	145 (14)
Father's occupation				
Industrial worker	136 (49)	465 (50)	38 (54)	465 (46)
Agricultural worker	59 (21)	131 (14)	16 (23)	166 (16)
Non-manual	41 (15)	168 (18)	12 (17)	223 (22)
Professional	36 (13)	149 (16)	3 (4)	144 (14)
Not working	3 (1)	8 (1)	1 (1)	14 (1)

infarction (MI) in the age group 25–64 years, identified by the existing register of MI and fulfilling the WHO MONICA criteria of definite or probable MI,[19] were considered eligible. Definite MI was defined (1) by certain ECG, or (2) by probable ECG plus abnormal enzymes, or (3) by typical symptoms and uncertain or unavailable ECG and enzymes. A total of 380 non-fatal first MI occurred in the five districts over the period 15 March 1992–14 March 1993, and all have agreed to participate in the study.

An age stratified random sample, drawn from the population registers of the five districts, served as controls for the cases. Subjects were invited by mail, and non-responders were sent up to three reminders; 984 men and 1068 women participated in the study (final response rate 77%). Non-participants were sent a short mail questionnaire, which was returned by 71% of them.

Cases were recruited in hospitals and cardiological outpatient clinics. Over 97% of cases were interviewed within two weeks after the infarction, before discharge from the hospital; the few cases hospitalised outside their districts were interviewed in outpatient clinics. Controls were invited to be interviewed in their local hospital. Data on cases and controls were collected by identical protocol, by personnel of the local hospital. The questionnaire included socioeconomic, demographic, childhood and psychosocial factors, life styles and health behaviours. History of having high blood pressure and high cholesterol diagnosed by a doctor was taken, and the subjects underwent anthropometric measurements. Own education was categorised into primary, apprenticeship, secondary and university, according to Czech census. Subjects reported whether their household owned a car and the number of rooms and people in their house/flat. Crowding was defined as more than one person per room. The questionnaire included three categories of mother's and father's education (primary/apprenticeship, secondary and university), and names of mother's and father's occupations, which were classified into five categories (industrial manual; agricultural manual; non-manual clerical; professional; and not working).

After excluding subjects with missing information on socioeconomic status, the analyses used data on 279 male and 79 female cases and 938 male and 1048 female controls. Associations between adult height, as a measure of childhood social circumstances, and parental and adult socioeconomic circumstances, were assessed by linear regression for men and women separately, adjusting for age and district. The associations between socioeconomic factors and MI was estimated by unconditional logistic regression. As there was no significant interaction between any socioeconomic factor and sex, data for both sexes were pooled. Firstly, odds ratios for MI by categories of socioeconomic factors were adjusted for sex, age as a continuous variable, and district. Secondly, odds ratios for adult own socioeconomic status were adjusted for a range of coronary risk factors. Finally, odds ratios of MI were estimated in a model incorporating parental, childhood and current circumstances.

Results

Table 1 shows descriptive characteristics of the cases and controls. The large differences in age distribution between cases and controls reflect their selection. The study recruited all incident cases, and accordingly their age distribution reflects the increasing incidence of MI with age. Controls were a population random sample stratified for age, and their ages are therefore equally distributed. These differences in age structure affect the crude comparisons of cases and controls with respect to their socioeconomic status, as age is related to both education (younger persons tend to be better educated) and material circumstances (older people tend to live in better conditions). All further case-control comparisons in the paper are adjusted for age.

Table 2 shows correlations between own education, parental education and current material circumstances in controls. Car ownership was more common among subjects with

Table 2 Correlation coefficients between current and parental socioeconomic circumstances in the population sample (controls)

	Own education	*Car ownership*	*Crowding*	*Mother's education*	*Father's education*
Own education	1.0				
Car ownership	0.17	1.0			
Crowding	0.03	0.01	1.0		
Mother's education	0.31	0.03	0.01	1.0	
Father's education	0.32	0.05	0.02	0.52	1.0
Adult height	0.22	0.12	0.07	0.10	0.11

Table 3 Odds ratios (95% confidence intervals) for socioeconomic characteristics and risk of MI, both sex combined

	Adjusted for age, sex and district	*Fully adjusted**
Education		
Primary	1.0	1.0
Apprenticeship	0.87 (0.63,1.20)	0.93 (0.64,1.32)
Secondary	0.74 (0.52,1.07)	0.85 (0.57,1.26)
University	0.46 (0.25,0.84)	0.60 (0.31,1.15)
p for trend	0.009	0.142
Car ownership		
No	1.0	1.0
Yes	1.01 (0.77,1.34)	1.27 (0.93,1.75)
Crowding		
No	1.0	1.0
Yes	0.92 (0.76,1.12)	0.83 (0.61,1.13)

*Age, sex, district, smoking, waist-hip ratio, history of diabetes, hypertension, and hypercholesterolaemia, and all socioeconomic characteristics in one model.

higher education, and crowding was associated with neither education nor car ownership. Parental education was only weakly associated with current material circumstances, and moderately associated with own education. Own education was also related to parental occupation but this was largely explained by parental education (not shown).

Age and district adjusted associations between socioeconomic characteristics and MI were similar in both genders (not shown) and data were therefore pooled. The odds ratios for MI declined with education but did not show any significant relation to car ownership or crowding (table 3). Adjustment for coronary risk factors (smoking, waist-hip ratio, and history of hypertension, hypercholesterolaemia and diabetes; the last column of table 3) somewhat reduced the odds ratios for education and the trend lost statistical significance. Car ownership and crowding remained unrelated to MI.

Table 4 Association between height and own and parents' socioeconomic status, by sex (differences from the baseline category, in cm, adjusted for age and district)

	Age and district adjusted	
	Men	*Women*
Own education		
Primary	—	—
Vocational	2.27 (0.67)***	0.93 (0.46)*
Secondary	3.78 (0.72)***	2.26 (0.44)***
University	4.08 (0.86)***	3.52 (0.78)***
Car ownership		
No	—	—
Yes	1.39 (0.36)*	1.27 (0.37)*
Crowding		
No	—	—
Yes	−0.60 (0.44)	0.23 (0.25)
Mother's education		
Primary/vocational	—	—
Secondary	1.89 (0.56)*	1.27 (0.46)*
University	4.38 (1.39)*	3.18 (0.96)*
Father's education		
Primary/vocational	—	—
Secondary	1.83 (0.45)*	1.29 (0.41)*
University	2.45 (1.55)	2.34 (0.74)*
Mother's occupation		
Industrial worker	—	—
Agricultural worker	−0.73 (0.57)	0.31 (0.42)
Non-manual	1.02 (0.43)	1.40 (0.68)
Professional	2.02 (0.42)**	1.99 (0.46)**
Not working	0.14 (0.64)	−0.44 (0.24)
Father's occupation		
Industrial worker	—	—
Agricultural worker	−0.38 (0.88)	−0.02 (0.75)
Non-manual	2.28 (0.76)*	1.92 (0.75)
Professional	2.33 (0.68)*	1.50 (0.54)*
Not working	1.29 (4.28)	1.27 (4.66)

*p<0.05; **p<0.01, ***p<0.001.

KEY POINTS

- In contrast with western populations, education and material circumstances are only weakly associated in the former communist countries.
- We found that the risk of myocardial infarction was strongly related to education but not to car ownership, crowding, or parental education and occupation.
- Risk factors explained part of the educational gradient.
- These results suggest that material explanations for the educational gradient in myocardial infarction are unlikely. Health behaviours and psychosocial or developmental factors associated with success of failure in education may explain inequalities in the risk of myocardial infarction.

We were interested in whether the association between education and MI may be influenced by socioeconomic circumstances in childhood. Own education was related to parental education and occupation; men and women with parents with higher education and non-manual clerical and professional occupations were more likely to achieve university education (not shown). Height, seen as an index of material circumstances in childhood, was associated most strongly with own education, somewhat less with parental education and occupation, weakly with car ownership, and not at all with crowding (table 5).

Parental education was positively associated with MI; age-sex-district adjusted odds ratios for father's and mother's education (university versus primary) were 1.51 (95% CI 0.71, 3.22) and 1.52 (0.32, 7.29), respectively (table 6). Odds ratio for 1 cm increase in adult hight was 1.02 (95%CI 1.00, 1.04). There was a slightly increased risk of MI among subjects whose mothers did not work, but there was not reduction in risk among those with parents in professional occupations. Controlling for these variables did not change the effects of own education at all.

Discussion

In this former communist country, one's own education was related to risk of MI in the expected direction (that is, inversely), but current material circumstances or parental socioeconomic characteristics were not associated with the disease.

Evidence that a strong educational gradient in mortality existed in communist and post-communist societies has recently emerged. Although cause specific mortality has been examined only in a minority of the studies, it seems that educational differences in mortality are a general phenomenon in central and eastern Europe.[20–27] Unfortunately, these studies have not examined the role of other socioeconomic factors. Our previous study on risk factors[28] and this report on myocardial

Table 5 Odds ratios (95% confidence intervals) of MI for adult and parental socioeconomic status

	Adjusted for age, sex and district	*Adjusted for age, sex, district and all variables in the table*
Education		
Primary	1.0	1.0
Apprenticeship	0.87 (0.63, 1.20)	0.84 (0.59, 1.20)
Secondary	0.74 (0.52, 1.07)	0.68 (0.45, 1.02)
University	0.46 (0.25, 0.84)	0.40 (0.21, 1.77)
p for trend	0.009	0.003
Car ownership		
No	1.0	1.0
Yes	1.01 (0.77, 1.34)	1.15 (0.85, 1.56)
Crowding		
No	1.0	1.0
Yes	0.92 (0.76, 1.12)	0.91 (0.68, 1.22)
Height (per 1 cm increase)	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)
Mother's education		
Primary/vocational	1.0	1.0
Secondary	1.20 (0.78, 1.84)	1.67 (0.91, 3.07)
University	1.52 (0.32, 7.29)	2.23 (0.38, 13.3)
p for trend	0.341	0.074
Father's education		
Primary/vocational	1.0	1.0
Secondary	0.74 (0.51, 1.07)	0.73 (0.45, 1.18)
University	1.51 (0.71, 3.22)	1.50 (0.59, 3.86)
p for trend	0.592	0.742
Mother's occupation		
Industrial worker	1.0	1.0
Agricultural worker	1.02 (0.72, 1.45)	1.05 (0.69, 1.59)
Non-manual	1.55 (0.96, 2.50)	1.77 (1.07, 2.93)
Professional	1.00 (0.63, 1.61)	0.84 (0.44, 1.63)
Not working	1.44 (1.02, 2.03)	1.55 (1.07, 2.24)
Father's occupation		
Industrial worker	1.0	1.0
Agricultural worker	0.92 (0.66, 1.29)	0.95 (0.63, 1.43)
Non-manual	1.07 (0.74, 1.55)	1.04 (0.69, 1.56)
Professional	0.76 (0.51, 1.14)	0.87 (0.51, 1.48)
Not working	1.62 (0.50, 5.32)	1.63 (0.48, 5.50)

infarction suggest that education has been the main factor producing the gradients in coronary heart disease in these societies, at least until the early stages of the transition.

Parental factors and adult height were not associated with the risk of MI in the expected direction. Height was strongly associated with own education and less strongly with parental education and occupation (table 4). This association of height and own education lends support to the notion that one's level of education can be taken, in part, as a surrogate for the quality of childhood circumstances and experiences. However, higher levels of education were protective for MI whereas increasing height and maternal education seemed to confer a small risk. The former observation is consistent with studies in other countries, and with an interpretation that both own socioeconomic status and childhood experiences can affect the risk of MI in adulthood.[13 14 29]

The result on height is, however, anomalous, because tall stature is usually[30] (although not always[31]) found to be protective. Our best speculation as to the reasons for this are as follows. The population in this study were made up of those who "came of age" in post-war Czechoslovakia. The Soviet style regime would have distributed social rewards differently from before the war. As education was an important social reward, higher levels of education conferred health benefits. On the other hand, tall stature would likely be a property of the children of more privileged parents from the pre-Soviet era. After the war, these families would have experienced, on average, a loss of privilege. Thus, for specific historical/contextual reasons, tall stature might be a surrogate for adverse life experiences during the Soviet era. It is also possible that the Czech Republic, and perhaps other former communist countries, may have lagged behind western countries in development of the inverse gradient in coronary heart disease. This is also consistent with absence of the expected inverse relation between the risk of MI and parental socioeconomic circumstances and adult height.

Although case-control studies are generally thought of as more prone to bias than cohort studies, we believe that these results were not because of a major bias. We have attempted to recruit all incident non-fatal cases in the study population over one year. None of the identified cases refused to participate, and the final number of cases agrees well with numbers of registered infarction in other years.[32] Preferential recruitment of taller cases seems unlikely. Response rate among controls was 77%, and if non-responders were substantially more likely to have low education, the educational gradient found in our study could potentially be overestimated. However, this was not the case. A short mail questionnaire was obtained from 71% of non-responders. The proportions of subjects with primary education or apprenticeship were similar in responders and non-responders: 61% and 60%, respectively. There were no differences in other socioeconomic characteristics. Even in the unlikely instance that all 29% of non-responders with no data (less than 7% of all controls) had primary education, the educational gradient would remain strong.

The second potential problem arises from the fact that only surviving cases of first MI were included in the study. This could have introduced bias because survival may be positively related to socioeconomic status[33–35] and, potentially, to height. Subjects with higher socioeconomic status would be over represented among cases, leading to underestimation of the effects of socioeconomic factors. However, to produce results such as we found would require a high degree of differential survival by material factors, education and height. This seems unlikely. Because risk factors used in multivariate analyses might change after a coronary event, information on their history (before the MI) was used instead of direct measurements. Bias related to measurement of height may also have occurred, as cases were measured during hospitalisation, and some doctors delegated the anthropometric measurements to nurses. It is likely, however, that such bias would be random, and should not lead to spurious results.

There is no clear cut definition of social stratification in post-communist societies.[36] The three socioeconomic factors in adulthood studied in this project were therefore selected to reflect different aspects of the socioeconomic environment. Despite a general trend towards higher income among better educated groups after 1990,[37] the data have confirmed the anecdotal impression that in the former communist societies better education was not rewarded systematically by better material

conditions. We have found a weak relation between education and car ownership, and crowding was unrelated to the two other socioeconomic indicators.

Because of the absence of an open housing market, residential mobility was low, and people often relied on their families. It was not unusual for two or three generations to live in one house. New flats were, in general, allocated by employers or local authorities on the basis of two criteria: political reliability and labour force needs. In consequence, two broad groups were privileged: members of the party and preferred occupations. Neither of these criteria were necessarily related to other life circumstances. Most party members were not substantially richer or better educated than the rest of the population, and the preferred occupations often included manual workers without much education. There was an unofficial market in properties, and in some instances the above described allocation of flats owned by the state (or a factory) could be influenced by under the table payments, but the scale of such a "market" was probably small.

Car ownership can be taken as a measure of economic circumstances. There was a car market in Czechoslovakia before 1989 (although the variety of cars was limited), and car ownership was generally considered both desirable and a symbol of better position.[37] Data on income were not collected in this study, although it was considered at the design stage. Our Czech collaborators opposed questions on income for fears that this would jeopardise the response rate. In addition, the programme of restitutions initiated in 1990, which returned the property confiscated by the communist after 1948 to their original owners or their descendants, substantially changed the distribution of economic means by 1992, and the new reality would not be accurately reflected by data on income.

Education has been free and, although the allocation of university places was influenced politically, particularly in the 1950s, it was generally accessible to most people. The perception of education was somewhat paradoxical: it was not considered a road to success but it commanded high prestige.[37] For example, 62% of Czech in 1992 considered education important for achieving success in life, compared with 97% of British or 98% of Germans.[37] At the same time, education was important for self perception of own social status, although it was not rewarded by higher income. In the mid-1980s, wages of university educated men and women were only 27% and 40%, respectively, higher than of primary educated persons.[37] International comparisons also confirm the weak association between income and education in the Czech Republic; for example, a Czech doctor earned 1.5 times more than a qualified worker in 1992, compared with a ratio of 2.7 in Britain.[37] The importance of education for income somewhat increased after the fall of communism in 1989, but the relation in 1992 was similar to the pre-1989 situation.[37] On the other hand, as the educational gradient in most risk factors increased after 1989, mainly from non-economic reasons,[38] a part of the observed gradient in MI in this study might be attributable to post-1990 changes.

What possible mechanisms explain the educational gradient? We have previously shown that coronary risk factors are strongly related to education but not to material conditions,[28] and can therefore contribute to the gradient in MI. In this study, the educational gradient was reduced by adjustment for coronary risk factors. This points to health behaviours that reflect both individual and collective patterns.

Risk factors explained only part of the education gradient in MI, and the existence of other mediating factors is likely. These may include further physical or dietary factors, but may also include psychosocial factors. We have shown that among working men in our study, job decision latitude was strongly related to risk of MI, and explained a substantial part of the educational gradient in MI.[39] In fact, the combination of biological/behavioural factors and job control explained the entire educational gradient among working men. Although the biological mechanisms by which psychosocial factors would affect risk of MI are unclear, psychosocial factors, such as social isolation, social networks, psychosocial work environment or perceived control, may contribute to the gradient in coronary heart disease.

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