Socio-economic influences on self-rated health in Russian men and women – a life course approach

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Abstract

Socio-economic differentials in health in Russia are not well understood and the life course approach has been relatively neglected. This paper examines the influence of socio-economic risk factors over the life course on the self-rated health of older Russian men and women. A random sample (response rate 61%) of the general population of the Russian Federation in 2002 included 1004 men and 1930 women aged 50 years and over in a cross-sectional study. They provided information concerning their childhood circumstances (including going to bed hungry); education; current social conditions (including per capita household income); health behaviours and self-rated health.

There was considerable tracking of adverse social conditions across the life course with men and women who reported hunger in childhood having lower educational achievements, and current household income was strongly influenced by educational attainment. The effect of these socio-economic risk factors on health accumulated, with an odds ratio of poor health of 1.87 [1.07-3.28] for men with one risk factor, 3.64 [2.13-6.22] for two risk factors and 4.51 [2.57-7.91] for all three compared to men with no risk factors. For women, the odds ratios were 1.44 [1.05-2.01], 2.88 [2.10-3.93] and 4.27 [3.03-6.00] for one, two and three risk factors respectively. Current income was the strongest individual predictor for men, and education for women. Adjustment for health behaviours reduced the odds ratios only marginally.

The results suggest that self-rated health in older Russians reflects social exposures accumulated over the life-course, with the differentials observed only partially explained by current social conditions. Health behaviours were not involved in mediating social differences in self-rated health. Our results indicate that a life-course approach may contribute to the understanding of health in Russia.

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Introduction

Socio-economic differentials in health in Russia are not well understood, partly because of the limited number of individual-level studies conducted in the Russian population so far. Several investigators have reported educational differences in mortality (Bobak, Murphy, Rose & Marmot, 2003; Davis, Deev, Shestov, Perova, Plavinskaya, Abolafia et al. 1994; Dennis, Zhukovski, Shestov, Davis, Deev, Kim et al. 1993; Malyutina, Bobak, Simonova, Gafarov, Nikitin & Marmot, 2004; Shkolnikov, Leon, Adamets, Andreev & Deev, 1998) and self-rated health (Bobak, Pikhart, Hertzman, Rose & Marmot, 1998; Carlson, 2001; Carlson, 2000); even less is known about marital status (Malyutina et al., 2004) and material conditions (Perlman, Bobak, Pikhart, Singh-Manoux, Bartley, Rose et al. 2004). Socio-economic differentials are of increasing interest since there is evidence that recent fluctuations in mortality have affected lower social groups disproportionately (Plavinski, Plavinskaya & Klimov, 2003; Shkolnikov et al., 1998; Shkolnikov, Deev, Kravdal & Valkonen, 2004; Murphy, Bobak, Nicholson, Rose & Marmot, 2004)The extent to which health behaviours, especially alcohol consumption, mediate the link between social factors and mortality is a matter of debate (Bobak & Marmot, 1999; Leon, Chenet, Shkolnikov, Zakharov, Shapiro, Rakhmanova et al. 1997; McKee, Shkolnikov & Leon, 2001).

One of the major advances in research on socioeconomic determinants of health has been the recognition of the importance of social exposures experienced throughout the life course. Causal pathways may represent either accumulation of risk in which separate insults add up to increase risk, or chains of risk in which one bad experience leads to another with the final experience leading to disease, although clustering of risk factors and independent effects from factors along a chain of risk complicate this division. In the critical period model, an exposure occurring during a specific period (e.g. in utero) has effects on the structure or function of organs which may lead to disease later in life but whose effect may be modified by later exposures (Ben Shlomo & Kuh, 2002; Kuh, Ben Shlomo, Lynch, Hallqvist & Power, 2003). Lifetime socioeconomic influences have been

examined for a variety health outcomes, such as cardiovascular disease (Lynch, Kaplan, Cohen, Kauhanen, Wilson, Smith et al. 1994; Smith, Hart, Blane, Gillis & Hawthorne, 1997; Wannamethee, Whincup, Shaper & Walker, 1996), hypertension and diabetes. Socioeconomic influences on adult self-rated health have been examined in detail by Power et al in the UK 1958 birth cohort (Power, Matthews & Manor, 1998; Power, Manor & Matthews, 1999) and in the Netherlands by van de Mheen (van de Mheen H., Stronks, Looman & Mackenbach, 1998; van de Mheen H., Stronks, van den & Mackenbach, 2004). Both investigators report a persisting independent effect of social conditions in childhood on adult self-rated health.

To date, the life course approach has been largely neglected in the investigation of social influences on health in Russia. The effect of childhood experience on adult health is of great potential interest as social policy and ideology in the Soviet Union under Communist rule might suggest that tracking of adverse social conditions throughout life was less likely to occur, with, for example, income less closely associated with education. Thus social chains of risk may be weaker and risk may not accumulate in the same way as in the West. With a few exceptions (Sparen, Vagero, Shestov, Plavinskaja, Parfenova, Hoptiar et al. 2004; Stanner, Bulmer, Andres, Lantseva, Borodina, Poteen et al. 1997), there is a lack of suitable datasets in Russia with data from childhood onwards.

We used cross-sectional data from Russian men and women over 50 years of age in 2002 to examine socio-economic influences at different stages of life on current self-rated health. This paper has three related aims. First, to investigate the social chains of risk over the life course. Second, to examine whether socio-economic variables at various stages of life are associated with adult self-rated health, whether there is a persisting effect from childhood, and whether the risk accumulates over the life course. And finally, to study the extent to which these associations are mediated by current health behaviours.

Methods

Subjects

A cross-sectional survey of national samples of the Russian population was conducted in 3 waves in July, September and November 2002. The data were collected in collaboration with the Levada Center, Moscow, and the New Russia Barometer survey program programme(New Russia Barometer Survey, 2004). The population sample was selected in a multi-stage process as follows: the whole Russian Federation was first stratified into 10 large economic-geographical regions, and each region was further stratified into urban and rural areas. Within this framework, towns and settlements were randomly selected proportionately to population size. Within these locations, primary sampling units (locations) were randomly drawn. In each primary sampling unit, an address was randomly selected, and interviewers were instructed to seek a face-to-face interview at every n-th eligible household. At each address, the interviewer asked for a respondent matching an age-sex-education grid, and if more than one respondent was eligible, the person with the most recent birthday was selected.

In total, 11,776 households containing an eligible respondent were identified. Of these 3837 declined to be interviewed, 608 were unable to answer due to bad health or other reasons, 159 interviews were interrupted or rejected during control, yielding an overall response rate of 61%. A total of 7172 respondents, (2825 male, 4347 female) were successfully interviewed (2407, 2359 and 2406 in the July, September and November rounds respectively). There was deliberate oversample of 900 Moscow residents. The distribution of respondents in the 10 different regions was as follows. 30% lived in the Central region; approximately 10% in each of the Urals, North and North-West, Povolzhskii, North Caucasus, Western Siberia; and approximately 5% in each of Volga-Viatka, Central Chernozemnyi, Eastern Siberia and Far East. The sampled population had more women, was older and better educated than the national population.

Since socio-economic differentials, and specifically the effects of childhood conditions on adult health, may alter during the life course, we felt it would be inappropriate to consider the whole population, aged 16 to 90 years plus, in one group. In addition, the swings in Russian history during the twentieth century mean that the exposure variables, such as educational attainment, may have different meaning for different age-groups. For

these reasons, we focused on the 3063 respondents who were aged 50 years and over and thus were all born before 1952; their childhood, education, transition into the labour market, and a substantial proportion of their employment had occurred under Soviet rule.

Measurements

Respondents answered questions concerning their current health. The outcome variable for this study was self-reported physical health which was assessed on a 5 point scale: excellent, good, average, poor and very poor. This was converted to a binary variable with poor or very poor coded as poor health.

Socioeconomic data were available on three different stages of life. For stage 1, when the respondent was aged 15 years (which we use as a proxy for childhood conditions), data collected included whether the respondent went to bed hungry (never, occasionally, often or condition very bad); whether the family had access to a toilet or kitchen (exclusive use, shared use, did not have); and whether the respondent lived with both parents, with mother only, with father only, or with neither parent (family structure). Stage 2, roughly corresponding to young adulthood, was assessed by educational attainment (coded as elementary or incomplete secondary only, secondary education with vocational training, secondary education with technical training, higher education). Data on stage 3, corresponding to current circumstances, included perceived social class (lower, lower middle, middle middle, upper middle, upper), per capita household income in the last month, and marital status.

The respondents were asked two questions concerning current alcohol consumption. First, the frequency of drinking vodka or other spirits, and second, the frequency of drinking more than 0.5 l (half bottle) of vodka in one evening (binge drinking). Respondents were also asked about their smoking behaviour (never, ex-smoker, occasional smoker, daily light or daily heavy).

Statistical analyses

Initial analyses examined the distribution of exposure variables in the study population and their associations with poor self-rated health in logistic regression models including respondent age as a continuous variable. All analyses were performed within sexes. Household income was divided by the number of people usually resident in the household and log-transformed. Quartiles were set within sexes across the whole study population (aged 16 to 90+ years). For drinking frequency in men, we used those who drank "occasionally, up to once a month and never binged" as the reference group but for women, never drinkers were used as the reference category.

Based on these initial analyses, one socio-economic indicator for each life stage was selected and dichotomized: going to bed hungry at 15; education; and current income. The combinations of these indicators were used to describe the life trajectories. First, the associations between these three risk factors were examined by comparing percentages and estimating age-adjusted odds ratios. Second, the impact of these selected factors on health was examined using the trajectories as exposure groups and by calculating a cumulative score of periods at risk (the most privileged group experienced disadvantage at no stage while the most deprived experienced disadvantage at all three stages). In addition, in a series of logistic regression models, the risk factors were entered separately (Model I), then together (Model II), then with health behaviours added (Model III) and finally with marital status (Model IV). For consistency all analyses were restricted to these participants who had available data for the life trajectory analyses.

Results

There were 1004 men and 1930 women included in the analyses, with mean age of 62.6 and 65.0 years, respectively (Table 1). There were marked sex differences in the prevalence of self-rated health with 30% of men and 40 % of women reporting poor health. Women were less likely to have had a higher or technical education and more likely to be widowed or divorced than men. Drinking alcohol and smoking were uncommon in women, whereas almost 50% of men smoked every day and over 30%

drank vodka several times a month or more. Approximately 45 % of the study population reported some adverse material circumstances when aged 15 years.

In age-adjusted analyses, poor self-rated health was associated with current lower social class, income and education in both genders and with widowhood in men but not women (Table 1). Smoking behaviour was only weakly associated with poor health. Alcohol showed a U-shaped association with health. Amongst social circumstances at age 15, going to bed hungry was the most strongly associated with poor health in men and women; family structure and household amenities were weakly associated with poor health in women. Based on these results, ever going to bed hungry aged 15 years, elementary or vocational education and current income below the median were selected as variables to examine trajectories of social circumstances across the life course. Table 2 summarises the pathways and associated risks of poor health. Logistic regression models quantified the associations between variables. Deprived social circumstances in childhood were associated with lower educational achievement. The age-adjusted odds ratio of having low educational attainment for ever going hungry to bed was 1.36 [1.03-1.79] in men and 2.44 [2.00 -2.99] in women. For current circumstances, higher education was associated with higher income; e.g. the odds ratio of having below median per capita household income for going to bed hungry and low educational attainment (adjusted for each other and age) were 1.76 [1.32-2.33] and 3.01 [2.30-3.93] respectively for men, and 1.06 [0.87-1.29] and 2.73 [2.23-3.32] for women.

When the population was divided into 8 groups according to social factors at various life stages the prevalence of poor health increased with an increasing number of risk factors for both men and women (Table 2, bottom four rows). The odds ratio of poor health in those with all three risk factors, compared to those with none was 4.51 in men and 4.27 in women. The group with one risk factor consisted of three separate groups which can be identified from the column labelled “group” in Table 2. For men, the relative risk of poor health, compared to men with no risk factors, ranged from 1.69 for childhood to 1.98 for income, and in women from 1.35 for childhood to 1.50 for education.

This pattern of relative strength of effects is confirmed in Table 3. When all social risk factors were entered together (Model II), in men childhood circumstances became borderline significant and income was the strongest predictor. In women, education was the strongest predictor but both income and childhood conditions retained significance. Health behaviours (Model III) explained little of the effect of socio-economic status in men or women, but reduced the effect of education in men slightly. Marital status did not explain the associations (Model IV) and stratified analyses (not shown) did not show any differences in the effect of the socio-economic risk factors on health between married participants and those living without a partner.

Discussion

This paper is one of the first systematic attempts to apply the life course approach to social influences on health in Russia. We found that there was a pronounced tracking of social disadvantage over the life course, that both early and current social conditions influenced health, and that health behaviours did not appear to mediate the link between social factors and health.

There are several limitations of this study. First, the cross-sectional design is not ideal. The cross-sectional design obviously excludes participants who died prematurely so that only survivors are included. In order to examine the importance of any survivor effect in our data, we repeated the analyses in participants aged 30 to 50 years. The overall pattern of results was very similar to those seen in the over 50s, with clear accumulation of risk with increasing number of social risk factors.

Health-related social mobility has been proposed to account for the observed social differentials in health but we do not have data on health in childhood or early adulthood to examine this possibility directly. However, although it is possible that education and income were influenced by respondents' health early in life, adverse social circumstances at 15 years were less likely to be the result of ill-health of the child. The lack of

association between marital status and health in women is also inconsistent with a major contribution of endogeneity to the observed associations.

Reporting bias is another potential problem with cross-sectional self-reported data. Persons with adverse childhood conditions or low income may be more likely to report adverse health, and those in poor health more likely to report adverse early or current life conditions. Although previous studies suggest that a massive reporting bias was unlikely, the interpretation of such results needs to be cautious (Lundberg, 1993; Lundberg, 1991).

Secondly, this study has used self-assessed morbidity as an outcome measure. Self-rated health is widely used in epidemiological studies and has consistently shown to be related to future mortality in many different countries (Idler & Benyamini, 1997), including Eastern Europe. Recent longitudinal data from Russia have confirmed an association with mortality in a national sample *(Perlman, PhD thesis to be submitted in May)* and cross-sectional findings confirm worse self-rated health in Eastern Europe in line with higher mortality rates and ecological correlations with IHD mortality (Carlson, 1998). Despite these consistent strong associations, self-rated health is measuring something different from objective health outcomes and may be sensitive to influences such as differences in expectation, perception and experience (Sen, 2002). It is possible that self-rated health is more sensitive to social and economic factors (Carlson, 2001). Any associations demonstrated between self-rated health and risk factors may not be replicated with more objective endpoints. Despite these important caveats, self-rated health is generally considered a valuable source of information on health status. It consistently contributes to the prediction of mortality in the presence of objective health measures (Idler & Benyamini, 1997).

Thirdly, the exposure data used also has certain limitations. We were unable to separate the period of exposure from the type of exposure, unlike other studies that have repeated measures of the same indicator such as social class (Power et al., 1998; Power et al., 1999). The range of childhood experiences assessed was limited and several of them,

previously shown to be important (van de Mheen H. et al., 2004) such as father's occupation and mother's education, could not be included. This may account for the relatively weak childhood effect seen in men. The measurement of current circumstances may be incomplete, and this may potentially introduce residual confounding in the final models. For example, migration of those with more education to more affluent areas, might mean that current living conditions account for the associations seen between more education and better health. Unfortunately with these data we cannot fully control for the effect of area. In addition, as all exposure data are self-reported, misclassification (for example of alcohol or income) may also lead to incomplete control for these variables in the statistical models.

Finally, given the recent profound changes in Russia, we cannot determine whether these effects would have been observed in the Soviet era, or whether earlier social circumstances have affected the ability to cope with recent adjustment and have therefore been "unmasked" by the transition to a market economy. Nevertheless, given the lack of similar data from non-western societies, the present study offers interesting insights into social determinants of health.

Our first research question examined the extent to which social conditions tracked through life in this population of Russian men and women. We found that childhood circumstances were associated with educational achievement, particularly in women. Childhood conditions had an independent effect on adult income in men, but in women education was the strongest predictor. These results are similar to those in Western populations including persistence of the effect of childhood social conditions on male earnings (Kuh, Head, Hardy & Wadsworth, 1997; Kuh & Wadsworth, 1991). Our results also suggest that education plays an important role in improving adult conditions in those who experienced deprivation in childhood. In this study population the per capita income in older Russians was lower than that reported by adults aged between 30 and 50 years and this, together with the social stratification of income, suggests that elderly Russians with poor social background and poor education are suffering most in current economic conditions. This is consistent with official statistics(US Department of Commerce, 1998).

Although under Soviet rule income was less influenced by education than in the West (Perlman et al., 2004), it has been proposed that the transition to market economy may have enhanced returns to education. Longitudinal data are scarce and have not always been supportive (Gerber & Hout, 1998) but in this study it appears that education may enable individuals to adapt to the changing economy and to maximize opportunities .

Our second research question addressed how these related social risk factors combine to affect health in Russians. The results support the accumulation of risk model, with risk of poor health rising with an increasing number of social risk factors. Analyses to examine the relative strength of each of the three selected social risk factors (Table 3) suggest that both current income and education were strongly associated with health in both men and women while childhood circumstances were weakly associated with adult health in men but strongly so in women. The effect of education in our study is consistent with other results from Russia (Carlson, 2001; Carlson, 2000; Bobak, Pikhart, Hertzman et al., 1998; Bobak, Pikhart, Rose, Hertzman & Marmot, 2000) but we are aware of only one other study that reported the influence of childhood economic difficulties on adult health(Carlson, 2001); the study found a positive association. Our finding that going to bed hungry aged 15 was the strongest predictor amongst childhood variables is also consistent with the results of the Leningrad siege study (Sparen et al., 2004),where persons aged 9 to 15 years during the siege had increased adult cardiovascular mortality, indicating puberty may be a critical period during which poor nutrition increases vulnerability to disease later in life.

Although these analyses were restricted to those over 50 years, the possibility remains that there are period effects in the data, given the turmoil of Soviet social policy and impact of Second World War on living conditions. Within the study sample, older participants (aged 70 years and over) were more likely to have experienced hunger , low education or low income than those aged 50-59 years. However, in additional analyses we found no evidence that the observed effects were restricted to a group who had suffered particularly harsh childhood conditions due to historical events.

Although the models do not support interactive effects between childhood or education and current social factors, in these data we were unable to examine the extent to which the social differentials observed have been exposed by recent social upheavals. It is possible that the effect of early life on adult health has become stronger since the collapse of communist rule, with recent increasing inequalities acting as an effect modifier of a latent effect.

The results on childhood social factors other than nutrition we considered are also interesting. We found no effect of family structure on adult health in men, and the effect of household facilities on health was also seen in women only, suggesting that perhaps women are more susceptible to less extreme deprivation. Marriage did not offer any health advantage to women, whereas married men were less likely to report poor health. Some previous studies in Russia have not found any clear gender differences in the association between marital status and self-rated health or mortality(Malyutina et al., 2004; Bobak, Pikart, Hertzman et al., 1998), but other's work has indicated that women may be less protected by marriage than men (Berkman & Syme, 1979; Vagero & Modin, 2002).

Our third research question considered the extent to which health behaviours mediated any observed socio-economic differences in health. For example, other authors have suggested that alcohol may underlie many of the social differentials of mortality in Russians aged 20-69 years (Shkolnikov et al., 1998). Our results do not support a major role of smoking and drinking in the explanation of social differences in self-rated health in Russians aged over 50 years. Associations between adverse health behaviours and poor self-rated health were generally weak and hence social differentials were reduced only marginally by adjusting for drinking and smoking. The relationships between health behaviours and self rated-health have not been investigated extensively in Russia (Bobak, Pikhart, Hertzman, et al., 1998) found generally weak associations compared to those Western populations (Manderbacka, Lundberg & Martikainen, 1999). It is not clear what accounts for this discrepancy. As mentioned above, Carlson has suggested this raises

questions about the nature of self-rated health in Russia (Carlson, 2001). Health behaviours do not appear to mediate social differences in self-rated health in Russia but this may not be the case for other health outcomes.

Despite the limitations of the study discussed above, this study makes a contribution to understanding social influences on health in Russia, especially given the paucity of data available. Our results demonstrate that in a society which has had a fundamentally different structure from Western Europe, social conditions throughout life influence adult health in a similar way to that observed in the West. The data suggest that health in older Russians reflects social exposures accumulated over the life-course and that health behaviours do not appear to be involved in mediating social differences in self-rated health. The study indicates that a life-course approach may contribute to the understanding of health in Russia and other societies in transition.

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Table 1: Descriptive data and associations with poor self-rated health

	Male		**Female**	
	N (%)	**Odds ratio for poor health (age adjusted)**	**N (%)**	**Odds ratio for poor health (age adjusted)**
N	**1004**		**1930**	
Mean age	62.8 yrs		65.1 yrs	
Self-rated health				
Excellent	8 (0.8)		13 (0.7)	
Good	174(17.3)		178 (9.2)	
Average	510 (50.8)		964 (50.0)	
Poor	279 (27.8)		679 (35.2)	
Very poor	33 (3.3)		96 (5.0)	
Poor self-rated health	**312 (31.1)**		**775 (40.2)**	
CURRENT CIRCUMSTANCES				
Marital status				
Married /cohab	751 (74.8)	1	700 (36.3)	1
Divorced /sep	76 (7.6)	1.62 [0.96-2.73]	283 (14.7)	1.04 [0.77-1.40]
Single	45 (4.5)	1.50 [0.77-2.95]	85 (4.4)	0.86 [0.53-1.41]
Widowed	132 (13.2)	1.89 [1.27-2.81]	862 (44.7)	1.00 [0.80-1.26]
Education				
University	220 (21.9)	1	359 (18.6)	1
Secondary /tech	171 (17.0)	1.71 [1.04-2.82]	437 (22.6)	1.80 [1.29-2.52]
Secondary/voc	289 (28.8)	1.89 [1.21-2.96]	430 (22.3)	2.66 [1.92-3.70]
Elementary	324 (32.3)	3.63 [2.38-5.53]	704 (36.5)	3.71 [2.72-5.06]
Social class				
Low	191 (20.3)	2.48 [1.69-3.62]	444 (24.5)	2.69 [2.09-3.48]
Low-middle	349 (37.0)	1.66 [1.19-2.31]	653 (36.0)	1.58 [1.25-1.99]
Mid-middle & above	403 (42.7)	1	714 (39.4)	1

Table 1: Descriptive data and associations with poor self-rated health (continued)

	Male		**Female**	
	N (%)	**Odds ratio for poor health (age adjusted)**	N (%)	**Odds ratio for poor health (age adjusted)**
Per capita household income last month				
Max (roubles)	25,000 r		20,000 r	
Min (roubles)	83 r		1200 r	
Continuous [a]		0.70 [0.60-0.81]		0.68 [0.62-0.76]
Median in 50 yrs +	1,619 r		1,550 r	
Median in whole population	1,750 r		1,600 r	
Bottom quartile [b]	228 (22.7)	1	382 (19.8)	1
2nd quartile vs bottom	347 (34.6)	0.84 [0.58-1.20]	607 (31.5)	0.67 [0.51-0.87]
3rd quartile vs bottom	239 (23.8)	0.47 [0.31-0.71]	563 (29.2)	0.52 [0.40-0.68]
Top quartile	190 (18.9)	0.34 [0.21-0.54]	378 (19.6)	0.31 [0.23-0.43]
HEALTH BEHAVIOURS				
Drinking frequency				
Never drank	211 (21.5)	1.77 [1.25-2.52]	1171 (60.9)	1
Occasionally	461 (47.0)	1	642 (33.4)	0.68 [0.55-0.86]
2-3/mnth	144 (14.7)	0.91 [0.58-1.41]		
Weekly	149 (15.2)	1.27 [0.84-1.93]	111 (5.8)	1.02 [0.67-1.56]
Daily	17 (1.7)	2.49 [0.90-6.89]		
Ever binged ?				
No	343 (44.7)	1	627 (83.6)	1
Yes	424 (55.3)	1.35 [0.96-1.89]	123 (16.4)	2.11 [1.40-3.19]
Smoking				
Never	322 (32.1)	1	1689 (87.6)	1
Ex	136 (13.6)	1.49 [0.95-2.31]	104 (5.4)	1.44 [0.94-2.18]
Occasional	89 (8.9)	1.29 [0.76-2.19]	43 (2.2)	1.57 [0.83-2.97]
A little each day	198 (19.8)	1.02 [0.67-1.57]	54 (2.8)	0.67 [0.34-1.31]
A lot each day	257 (25.7)	2.11 [1.44-3.10]	39 (2.0)	1.43 [0.72-2.86]

Table 1: Descriptive data and associations with poor self-rated health (continued)

	Male		**Female**	
	N (%)	**Odds ratio for poor health (age adjusted)**	N(%)	**Odds ratio for poor health (age adjusted)**
EARLY LIFE CIRCUMSTANCES				
Family structure at age 15				
Lived with both parents	635 (63.3)	1	1077 (56.1)	1
Lived with only mother	291 (29.0)	1.03 [0.76-1.40]	636 (33.1)	1.28 [1.04-1.57]
Live with father/neither	78 (7.8)	0.83 [0.49-1.40]	207 (10.8)	1.38 [1.01-1.88]
Went to bed hungry (aged 15 yrs)				
Never	561 (55.9)	1	1051 (54.5)	1
Occasionally had to do without	329 (32.8)	1.35 [0.99-1.84]	560 (29.0)	1.58 [1.27-1.97]
Often had to do without /conditions very bad	114 (11.4)	2.03 [1.31-3.14]	319 (16.5)	2.47 [1.88-3.23]
Toilet - aged 15 yrs				
Exclusive	559 (55.8)	1	991 (51.4)	1
Shared	279 (27.8)	1.06 [0.77-1.46]	558 (28.9)	0.92 [0.74-1.15]
Didn't have	164 (16.4)	0.80 [0.54-1.19]	380 (19.7)	1.23 [0.96-1.58]
Kitchen – aged 15 yrs				
Exclusive	598 (59.8)	1	1096 (57.0)	1
Shared	271 (27.1)	1.01 [0.74-1.38]	527 (27.4)	0.99 [0.79-1.23]
Didn't have	131 (13.1)	0.69 [0.45-1.07]	300 (15.6)	1.50 [1.15-1.96]

[a] per capita income on a log scale. Odds ratio given for 1 SD increase.

[b] quartiles set across whole population aged 16 years and over.

Table 2: Social chains of risk and associated risk of poor self-rated health : Men * -uppercase denotes risk factor present

Hungry to bed Age 15 years (C) N	Education (E)	N (%)	Adult per capita household income (I)	N (%)	Group*	Number of risk factors	Odds ratio for poor health
			Above median	156 (63.7)	cei	0	1
	Technical / higher	245 (43.7)					
			Below median	89 (36.3)	ceI	1	1.98 [0.98-4.02]
Never			Above median	122 (38.6)	cEi	1	1.90[0.99-3.66]
561	Elementary/ vocational	316 (56.3)					
			Below median	194 (61.4)	cEI	2	4.09 [2.31-7.22]
			Above median	77 (52.7)	Cei	1	1.69 [0.82-3.49]
	Technical / higher	146 (33.0)					
			Below median	69 (47.3)	CeI	2	3.08 [1.53-6.22]
Ever			Above median	74 (24.9)	CEi	2	3.09 [1.55-6.17]
443	Elementary/ vocational	297 (67.0)					
			Below median	223 (75.1)	CEI	3	4.45 [2.54-7.82]
						0	1
						1	1.87 [1.07-3.28]
						2	3.64 [2.13-6.22]
						3	4.51 [2.57-7.91]

Table 2: Social chains of risk and associated risk of poor self-rated health : Women

* - uppercase denotes risk factor present

Hungry to bed (C) age 15 years N	Education n(%)	Adult per capita household income N (%)		Group*	Number of risk factors	Odds ratio for poor health
Never 1051	Technical / higher 561 (53.4)	Above median	358 (63.8)	cei	0	1
		Below median	203 (36.2)	ceI	1	1.48 [0.98-2.23]
	Elementary/ vocational 490 (46.6)	Above median	194 (39.6)	cEi	1	1.50 [0.96-2.26]
		Below median	296 (60.4)	cEI	2	2.84 [1.99-4.05]
Ever 879	Technical / higher 235 (26.7)	Above median	148 (63.0)	Cei	1	1.35 [0.87-2.12]
		Below median	87 (37.0)	CeI	2	2.22 [1.33-3.69]
	Elementary/ vocational 644 (73.3)	Above median	241 (37.4)	CEi	2	3.23 [2.22-4.71]
		Below median	403 (62.6)	CEI	3	4.28 [3.04-6.02]
					0	1
					1	1.45 [1.05-2.01]
					2	2.88 [2.10-3.93]
					3	4.27 [3.03-6.00]

Table 3: Association between socio-economic variable and poor self-rated health, odds ratios shown

	Model I	Model II	Model III	Model IV
MEN N = 976				
Hungry aged 15 years	1.44 [1.08-1.94	1.29 [0.95-1.74]	1.37 [1.00-1.87]	1.38 [1.01-1.88]
Education	2.02 [1.49-2.73]	1.69 [1.23-2.31]	1.62 [1.17-2.24]	1.58 [1.14-2.19]
Adult per capita household income	2.16 [1.61-2.01]	1.83 [1.34-2.50]	1.84 [1.34-2.53]	1.95 [1.41-2.69]
WOMEN N = 1921				
Hungry aged 15 years	1.85 [1.52-2.25]	1.61 [1.32-1.99]	1.62 [1.32-1.99	1.62 [1.32-1.99]
Education	2.30 [1.87-2.82]	1.90 [1.53-2.36]	1.89 [1.52-2.35]	1.92 [1.55-2.40]
Adult per capita household income	1.79 [1.48-2.17]	1.53 [1.26-1.87]	1.50 [1.23-1.84]	1.52 [1.24-1.86]

Model I = age adjusted only SE variables entered individually
Model II = age + other SE variables in one model
Model III = Model II + smoking and drinking
Model IV = Model III + marital status