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ORIGINAL ARTICLE

Poor social relations and adverse health behaviour: stronger associations in low socioeconomic groups?

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Abstract
Objective Poor social relations are supposed to contribute to adverse health behaviour. We examined this association and the role of low socio-economic position.
Methods We regressed health behaviour on composite variables of the two exposures of social relations and socio-economic position (SEP). Social relations included networks and support; health behaviour was analysed in terms of smoking, poor nutrition and physical inactivity; socio-economic position comprised of income and education. Cross sectional data from a population based epidemiological study in German (4,814 men and women aged 45–75) was analysed.
Results Among the indicators for social relations, social isolation was consistently associated with adverse health behaviour; social support showed modest effect. A combination of poor social relations and low SEP displayed stronger (additive) associations with adverse health behaviour than each factor alone. However, superadditivity was excluded.
Conclusion Given the important role of health adverse behaviour in chronic disease development, results underline the relevance of social environment and socio-economic structure in Public Health interventions.

Keywords Socio-economic position · Social networks · Social support · Smoking · Nutrition · Physical activity

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Introduction

Health behaviour plays a central role among the explanatory factors of inequalities in health. Social inequalities in health behaviour have been documented throughout Europe with more health promoting behaviour among those with higher education, higher income or occupational standing (Mackenbach 2006). Yet, the social determinants of these variations in health behaviour have not been sufficiently clarified. In this contribution, we focus on social relations for two reasons. First, social relations have partly been associated with socio-economic position (Krause and Borawski-Clark 1995; Weyers et al. 2008). Second, social relations have been recognised as important social determinants of health (Berkman and Glass 2000), operating through physiological, psychological and behavioural pathways. Until now, however, there is limited evidence of a behavioural pathway. Berkman and colleagues in their well-known Alameda county study found a striking association between degree of social network cohesion and number of health adverse behaviours (Berkman and Glass 2000), but did not explore the contribution of socio-economic position.

We therefore explored the association of social relations in health behaviour and what role socio-economic position

has in this context. Our hypothesis was that the effects of poor social relations on health behaviour are particularly strong among people with lower as compared to people with higher socio-economic position. This effect may be due to a general tendency of increased vulnerability in lower position people who are often exposed to cumulative burden in their life course. These assumptions have been analysed with regard to morbidity measures (Marmot et al. 1997; Stronks et al. 1998), but not so far with regard to health behaviour.

In our contribution, we tried to answer the following questions: first, are poor social relations related to adverse health behaviour in our study and, second, does socio-economic position moderate this association? We carried out our analyses using the German Heinz Nixdorf Recall (HNR) Study with comprehensive and generic measures of socio-economic position (education and income), social relations (social networks and support) and health behaviour (smoking, nutrition and physical activity).

Methods

Study population

Data were collected during the baseline examination of the Heinz Nixdorf Recall (HNR) Study which is an ongoing prospective population-based cohort study in Germany. Rationale, design and methods of this study have been described elsewhere in detail (Schmermund et al. 2002, 2006; Stang et al. 2005). Respondents were recruited from the German population aged 45–75 years, living in three cities in an industrialised urban region (Ruhr Area), Recruitment was based on a random sample from mandatory citizen registries. Overall, 4,814 men and women participated in our study, which corresponds to a response proportion of 56% (Stang et al. on behalf of the Heinz Nixdorf Study 2005). Comprehensive baseline examinations were conducted from December 2000 to August 2003 and a 5-year follow up is currently completed. The main aim of the Heinz Nixdorf Recall study is to improve prediction of coronary heart disease by combining established with new cardiovascular risk factors. Social position, social relations and health behaviour were assessed in the baseline screening as part of a social risk factor assessment through face-to-face interviews and paper and pencil questionnaires.

Measures

Socio-economic position (SEP) was measured by equivalent household income including information on disposable income, household size and number of adults and children according to OECD criteria. For the analyses, income was dichotomized by median split. As a second SEP indicator we chose education classified according to the International Standard Classification of Education as total years of formal education, combining school and vocational training (UNESCO 1997). The continuous variable was dichotomized into 10 and less years versus the rest.

Social networks were measured by the Social Integration Index (Berkman et al. 2004). The index has three domains: marital status or cohabitation, number of ties to children, relatives and friends as well as at least monthly participation in clubs and organizations. Each domain scores from 0 to 2 depending on the integration: marital status or cohabitation was scored 2, else 0; number of ties was scored 0 (for 0–2 contacts), 1 (for 3–11 contacts), or 2 (for $\geq$12 contacts); participation was scored 0 (no clubs or organizations), 1 (one), or 2 ($\geq$2). The total score ranging from 0 to 6 was categorised into four levels of integration: level I (0–1, social isolation), II (2–3), III (4–5) and IV (6, high integration), respectively. These four levels were recoded into two: level I (social isolation) versus the rest.

Instrumental and emotional social support were measured with a German adaptation of the New Haven EPESE questionnaire (Seeman and Berkman 1988) asking for persons available for help in daily tasks and for personal conversation. Subsequently, information was collected on who actually provided support and whether the support received was appropriate. Based on the combination of information, four categories were built: 'support not needed', 'support appropriate', 'support inappropriate' and 'support needed but not available'. We defined lack of instrumental or emotional support if one of the latter two answers were given.

Health behaviours were assessed with respect to smoking, nutrition and physical exercise. Smoking was carefully assessed using standard questions from a national health survey (Bellach et al. 1998). For the analyses, current smokers were opposed to never- and ex-smokers. Concerning nutrition, we were particularly interested in the health-promoting effects of daily intake of fresh fruit, raw vegetables and salad, given their antioxidative potential (Polidori 2003). Items measuring nutritional behaviour were taken from the food frequency questionnaire (Winkler and Döring 1995), where consumption once in a week or less is categorised adverse. Participants reporting intake of fruit and vegetables 1–3 times per week or less were therefore categorised as exhibiting health-adverse nutritional behaviour. With regard to physical exercise, respondents were asked whether they had carried out any sports in the preceding month, and if so how often and for how many minutes or hours. The proportion of those who reported that they had exerted no sports at all was defined as physically inactive. A special emphasis was given on

data quality and study certification (DIN EN ISO 9001:2000).

Statistical analyses

We used binominal logistic regression analyses with models adjusted for age and gender. We regressed health behaviours on composite variables of the two exposures of social relations and SEP. The dichotomised exposure variables were combined in the following way: (1) good social relations and high SEP, (2) poor social relations, but high SEP, (3) good social relations, but low SEP, (4) both poor social relations and low SEP present. To explore departure from relative risk additivity, we used an approach described by Rothman and Greenland (1986): the relative excess due to interaction (RERI) using the equation

$$\mathrm{RERI} = \mathrm{RR}(\mathrm{AB}) - \mathrm{RR}(\mathrm{AB}') - \mathrm{RR}(\mathrm{A}'B) + 1.$$

If there is no superadditive interaction (null hypothesis), RERI equals 0. If there is superadditivity, RERI is >0, and subadditivity will yield an RERI <0. Statistical analyses were carried out using SPSS 14.0.

Results

Table 1 shows the distribution of the variables under study with values pointing to categorical variables (without brackets) or numeric variables (with angular brackets). The mean income of 1,566.00 Euros is below the Western-German average (1,803.00 Euros in 2003). Education is right-skewed with a higher prevalence of low educational degree. With regard to the three indicators of social relations, we can see that some 12.2% are socially isolated, 12.6% report no or inappropriate instrumental support and 16.2% report no or inappropriate emotional support. With regard to the three indicators of health behaviours, it becomes obvious that some 23.5 of participants are (still) smokers, 22.1% report both low intake of fruit and vegetables (three times per week or less) and 46.3% do not carry out any physical activity in leisure time. As a first approach to our research questions, we observed the association of social relations and health behaviour in a bivariate analysis.

Table 2 shows the numbers and percentages of smoking, poor nutrition and physical inactivity by categories of social relations. The table reads as follows: 34.4% of those reporting low social integration smoke whereas only 21.7% of those reporting medium to high social integration smoke. This pattern is found throughout the data, but it is not always significant. Social integration shows consistent and highest effects. Emotional support is significantly associated with two out of three behaviours, instrumental support with physical inactivity, only. Further analyses adjusting for partnership did not invalidate the explanatory contribution of the network index.

Table 1 Distribution of variables in total sample

Characteristic (no. of missings)	Number (mean)	% (SD)
Total sample	4,814	100
Age (0)	(59.6)	(7.8)
Gender (0)		
Male	2,395	49.8
Female	2,419	50.2
Household equivalent income (310)	(1566.0)	(707.3)
Education, years of training (16)		
>18	507	10.5
14–17	1,068	22.2
11–13	2,676	55.6
<10	547	11.4
Social integration index (110)		
Level IV	217	4.6
Level III	1,954	41.5
Level II	1,960	41.7
Level I (isolation)	573	12.2
Instrumental support (99)		
Yes	4,121	87.4
No	594	12.6
Emotional support (69)		
Yes	3,977	83.8
No	768	16.2
Smoking (12)		
Never smoker	2,013	41.9
Ex-smoker	1,661	34.6
Smoker	1,128	23.5
Nutrition (consumption of raw vegetables) (118)		
(Almost) daily	3,660	77.9
Less than daily	1,036	22.1
Physically active (1)		
Yes	2,586	53.7
No	2,227	46.3

We have seen that poor social relations are related to adverse health behaviour. The next question is: does socio-economic position moderate this association?

For the interaction analyses, we have further condensed the social network indicator. Table 3 shows the multivariate adjusted odds ratios of composite variables of the two exposures of social relations and SEP: categories 'poor social relations, but high SEP', 'good social relations, but low SEP' and 'both poor social relations and low SEP' are opposed to the prosperous condition 'good social relations and high SEP' (reference group). The table reads as follows, for instance, with regard to income and smoking

Table 2 Numbers and percentages of adverse health behaviour by social relations

	N (%)[a]		
	Smoking	Poor nutrition	Physical inactivity
Social integration			
Level IV–II (high)	897 (21.7)*	845 (20.7)	1,770 (42.8)
Level I (low)	197 (34.4)	173 (31.6)*	381 (66.5)*
Missing	34	18	76
Instrumental support			
Not needed/appropriate	954 (23.1)	878 (21.7)	1,836 (44.6)
Inappropriate/not available	157 (26.4)	141 (24.9)	332 (55.9)*
Missing	17	17	59
Emotional support			
Not needed/appropriate	923 (23.2)	833 (21.4)	1,781 (44.8)
Inappropriate/not available	188 (24.5)	187 (25.1)*	402 (52.3)*
Missing	17	16	44
Total	1,128	1,036	2,227

[a] Number and percentage

* $p \leq 0.05$

(upper left panel): as compared to the reference group, persons with low social integration only have increased odds (1.8 times) of smoking. Low SEP only increased the odds of smoking by 1.3 times. When participants have both poor social relations and low SEP, the odds of smoking are 2.7 times that of the reference group. Yet, RERI does not reach statistical significance pointing to additive rather than interactive effects.

This pattern is found for most combinations, with some particularities: social isolation displays consistent and highest effects on health behaviours, whereas the effect of social support is inconsistent and weaker.

Physical inactivity is the one component of health adverse behaviour that is most strongly associated with poor social relations only and the combined exposure with low SEP. Superadditivity was found for isolated and low income persons.

As we would have expected, low socio-economic position is significantly associated with adverse health behaviours. With regard to nutrition and physical inactivity, education displays stronger associations than income. Surprisingly, with regard to smoking, education shows no significant association. It turns out that this is due to a gender effect. If we stratify the analyses by gender groups, we see that the less educated (but well integrated) men have an odds ratio of 1.5 (1.0–2.2) and the less educated (but well integrated) women have an odds ratio of 0.6 (0.5–0.9) to smoke compared to the reference group (results not shown here).

In almost every case, the odds of adverse health behaviour are elevated when poor social relations and low SEP coincide. Social isolation, low education and smoking are the one exception. Again, this is due to a gender effect. If we stratify the analysis into gender groups, we find that in men, exposure to both isolation and low education shows the highest associations [2.8 (1.2–6.8)] whereas among women, isolation only shows highest effects [2.2 (1.0–1.1)] (results not shown here).

Discussion

We provide evidence that poor social relations are associated with adverse health behaviour. Social integration showed consistent and strongest associations with health behaviours, social support was less consistently related to them. One could argue that the social integration index combines to distinct measures. However, we have seen in sub analyses that any of the three network components contributes to the observed associations. For instance, 25.9% of those persons with no partner report low intake of fruit and vegetables as compared to 21.3 with partner; 28.2% of those with very few contacts as compared to 20.8% with medium to many contacts; 26.6% of those with no social participation at all as compared to 19.0% who at least participate in one club. Poor socio-economic position was associated with adverse health behaviours with the exception of education and smoking where we found opposing gender effects.

A combination of poor social relations and low SEP displayed stronger associations with adverse health behaviour than each factor alone. However, superadditivity was excluded. It can be concluded that socio-economic position does not moderate the effect with regard to adverse health behaviours, it only adds to it.

The results of this study are based on a large unselected urban population sample of middle-aged to early old age men and women. Special emphasis was put on quality control of data collection and data handling, as evidenced by an external certification. The results are not confounded

Table 3 Multivariate adjusted odds ratios of adverse health behaviour by social relations and SEP

	Smoking			Poor nutrition			Physical inactivity		
	High SEP	Low SEP	RERI	High SEP	Low SEP	RERI	High SEP	Low SEP	RERI
SEP defined by income									
Social integration									
Level IV–II (high)	1.0[a]	1.3 (1.1–1.5)	0.6 (−0.2 to 1.4)	1.0	1.3 (1.1–1.5)	0.5 (−0.2 to 1.4)	1.0	1.4 (1.2–1.6)	1.5 (0.3–2.7)
Level I (low)	1.8 (1.3–2.5)[b]	2.7 (2.1–3.5)		1.6 (1.1–2.3)	2.5 (1.9–3.3)		2.2 (1.6–3.0)	4.2 (3.3–5.5)	
Instrumental support									
Not needed/appropriate	1.0	1.4 (1.2–1.6)	0.2 (−0.3 to 0.8)	1.0	1.3 (1.1–1.5)	0.3 (−0.2 to 0.9)	1.0	1.5 (1.3–1.7)	0.3 (−0.2 to 1.0)
Inappropriate/not available	1.1 (0.8–1.6)	1.8 (1.3–2.4)		1.1 (0.7–1.5)	1.7 (1.3–2.3)		1.4 (1.0–1.8)	2.3 (1.8–2.9)	
Emotional support									
Not needed/appropriate	1.0	1.3 (1.1–1.5)	0.3 (−0.0 to 0.8)	1.0	1.3 (1.1–1.5)	0.2 (−0.3 to 0.7)	1.0	1.5 (1.3–1.7)	0.2 (−0.2 to 0.8)
Inappropriate/not available	0.8 (0.6–1.2)	1.6 (1.2–2.0)		1.1 (0.8–1.4)	1.6 (1.2–2.1)		1.2 (0.9–1.5)	2.0 (1.6–2.5)	
SEP defined by education									
Social integration									
Level IV–II (high)	1.0	1.1 (0.9–1.5)	−0.2 (−1.2 to 0.7)	1.0	2.2 (1.5–2.5)	0.7 (−0.9 to 2.5)	1.0	1.8 (1.4–2.2)	2.2 (−0.4 to 4.8)
Level I (low)	2.0 (1.6–2.5)	1.9 (1.2–3.1)		1.8 (1.5–2.3)	3.6 (2.4–5.6)		2.5 (2.0–3.0)	5.5 (3.4–8.8)	
Instrumental support									
Not needed/appropriate	1.0	1.1 (0.8–1.5)	0.0 (−0.7 to 0.8)	1.0	2.1 (1.6–2.7)	0.0 (−1.1 to 1.2)	1.0	1.9 (1.6–2.4)	0.2 (−1.0 to 1.5)
Inappropriate/not available	1.2 (1.0–1.6)	1.4 (0.9–2.4)		1.2 (0.9–1.5)	2.4 (1.5–3.8)		1.5 (1.2–1.8)	2.7 (1.8–4.2)	
Emotional support									
Not needed/appropriate	1.0	1.1 (0.8–1.4)	0.2 (−0.4 to 0.9)	1.0	2.0 (1.5–2.5)	0.4 (−0.6 to 1.6)	1.0	1.9 (1.5–2.4)	0.0 (−0.9 to 0.9)
Inappropriate/not available	1.0 (0.8–1.3)	1.4 (0.9–2.2)		1.1 (0.9–1.4)	2.6 (1.8–4.0)		1.3 (1.1–1.5)	2.3 (1.5–3.3)	

[a] Reference category

[b] 95% confidence interval

by the effects of age and gender as these variables were taken into account in multivariate logistic regression analyses. To the best of our knowledge, this is one of the first studies of the effect of social relations on health behaviour by socio-economic position. Accordingly, a combination of being socially disadvantaged and excluded from society produces 1.4- to 5.5-fold increased odds of health adverse behaviour. Similar tests were conducted in another area or research on social inequalities in health, namely chronic psychosocial stress at work (for overview see Siegrist and Theorell 2006). Stronger associations were interpreted in terms of increased susceptibility to an exposure among lower status people. In our case, this interpretation seems meaningful because appropriate coping resources of reducing health adverse behaviours and strengthening health promoting attitudes and actions may be as available among lower SEP groups compared to higher SEP groups.

Despite its strengths, this analysis is subject to several limitations. Due to its cross-sectional design, we cannot draw any conclusion concerning the temporal sequence of events. We implicitly assume that social relations affect health behaviours. Yet, it is possible that a sedentary life style associated with adverse health behaviour limits people's interest in active social involvement, thus resulting in a restricted social network and unavailable support. The causal sequence of exposure will be explored with forthcoming own prospective study data. Available results from prospective studies (e.g. Droomers et al. 2002) suggest that emotional support in part explains educational differences in continued smoking. Furthermore, we cannot exclude that an underlying unobserved personal characteristic accounts for some covariation of smoking with social relations.

A second limitation concerns gender effects as mentioned in the "Results" (Table 3). We have seen that education is differently associated with smoking in men as compared to women. It is the less educated men and the well-educated women who smoke. These kinds of effects may be operating in other constellations. Therefore, we have repeated our analysis separately for gender groups. In most cases, we found the above mentioned pattern, i.e. social relations and socio-economic position have effects, both alone and combined. But again we found a few exceptions (results not shown here). Although we were able to show a general trend here, we must be aware that different means of social hierarchy such as education or occupation have different implications for men and women and that these factors have different implications for life style activities and health (Annandale and Hunt 2000). This will be further elaborated.

A third limitation concerns a possible sample bias. In an attempt to control for this bias we carried out a short telephone interview with the majority of those men and women who refused to participate in this study ($n = 2{,}909$). In fact, non-responders were more likely to be less educated, to have no partner and to smoke. Our analysis may thus underestimate the effects. Based on an abbreviated version of questions, the main findings of the study sample could be replicated in the non-responders.

A last concern refers to a possible reporting bias. A general tendency towards negative reports, as measured by negative affectivity, may underlie the reported associations of poor social relations and adverse health behaviour. However, we assessed negative affectivity with a scale measuring negative mood and entered this variable as a confounder into multivariate analysis. Results did not change to any substantial degree.

Policy implications

Despite these limitations, results have several implications for public health. First, interventions should be conceptualised for socially disadvantaged persons. The aspect of social inequalities is increasingly recognised in public health practice. Accordingly, measures of health promotion and prevention need to be tailored to the needs of lower socio-economic participations, strengthening their options of participation and empowerment (Lehmann et al. 2006).

Second, results underline that health behaviours are embedded in social environments. There are some stimulating examples of how the social environment can be modified to reduce health adverse behaviours such as a Canadian anti-smoking intervention (Carlson et al. 2002), the US American Heart and Soul Physical Activity Programme (Peterson et al. 2005) or the US American Polyp Prevention Trial (Murphy et al. 2001). Here, the inclusion of 'buddies' or trust persons led to better results in the target group.

Conclusion

This study documents both social inequalities in health behaviour as well as the role of poor social relations in health behaviour in the frame of a large unselected sample of middle aged to early old aged men and women in Germany. Effects of poor social relations on health adverse behaviour were particularly strong among lower SEP groups, in particular physical inactivity. Results underline the importance of tailoring health-promoting activities according to the needs of lower SEP groups.

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