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Abstract

Differentials in health status and behaviour by socioeconomic status (SES) constitute a scientific and policy challenge. In this article, data from a national survey on Canadians' perceptions of population health risks were analysed to determine whether various types of health risk perceptions mediated SES differentials in health behaviour. As expected, health behaviours and risk perceptions both varied with SES. Results suggested a mediating role of health risk perceptions—particularly those of a social nature—in the association between SES and smoking. Findings underscore the importance of improving the social environment to fostering better lifestyle and health among disadvantaged individuals.

Keywords

- *health behaviour*
- *health risk perception*
- *social environment*
- *socioeconomic health differentials*

STUDIES in numerous contexts have shown that persons of lower socioeconomic (SES) are subject to higher mortality rates and poorer health status, even in more prosperous populations (Evans, Barer, & Marmor, 1994). Among prominent explanations or pathways of this gradient is an SES differential in health behaviour (Lynch, Kaplan, & Salonen, 1997; Wardle & Steptoe, 2003). Indeed, smoking, poor diet, physical inactivity, and alcohol consumption were identified as leading causes of deaths in the United States in 2000 (Mokdad, Marks, Stroup, & Gerberding, 2004), with similar trends observed in Canada (Single, Rehm, Robson, & van Truong, 2000). At the same time, individuals of lower SES have been found to be more likely to engage in these types of behaviours (Pomerleau, Pederson, Østbye, Speechley, & Speechley, 1997; Statistics Canada, 1999; Wardle & Steptoe, 2003), and to be more resistant to behaviour change interventions (Lynch et al., 1997). Understanding the mechanisms through which SES is related to health behaviour is integral to developing more effective health interventions.

One potential explanation for SES differentials in health behaviour is that they result from differences in health-related perceptions. A recent study documented the tendency for individuals of lower SES to hold beliefs that, in turn, were associated with poorer behavioural choices (e.g. less health consciousness, that health is predicated on chance; Wardle & Steptoe, 2003). Similarly, Leganger and Kraft (2003) found that health-related control beliefs (i.e. health locus of control, self-efficacy) partially mediated the relationship between education and intentions to consume fruits and vegetables.

In light of the general emphasis placed on health-related perceptions as determinants of health behaviour (Janz & Becker, 1984; Weinstein, 1993a), it is not surprising that many approaches aimed at improving lifestyle attempt do so through the modification of related cognitive processes (Witte, 1998). For example, health risk perception is considered a significant predictor of self-protective behaviour in a number of health behaviour change models (van der Plight, 1996; Weinstein, 1993a; Witte, 1998). Accordingly, health risk perceptions have been associated with a wide range of behaviours such as cancer screening and lowered overall risk-taking (Cook & Bellis, 2001; Rimal, 2002; Royak-Schaler et al., 1995). From this perspective, SES differentials in health behaviour might be regarded more specifically as the result of differences in health risk perceptions.

To date, findings on the relationship between SES and health risk perception have been equivocal. A survey revealed that individuals of lower educational attainment were *less* likely to perceive lifestyle factors such as physical inactivity as posing a high risk to the health of Canadians (Krewski et al., 2006). In line with previous studies, however, they *more* frequently perceived environmental and social factors as posing a high risk (Finuncane, Slovic, Mertz, Flynn, & Satterfield, 2000; Lemyre, Lee, Mercier, Bouchard, & Krewski, 2006). Given the pervasiveness of SES differentials in perceptions of heath risks of this type, it would be interesting to explore whether these might also mediate health behaviour disparities.

There is a substantial body of evidence indicating that individuals of lower SES are exposed to a greater number of environmental and social health risks (Baum, Garofolo, & Yari, 1999; Evans & Kantrowitz, 2002; Orpana & Lemyre, 2004). Such exposures may not only account for heightened social and environmental health risk perceptions; they may also contribute to a sense of helplessness and subsequent decrease in effort to maintain a healthy lifestyle. Alternatively, disadvantaged individuals may adopt unhealthy behaviours to cope with the environmental and social adversities they face (Boardman, Finch, Ellison, Williams, & Jackson, 2001; Orpana & Lemyre, 2006). For instance, Graham (1984) found that underprivileged women used cigarette smoking to cope with the social pressures they felt in managing their families with limited resources.

Study objectives

The aim of the present study was to investigate the role of health risk perceptions as mediators of SES differentials in health behaviour using data from a national survey on population health risk perceptions (Krewski et al., 2006). A previous analysis of these data identified three broad categories of health risk perceptions: biochemical, social, and lifestyle health risk perceptions (Lee, Lemyre, Legault, Turner, & Krewski, 2008). It was thus determined whether income-based differentials in health behaviour are mediated by these three categories of health risk perceptions. As an indicator of SES, income is most closely related to access to material resources and can act as a proxy for other important aspects of SES including power, status, and way of life (Lynch &

Kaplan, 2000). In light of the pervasiveness of SES differentials, it was expected that individuals of lower income would engage in poorer health behaviours. It was also expected that health risk perceptions would differ by level of household income, and that such differences would be a contributing factor in the relationship between income and health behaviour.

Methods

Participants

A similar proportion of men and women over 18 years of age completed the survey ($N = 1503$, 48% men and 52% women). Most respondents were aged between 35–54 years (41.3%). Similar proportions of respondents had some/completed high school (30.1%), community college (28.3%), or university (30.9%). Fewer respondents had some/completed elementary school (2.5%) or graduate school (8.0%). The median household income category was $40,000–$49,000 per year. A total of 78 per cent of the interviews were conducted in English and the remaining 22 per cent were conducted in French. Comparison of the sample characteristics to the general Canadian population indicated that the sample was similar in terms of sex and age distribution. However, individuals with some/completed elementary or high school were underrepresented, while those with some/completed university or graduate school were overrepresented in the sample.

Measures

The survey was designed as a follow-up to a previous one conducted in 1992 (Krewski, Slovic, Bartlett, Flynn, & Mertz, 1995a, 1995b) and pre-tested with volunteers. Survey design and procedures are described in greater detail elsewhere (Krewski et al., 2006; Lee et al., 2008). Below is a description of items and rating scales used in the present analyses. Respondents were given the option of indicating if they did not know or had no opinion regarding each item.

Health risk perceptions Three separate scales, derived from a factor analysis of respondents' ratings of health hazards on perceived risk to the health of Canadians were used to assess Biochemical (i.e. 15 items involving biochemical processes or environmental pollutants), Social (i.e. five items related to the social environment), and Lifestyle (i.e. six items related to heath or risk behaviour) health risk perceptions (for more details, see Lee et al., 2008). Ratings were based on a four-point Likert-type scale (1 = almost no health risk; 2 = slight health risk; 3 = moderate health risk; 4 = high health risk). The three scales demonstrated adequate reliability, yielding Cronbach's alphas of .87, .70, and .77 respectively.

Health behaviours Four survey items assessed respondents' health behaviours over the past year ('On average in the last year, how often did you: (i) Smoke cigarettes, (ii) Participate in 20 minutes of vigorous exercise at least three times a week, (iii) Get between seven and eight hours of sleep a night, (iv) Eat breakfast daily?'). Answers were provided using a five-point rating scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, 5 = always).

Self-rated health Similar to the National Population Health Survey (NPHS; Statistics Canada, 2002, 2004), one item assessed respondents' health status ('How would you rate your personal health?'). Answers to this question were provided using a four-point rating scale (1 = excellent, 2 = good, 3 = fair, 4 = poor). This variable was reverse coded so that a higher score would reflect better health in order to facilitate interpretation.

Procedure

The study protocol was reviewed and approved by the Research Ethics Board of the University of Ottawa. Data were collected in a series of (approximately) thirty minute telephone interviews conducted in 2004. A stratified sampling procedure was used based on 2001 Canadian Census data, with province representing the first level of stratification, followed by age and gender within province. Random digit dialing with a maximum of five callbacks was used to establish a household contact. The household member with a date of birth closest to the date of contact was selected to complete the interview.

Analyses

Design effects due to the stratified sampling procedure were examined in a random sub-sample of variables and found to be close to 1 (ranging from 0.93–1.00). This permitted the use of simplified analytic procedures based on a simple random sample design, although resulting in slightly conservative inferences (Johnston & Elliot, 1998).

Bivariate correlations were computed to examine relationships between demographic variables, health behaviours, health risk perceptions, and self-rated health. For health behaviours found to be significantly associated with income, a test of mediation was performed according to specifications given by Baron and Kenny (1986). Only cases with complete data on model variables were included in the analyses. Using a Mahalanobis criterion of $p < .001$, six multivariate outliers were identified and removed from the sample, resulting in a sample of 984 cases. A p value of .05 was used as the criterion for all tests of significance.

Results

Bivariate correlations among all variables of interest are presented in Table 1. Most importantly, the SES-related variables of income and education were negatively associated with Biochemical and Social health risk perceptions. Income was also negatively associated with frequency of smoking and positively associated with frequency of exercise. Similar relationships were observed with education, although this variable was also positively associated with frequency of breakfast consumption.

Income as a predictor of health risk perceptions

An initial series of linear regression analyses revealed that income was a significant positive predictor of both Social health risk perceptions, adjusted $R^2 = .04$, $F(1, 982) = 38.99$, $p < .001$, and Biochemical health risk perceptions, adjusted $R^2 = .04$, $F(1, 982) = 41.98$, $p < .001$. However, its association with Lifestyle health risk perceptions failed to reach statistical significance.

Income and health risk perceptions as predictors of frequency of smoking

A sequential multiple linear regression analysis was performed to determine whether frequency of smoking was predicted by health risk perceptions. Age and gender were entered as covariates in the first step of this analysis, as these variables were found to be significantly associated with most health behaviours (see Table 1). It was found that health risk perceptions significantly predicted age- and gender-adjusted frequency of smoking, adjusted $R^2 = .05$, $F(5, 978) = 10.40$, $p < .001$.

Table 1. Intercorrelations between demographic variables, health risk perceptions, health behaviours, and self-rated health

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Age	—	–.15***	.03	–.11***	.17***	.09***	.11***	–.16***	–.05	.10***	.27***	–.11***
2. Education		—	–.05	.28***	–.23***	<-.01	–.17***	–.09***	.09***	<–.01	.04	.19***
3. Gender			—	–.13***	.23***	.25***	.25***	–.07**	.03	.07**	.06*	<.01
4. Income				—	–.21***	<.01	–.23***	–.09***	.10***	–.06*	–.01	.20***
5. Biochemical HRP					—	.49***	.61***	.04	.06*	.04	.05	–.10***
6. Lifestyle HRP						—	.50***	–.04	.10***	<.01	.03	–.02
7. Social HRP							—	.11***	.03	–.04	–.03	–.12***
8. Smoking								—	–.07**	–.06*	–.29***	–.21***
9. Exercise									—	.10***	.12***	.29***
10. Sleep										—	.18***	.15***
11. Breakfast											—	.16***
12. Self-rated health												—

Note: Spearman's r was computed for correlation analyses involving age, education, gender, and income. Pearson's r was computed for all other correlation analyses.
HRP = Health risk perceptions
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

Table 2. Summary of sequential multiple linear regression equations predicting frequencies of smoking and exercise with demographic variables and health risk perceptions

	Frequency of smoking				*Frequency of exercise*			
Variable	*B*	*SE B*	*β*	*Total R^2*	*B*	*SE B*	*β*	*Total R^2*
Step 1								
Age	–.10	.03	–.11***		–.04	.03	–.04	
Gender	–.16	.09	–.06	.01***	.16	.08	.06	<.01
Step 2								
Age	–.10	.03	–.11***		–.03	.03	–.04	
Gender	–.19	.09	–.07*		.19	.08	.07*	
Income	–.06	.02	–.10***	.02***	.06	.02	.12***	.02***
Step 3								
Age	–.11	.03	–.12***		–.04	.03	–.05	
Gender	–.25	.09	–.09**		.12	.09	.05	
Income	–.03	.02	–.06		.07	.02	.12***	
Biochemical HRP	.01	.01	.03		.01	.01	.04	
Social HRP	.09	.02	.19***		.01	.02	.01	
Lifestyle HRP	–.08	.02	–.14***	.05***	.04	.02	.07	.02**

Note: HRP = Health risk perceptions
*$p < .05$; **$p < .01$; ***$p < .001$

However, only Lifestyle and Social health risk perceptions emerged as significant unique predictors. Specifically, Lifestyle health risk perceptions were negatively associated with smoking, $B = –.09$, $p < .001$; whereas Social health risk perceptions were positively associated with smoking, $B = .10$, $p < .001$.

A sequential multiple regression analysis was also performed to determine: (1) whether income predicted smoking (again controlling for age and gender in the first step); and (2) whether the strength of the relationship between income and the behaviour would decrease when health risk perceptions were added to the equation in a next step. This analysis revealed that income significantly predicted age- and gender-adjusted frequency of smoking, adjusted $R^2 = .02$, $F(3, 980) = 8.08$, $p < .001$. However, its relationship with frequency of smoking was no longer significant when health risk perceptions were entered as predictors in the following step, adjusted $R^2 = .05$, $F(6, 977) = 9.18$, $p < .001$. In the final model, Lifestyle and Social health risk perceptions remained as significant predictors. Health risk perceptions explained half of the variation in the relationship between income and smoking according to the proportion mediated formula, 1 – [–0.03/–0.06] = 50 per cent (MacKinnon, Fairchild, & Fritz, 2007, p. 603).[1] Raw and standardized regression coefficients of each step of this analysis are presented in Table 2.

Income and health risk perceptions as predictors of frequency of exercise

Age- and gender-adjusted frequency of exercise was significantly predicted by health risk perceptions, with a total adjusted R^2 of .01, $F(5, 978) = 2.99$, $p < .05$. However, only Lifestyle health risk perceptions emerged as unique significant predictors. Specifically, these were positively associated with frequency of exercise, $B = .05$, $p < .01$.

Age- and gender-adjusted frequency of exercise was also significantly predicted by income, adjusted $R^2 = .02$, $F(3, 980) = 6.75$, $p < .001$. Although predictability was significantly improved when Lifestyle, Social, and Biochemical health risk perceptions were added to the equation in the next block, adjusted $\Delta R^2 = .01$, $F_{inc}(3, 977) = 2.95$, $p < .05$, neither of these uniquely emerged as significant predictors. Raw and standardized regression coefficients of each step of this analysis are presented in Table 2.

Discussion

The present study explored the potential role of health risk perceptions as mediators of SES differentials in health behaviour. Consistent with findings of numerous population health surveys (Lynch et al., 1997; Statistics Canada, 1999; Wardle & Steptoe, 2003), respondents of lower household income reported a higher frequency of smoking and lower frequency of regular exercise. However, neither breakfast nor sleeping habits differed by income (in contrast to previous studies: Hjartåker & Lund, 1998; Moore, Adler, Williams, & Jackson, 2002; Pomerleau et al., 1997), possibly due to the general nature of items used to assess these behaviours.

The finding that Lifestyle health risk perceptions did not differ by income underscores the need to extend explanations of SES differentials in health behaviour beyond divergent perceptions or understandings of lifestyle risks. In fact, results of other studies have demonstrated that the health risk perceptions of individuals of lower SES are not necessarily less accurate than those of individuals of higher SES (Daly et al., 1996). Similarly, Weinstein (1987) maintains that the phenomenon of unrealistic optimism (one's personal bias of judging his/her risk is lower than that of others) is independent of both level of education and occupational prestige.

By contrast, income-based differences were apparent in perceptions of Biochemical and Social health risks, in accordance with persistent SES disparities in exposure to these risks (Evans & Kantrowitz, 2002; Taylor, Repetti, & Seeman, 1997). Among other things, it seems viable that living in such adversity would be detrimental to psychological well-being. Indeed, one study found that individuals of lower SES were more likely to be distressed, in part due to their exposure to more adverse working conditions (Link, Lennon, & Dohrenwend, 1993). Additionally, sleep disturbances, nightmares, and anxiety have been linked to living in poor quality neighbourhoods (Taylor et al., 1997).

Tests of mediation revealed that higher Lifestyle health risk perceptions were associated with healthier behaviour as expected, whereas higher Social health risk perceptions were associated with riskier behaviour. One potential explanation for smoking is that heightened perceptions of Social health risks gave rise to the same psychological conditions that underlie this behaviour. In support of this view, distress and psychological stress, which are known contributors to smoking (Kassel, Stroud, & Paronis, 2003), have also both been linked with exposure to adverse social environments (Boardman et al., 2001; Link et al., 1993).

Of key importance, results provided strong evidence for the involvement of health risk perceptions as mediators of the relationship of income with smoking, but not for that with exercise. Social health risk perceptions appeared to play a particularly important role in this relationship, since only this category of health risk perceptions was predicted by income while predicting smoking (Baron & Kenny, 1986). Their limited involvement as mediators of income-based differences in exercise may relate to the complexity of factors influencing regular exercise. For instance, use of exercise as a coping mechanism in response to exposure to Social health risks could lead to a higher frequency of engagement. At the same time, exposure to Social health risks could interfere with the resources required for participation in recreational physical activity. Competing processes could thus have obscured the relationship between these variables (Orpana & Lemyre, 2006).

Since they were not significantly predicted by income, Lifestyle health risk perceptions alone could not account for income-based differences in health behaviours. These were nonetheless associated with health behaviours in accordance with most models (Janz & Becker, 1984; van der Plight, 1996; Weinstein, 1993a; Witte, 1998). It may be that individuals who recognize the risks associated with poor lifestyle choose to engage in healthier behaviour or that those who choose to engage in unhealthy behaviour deny the importance of lifestyle in maintaining good health. Longitudinal research could help disentangle the processes involved in this relationship.

Taken together, findings support the overall importance of addressing health risk perceptions in interventions aimed at improving health behaviour. At the same time, they emphasize the need to complement these with other approaches in order to attend to the unique needs of individuals of lower SES. Failure to account for the social circumstances in which these individuals live could be a factor in their greater resistance to behaviour change interventions. Wardle and Steptoe (2003, p. 440) noted that 'socioeconomic differences in healthy lifestyles are associated with differences in attitudes to health that may themselves arise through variations in life opportunities and exposure to material hardship and ill health over the life course'. Addressing these attitudes may increase the effectiveness of interventions aimed at improving health behaviours among individuals of lower SES.

However, the extent to which the effects of such interventions persist will also likely depend on the extent of efforts to improve the social circumstances contributing to these perceptions.

Notwithstanding the clear implications of findings for the development of health interventions, a few limitations must be brought to light. First, the measures used assessed perceptions of risk to the health of Canadians as opposed to perceptions of risk to personal health. Therefore, these do not necessarily reflect the degree to which respondents perceived themselves as having been exposed to these health risks, nor do they necessarily reflect respondents' perceptions of risks to their personal health. Further research is needed to determine whether findings also hold for perceptions of risks to personal health. In line with established health behaviour models, it would seem effect reasonable to expect that individuals' health behaviour choices are more closely related to such perceptions. Research including measures of perceived risk to personal health may therefore reveal a stronger basis for the mediating role of health risk perceptions in relationships between SES and health behaviours.

A second limitation involves the operationalization of SES as income. Certainly, SES is a complex construct, involving factors such as level of education or occupational status in addition to income. As stated earlier, income was selected as an indicator of SES because it most closely relates to access to material resources, and because it can act as a proxy for several other aspects of this multidimensional construct (Orpana & Lemyre, 2004). Still, the item used in the current investigation to measure household income did not account for the number of people living on the income. Stronger evidence may have been observed for the role of health risk perceptions in SES differentials had a more accurate indicator of SES been used. The fact that a test of mediation using education rather than income as a measure of SES produced similar, although attenuated findings nevertheless further supports the results presented here.

Third, regression equations achieved statistical significance; however, they only accounted for 5 per cent and 2 per cent of the variation in frequency of smoking and exercise, respectively. The relative modesty of these findings may relate to some methodological issues (i.e. the cross-sectional nature of analyses in a manner consistent with that described by Weinstein, 1993b). However, the inherent complexity of processes related to individual behaviours likely also contributed. While important predictors of heath behaviours, health risk perceptions are only one part of the picture. Accordingly, Ory, Jordan, and Bazzarre (2002, p. 507) noted that 'the ecological model for the 21st century recognizes the wide range of influences on individuals and behaviors, and recognizes a multi-level approach to intervention that includes the integration of individual, community, organizational and societal systems'.

At the same time, a focus on individual-level aspects of health in the current investigation should not be taken as an attempt to place sole responsibility for health on individuals. As noted by Marmot (2005, p. 1102), we rather 'need to examine the causes of the causes: the social conditions that give rise to high risk of non-communicable disease whether acting through unhealthy behaviours or through the effects of impossibly stressful lives'. Indeed, placing responsibility for health on individuals may mask the effects of social, economic, and political factors on health behaviour choices (Williamson & Fast, 1998). Furthermore, differentials in health behaviour account for some, but not all, of the social gradient in health. One study revealed that smoking accounted for less than half of the excess disease among socially disadvantaged individuals, suggesting that other factors such as social conditions may additionally be important (Marmot, 2006). Also, additional analyses of the present data (not presented here) revealed that health behaviours only slightly mediated the relationship between income and self-reported health.

Conclusion

Despite its focus on the individual, the current investigation provides further evidence of the need to address both individual-level factors and the broader social environment in designing health interventions. Corroborating evidence was found for differential Biochemical and Social, but not Lifestyle health risk perceptions according to SES, suggesting that the basis for SES differentials in health behaviour extends beyond perceptions of the specific health risks in question. Evidence was also found that heightened Social health risk perceptions contribute to increased smoking frequency among individuals of lower SES. Still, it is important to recognize that such perceptions are not necessarily wrong or inaccurate: if individuals of lower SES are exposed to a greater number of social health risks, should their perceptions not reflect it? Clearly, research on health-related perceptions involved in SES differentials in health behaviour has value for the development of more effective health interventions. However, the roles of the social

environment as well as individuals' perceptions of it warrant further scrutiny in research on SES differentials in health status and behaviour.

Note

1. The proportion of the effect that is mediated is equal to 1-c´/c, where c represents the raw regression coefficient for the relationship between the independent variable and dependent variable and c´ represents that of this relationship, adjusting for the mediator.

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