Explaining the Social Gradient in Health in Canada: Using the National Population Health Survey to Examine the Role of Stressors

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Understanding the mechanisms that explain the pervasive association between socioeconomic status and health has been identified as an important area of research. Using the 1994–1995 National Population Health Survey, this study examines whether exposure to psychosocial stressors may be one mediating mechanism of the social gradient in health. Data were obtained including indicators of socioeconomic status (SES); exposure to recent life events and chronic stressors; and self-rated health status. Results showed a clear gradient in poor self-rated health with decreasing SES. Higher exposure to stressors across several domains was also observed with decreasing SES. Exposure to stressors was further associated with poor self-rated health, above and beyond adjusting for SES. Across income adequacy groups, exposure to stressors accounted for 16% to 26% of the relationship between income group and poor self-rated health among men and for 6% to 15% among women, suggesting that exposure to psychosocial stressors may be one of the mediators underlying the higher prevalence of poor self-rated health within lower socioeconomic groups.

Keywords: socioeconomic status, social gradient, stressors, stress, self-rated health

The social gradient in health describes the graded association observed between socioeconomic status (SES) and health status. This pervasive pattern of greater morbidity and earlier mortality associated with lower income, education, or occupational status persists for almost every disease, including heart disease, diabetes, numerous cancers, and mental illnesses (Marmot, Shipley, & Rose, 1984; Pincus, Callahan, & Burkhauser, 1987; Susser, Hopper, & Watson, 1985). Researchers have attempted to identify the causal mechanisms governing this association so that interventions can be appropriately targeted. Current explanations of the social gradient in health fall into three broad categories: material/structural, behavioral/lifestyle, and psychosocial mechanisms (Elstad, 2000). The purpose of this article is to provide evidence for the contribution of psychosocial stressors to the social gradient in health, with consideration of the multifactorial nature of causation of patterns of health and illness.

The material/structural explanation posits that lower SES individuals are exposed to more harmful physical environments and have less access to health care and other material health-promoting resources (Lynch, Davey Smith, Kaplan, & House, 2000). The behavioral/lifestyle explanation suggests that lower SES individuals are less healthy as a result of poorer health-related behaviors such as smoking or poor eating habits (Lynch, Kaplan, & Salonen, 1997). However, evidence suggests that these two explanations can only explain part of the gradient (Adler et al., 1994; Evans, Barer, & Marmor, 1994) and considerable variance remains unexplained. The third paradigm is promising in explaining some of the residual variance between SES and health, and proposes that SES is associated with contextual social factors and resulting psychological processes that result in poor health through behavioral and psychobiological mechanisms. Although these three explanations are often presented as competing hypotheses, there is considerable overlap and potential synergy between them, as the effects of one source of health liability may compound the effects of another. For example, exposure to psychosocial stressors is associated with onset of depression (Brown & Harris, 1978), and an inability to pay for the services of a psychologist could prolong the healing period, leading the individual to smoke more (Graham, 1994). Therefore, although the primary purpose of this article is to explore the contribution of a psychosocial mechanism

to the social gradient in health, this is not to the exclusion of other important pathways.

One of the proposed psychosocial mechanisms is through differential exposure to adverse life circumstances, including exposure to stressors arising from living contexts largely determined by socioeconomic status (Baum, Garofalo, & Yali, 1999; Pearlin, 1989). Stressors can be conceptualized as acute events or ongoing situations in the environment that would, for the average person, invoke a strong emotional reaction and that usually constitute a threat, demand, or constraint (Brown & Harris, 1978; Wheaton, 1994). Such events or situations can be regarded as stressors regardless of whether a strong emotion is indeed perceived by the individual. Several taxonomies of stressors have been articulated, including life events, chronic stressors, and work stress. Many of these stressors demonstrate a social distribution, with lower status individuals being exposed to a greater number of life events (Cohen, Kaplan, & Salonen, 1999; Gottlieb & Green, 1984; Stronks, van de Mheen, Looman, & Mackenbach, 1998; Turner, Wheaton, & Lloyd, 1995; Brown & Harris, 1978); chronic stressors (Stronks et al., 1998; Turner et al., 1995); and work stress (Karasek & Theorell, 1990; Fotinatos-Ventouratos & Cooper, 1998; Pearlin, 1989).

If exposure to stressors is to mediate the social gradient in health, then it must also be related to poor health. Exposure to stressors and resulting psychological stress have been associated with numerous negative health outcomes, and at least two mechanisms for this have been suggested. First, changes in health-related behaviors have been associated with stressor exposure, such as increased smoking during times of stress (Baum & Posluszny, 1999; Graham, 1994). Second, direct psychophysiological effects on endocrine and immune systems are biologically plausible mechanisms (Brunner, 1997; McEwen, 1998). Exposure to a wide range of life events has been associated with greater risk for numerous diseases (Brown & Harris, 1989), and job strain has been consistently associated with a greater risk for cardiovascular disease (Schnall, Landsbergis, & Baker, 1994; Hemingway & Marmot, 1999). Indeed, these pathways between stressors and health attest to the impossibility of attributing social gradients in health to solely one explanation.

Recently, Stronks et al. (1998) demonstrated an inverse association between education and several stressors, and demonstrated that stressors contributed approximately 20% of the increased risk of poor health among the lowest educational groups in the Netherlands. Similarly, Cohen et al. (1999) reported a comparable contribution of exposure to stressors to poor health in lower income and education groups in both American and Finnish samples. These studies demonstrate that even using different indicators of socioeconomic status, a similar pattern of health gradients emerges. Socioeconomic status (SES) is a complex latent concept which refers to an individual's position in society relative to others. The relative importance of a given position is determined primarily by society's value for the function of that position, and scarcity of individuals with requisite skills to fulfill the role (Davis & Moore, 1945). One indicator of SES is income which, when obtained through employment or social transfer, reflects to a large extent the interplay of role value and scarcity of possible incumbents. Thus, occupational prestige and education are closely related to income. In terms of functional value, income is most closely related to access to material resources. At the same time, it can act as a proxy for other important aspects of SES, such as power, status, and style of life, which, although important, are the not the focus of these analyses.

The purpose of this study is to provide converging evidence for psychosocial mediation of the social gradient in health by testing whether a similar pattern of results is observed within a Canadian sample. The specific objectives of this study are to demonstrate inverse income gradients of self-rated poor health and exposure to stressors, and to test whether exposure to stressors can account for the increased prevalence of poor health among lower SES individuals.

Data and Methods

Data were obtained from the 1994–1995 cycle of the National Population Health Survey (NPHS; Statistics Canada, 1996) which has been described in detail by Tambay & Caitlin (1995). Approximately 17,000 participants were sampled using a multi-stage stratified sample of dwellings within clusters of dwellings. One participant per household was randomly selected as the targeted participant. Data were collected by Computer Assisted Interviewing. Within the 88.7% of households agreeing to participate, 96.1% of selected individuals agreed to provide detailed data, resulting in an overall response rate of 85.2 % of individuals. Reporting on selected individuals by another person (i.e. proxy reporting) accounted for 4% of the data (Statistics Canada, 1996). In order to take into account the complex survey design of the NPHS, sampling weights were calculated based on the formula provided by Statistics Canada, for men and women separately.

Participants ranging from age 20 to 80 and older were retained for our analyses (n = 15,779), including 7,126 men and 8,653 women. Less than 9% of participants had missing data on any of the variables included in the analyses. Participants with a complete set of data included 6,351 men and 8,077 women. Due to the use of weights as described previously, the weighted sample size for these analyses was 4,852 men and 6,215

women having a complete set of data, and all reported estimates are based on weighted data.

Twenty-five percent of men and 26% of women had less than high school education, whereas 17% of men and 14% of women had a university degree or higher. Most men and women were married or living in a spousal relationship (71% and 65%, respectively). Most women were currently employed (54%), however a considerable minority had not worked within the previous 12 months (40%). A greater proportion of men were currently employed (70%), with only 22% not having worked in the previous 12 months.

Measures

SES. Of the many possible indicators of SES status, in this study SES was measured by household income, grouped into five approximate income quintiles. Household income takes into account the incomes of all working adults in the household, and therefore is close to the concept of access to material resources. The lowest income quintile ranged from CN$0 to CN$19,999; the second from CN$20,000 to CN$ 39,999; the middle from CN$40,000 to CN$49,999; the fourth from CN$50,000 to CN$79,999; and the highest had household incomes of CN$80,000 and greater.

Stressors. Three stressors scales were included in the NPHS: chronic stressors, recent life events and job strain. Dichotomous variables as well as scores of the number of stressors were created as described later. The Chronic stressors scale consisted of a series of 18 questions relating to situations that the participant reported were present in his or her life (Wheaton, 1994; Turner et al., 1995). Examples included: "A child's behavior is a source of serious concern for you"; "You would like to move but you cannot"; and "Someone in your family has an alcohol or drug problem." The Chronic stressors scale has shown good convergent validity with indicators of difficult social circumstances (e.g., reports of prior life events which could result in chronic problems) and discriminant validity with measures of psychological distress (Wheaton, 1994). The Chronic stressors questions were used to calculate dichotomous exposure scores for each domain of stressors (0 = no problems, 1 = any number of problems; variable name indicated in parentheses). Several domains of stressors are measured, including stressors related to the individual (personal), relationship problems with a spouse (marital), problems with children (children), family health problems (family health), a poor physical and social environment (neighborhood), and financial problems (financial).

The job strain items were based on the Job Content Questionnaire (Karasek & Theorell, 1990) and comprised Decision Latitude (five questions reflecting skill discretion and decision authority; e.g., "Your job allows you freedom to decide how you do your job") and Psychological Demands (two questions; e.g., "Your job is very hectic"). Response choices ranged from 0 (*strongly agree*) to 4 (*strongly disagree*). Individuals falling in the bottom tertile of Decision Latitude and in the top tertile of Psychological Demands were considered to be exposed to job strain.

In this study, chronic stressors are conceptualized as adverse situations lasting for an extended period of time. Therefore, in creating an aggregate scale of chronic stressor exposures, dichotomous exposure scores on all six chronic stressor domains as well as the dichotomous Job strain exposure were summed to form a chronic stressor exposure index. This resulted in an interval scale that represents the number of domains in which an individual reports they are exposed to a chronic stressor, and can range from 0 to 5, 6 or 7 depending on marital, parental, and employment status.

The recent life events scale (Wheaton, 1994) was the sum of all positive responses to a series of 10 questions concerning major negative events that may have happened to the participant or his or her close others during the previous 12 months. Scores ranged from 0 to 8, 9 or 10, depending on marital and parental status. Examples of questions include "In the past 12 months, did you or someone in your family have an unwanted pregnancy?" and "In the past 12 months, were you (or your partner) demoted at work or did either of you take a cut in pay?" This variable was also recoded into an additional dichotomous exposure variable, with zero representing those participants with no reported life events and 1 representing all others.

Health. Numerous perspectives, including biomedical, biopsychosocial or functional perspectives, can be adopted with respect to the operationalization of the concept of health, determining the choice of measured health indicators. We take the position that health is a multidimensional concept that reflects more than a state of being free from disease and that includes an individual's subjective experience and evaluation of their own health. Thus, self-rated health was chosen here as the single best global measured indicator of health status.

In addition to its utility as an easy to administer and conceptually valid global evaluation of perceived health status, self-rated health has also demonstrated surprisingly robust concurrent and predictive ability of accepted objective indicators of health. Self-rated health predicts future mortality (Idler & Benyamini, 1997), and is associated with long-standing illness (Manor, Matthews, & Power, 2001) and health care utlization (Hansen, Fink, Frydenberg, & Oxhoj, 2002). It is highly stable, suggesting that it is not an assessment of transient, time-limited health states. In one study, 90% of participants reporting good health at

baseline reported good health at the ten year follow up (Manor et al., 2001).

In the NPHS, a single question assessing self-rated health was used, asking the respondents, "In general, would you say that your health is poor, fair, good, very good, or excellent?" The question was recoded into a dichotomous good versus poor health variable, with responses of excellent, very good and good being coded as 0 (*good health*) and responses of fair or poor being coded as 1 (*poor health*).

Analyses

Logistic regression using SPSS 11.0 was used to conduct statistical analyses. Analyses were run separately for men and women in order to enable the observation of sex differences in patterns of association. The highest income quintile was used as the reference group. Logistic regression was used to test the association between SES and self-rated health, SES and stressor exposures, and stressor exposures and self-rated health. All analyses controlled for age (in ten year groups from age 20 to 70 and over). Smoking status (daily smoker vs. all others), physical activity level (sedentary vs. all others), and the social roles of marital, parental, and employment status were also controlled when self-rated health was the dependent variable.

Age-adjusted prevalences of poor self-rated health and exposures to stressors were calculated, using the age-distribution of the sample as the standard. For Marital problems, Problems with children, and Job strain, prevalences were calculated only for participants in a spousal relationship, parents, and employed participants, respectively.

To test for mediation of the SES-health relationship by exposure to stressors, the aggregate chronic stressor score and the aggregate recent life events score were entered into the logistic regression predicting poor self-rated health from income quintile after adjustment for the aforementioned factors. In order to test for mediation a relationship must be demonstrated between the predictor variable (SES) and the mediator (stressors) and between the mediator (stressors) and the outcome variable (health). Mediation is demonstrated by a reduction in the original predictor-outcome relationship when the mediator is included in the regression (Holmbeck, 1997; Baron & Kenny, 1986). Raw logistic regression coefficients from different equations can not be directly compared because the scale of the variables varies as a function of the degree of prediction, which itself varies when different variables are included in the equation. To account for this, logistic regression coefficients must first be standardized before comparing coefficients from different models as a test for mediation (MacKinnon & Dwyer, 1993). The

method proposed by Menard (2002) was used to standardize the coefficients, using the equation:

$$b^*_{YX} = (b_{YX})(s_X)/\text{SQRT } (s^2 \text{ predicted logit}(\hat{Y})/R^2)$$
$$= (b_{YX})(s_X)(R)/S \text{ predicted logit}(\hat{Y})$$

Results

As shown in Table 1, a clear social gradient in poor self-rated health was observed. Age-adjusted prevalence of poor self-rated health ranged from 3% to 18% among men and from 7% to 20% among women. Age-adjusted prevalences of reported stressor exposures, including *p* for the Test for Trend obtained from logistic regression analyses, are also shown in Table 1. The direction and strength of these relationships varied across stressor domains. Contrary to expectations, the prevalence of personal stressors increased with increasing income quintile. For men, prevalence of all other stressors was inversely associated with income quintile: a significant trend across all domains indicated higher exposure among lower income quintile groups. For women, this significant trend was observed for exposure to marital, financial, neighborhood, and life event stressors. No significant trend among women was observed for stressors associated with children, family health problems, or job strain. As seen in Table 1, the social gradients in exposure to stressors were most pronounced with financial problems and neighborhood stressors.

Reported exposure to each stressor was associated with significant odds ratios for poor self-rated health after adjusting for age, behavioral factors, and social roles as reported in Table 2. Whereas confounding of the relationship by income quintile was a possibility, in fact adjusting for this had very little effect on the stressor–health relationship. After adjusting for income quintile only the odds ratio associated with Marital stressors among men became marginally nonsignificant.

As reported in Table 3, odds ratios for poor self-rated health increased progressively as income quintile decreased, even after adjusting for age and social roles. All odds ratios indicated a significant difference between the reference and comparison groups ($p < .5$), except for the second highest income quintile for both men and women. Adjusting for health behaviors resulted in attenuation of the odds ratios, with the odds ratio for the third highest income quintile in men also becoming nonsignificant. However, a step-wise gradient remained, with men in the lowest income quintile having an adjusted odds ratio of 3.12 and women in the lowest income quintile having an adjusted odds ratio of 3.27.

Adjusting for exposure to stressors as a test of mediation resulted in further attenuations of the odds ratios.

Table 1. *Age-Adjusted Prevalences of Poor Self-Rated Health and Reported Stressor Exposures by Income Quintile, Including p for Test for Trend*

| | Income Quintile (%) | | | | | |
	(Lowest) 1	**2**	**3**	**4**	**(Highest) 5**	**p**
Men						
Poor self-rated health	18	11	7	6	3	< .01
Personal	54	54	54	53	60	< .01
Marital [a]	19	20	19	14	12	< .01
Children [b]	38	36	32	27	30	< .05
Family health	26	22	16	20	17	< .01
Job strain [c]	8	9	7	8	4	< .01
Neighborhood	37	27	26	25	22	< .01
Financial	60	44	36	32	22	< .01
Life events	50	36	35	34	28	< .01
Women						
Poor self-rated health	20	13	10	6	7	< .01
Personal	63	62	62	62	65	< .05
Marital [a]	28	24	22	20	19	< .05
Children [b]	39	32	33	33	36	ns
Family health	27	26	26	24	24	ns
Job strain [c]	12	12	13	11	9	ns
Neighborhood	36	27	22	23	18	< .01
Financial	58	39	33	28	18	< .01
Life events	50	38	37	34	36	< .01

[a] Restricted to participants in a spousal relationship (men = 3,438, women = 4,065). [b] Restricted to parents (men = 3,316, women = 4,703). [c] Restricted to employed participants (men = 3,400, women = 3,345).

Table 2. *Odds Ratios for Poor Self-Rated Health According to Stressor Exposures Adjusting for Social Roles and Showing the Effect of Adjusting for Income Quintile (Model 2)*

| | Men | | | | Women | | | |
| | Model 1 | | Model 2 | | Model 1 | | Model 2 | |
Stressor	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Personal	1.90	1.53, 2.37	1.86	1.49, 2.31	1.99	1.66, 2.38	1.97	1.64, 2.35
Marital	1.40	1.04, 1.87	1.33	.99, 1.78	1.93	1.54, 2.42	1.88	1.49, 2.30
Children	1.35	1.06, 1.71	1.32	1.04, 1.68	1.82	1.52, 2.18	1.79	1.50, 2.15
Family health	1.48	1.18, 1.87	1.42	1.13, 1.80	1.51	1.26, 1.80	1.52	1.27, 1.82
Job strain	1.86	1.78, 2.95	1.75	1.11, 2.78	1.71	1.17, 2.50	1.68	1.15, 2.47
Neighborhood	2.04	1.62, 2.55	1.91	1.55, 2.43	1.84	1.54, 2.20	1.76	1.47, 2.10
Financial	2.12	1.17, 2.63	1.88	1.51, 2.35	2.04	1.71, 2.43	1.84	1.54, 2.21
Life events	1.93	1.55, 2.40	1.83	1.47, 2.28	1.65	1.39, 1.96	1.59	1.34, 1.90

Note. OR = odds ratio; CI = confidence interval. Model 1: Adjusted for age, social roles, and health behaviors; Model 2: Adjusted for age, social roles, health behaviors, and income.

Including stressor exposures in the model significantly improved the prediction of poor self-rated health. The last column in Table 3 presents the percentage reduction of standardized logistic regression coefficients for each income quintile group after including exposure to stressors in the logistic regression equation predicting poor self-rated health. Among men, the attenuation in standardized regression coefficients ranged from 16 to 26%, and among women, from 6 to 15%, suggesting partial mediation of the differences between the highest and lower socioeconomic groups by stressor exposures. Figure 1 demonstrates the reduction in the odds ratios, with the shaded portion of the bar representing the proportion of the odds ratio that was attenuated

when exposure to stressors was accounted for. However, as can be seen by the residual odds ratios, a considerable association between SES and poor self-rated health persisted.

Discussion

These results provide converging evidence for the psychosocial hypothesis of the social gradient in health. Decreasing income quintile was associated with incremental increases in the prevalence of poor self-rated health as well as higher prevalences of many stressors. Exposure to each stressor was associated

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Table 3. *Odds Ratios of Poor Self-Rated Health According to Income Quintile and Percentage Reduction of Standardized Logistic Regression Coefficients Demonstrating Mediating Effect of Stressors*

	Sample Size	Model 1[a]		Model 2[b]		Model 3[c]		%
Income	*n*	OR	95% CI	OR	95% CI	OR	95% CI	Reduction
Men								
(Lowest) 1	850	3.44	2.15, 5.52	3.12	1.94, 5.02	2.38	1.47, 3.86	26
2	1,400	2.29	1.46, 3.60	2.16	1.37, 3.40	1.88	1.19, 2.98	20
3	650	1.71	1.03, 2.86	1.61	.96, 2.70	1.51	.90, 2.54	16
4	1,280	1.28	.79, 2.08	1.23	.76, 2.00	1.17	.72, 1.91	25
(Highest) 5	672	1.0	1.0	1.0				
Women								
(Lowest) 1	1,558	3.50	2.28, 5.40	3.27	2.12, 5.04	2.72	1.76, 4.22	15
2	1,761	2.56	1.68, 3.91	2.43	1.59, 3.71	2.26	1.47, 3.47	8
3	807	1.90	1.19, 3.05	1.82	1.14, 2.91	1.75	1.09, 2.82	6
4	1,403	1.47	.93, 2.32	1.48	.94, 2.33	1.43	.90, 2.27	8
(Highest) 5	686	1.0	1.0	1.0				

Note. OR = odds ratio; CI = confidence interval. [a]Model 1: Adjusting for age and social roles; [b]Model 2: Adjusting for age, social roles, and health behaviors; [c]Model 3: Adjusting for age, social roles, health behaviors, and all stressors.
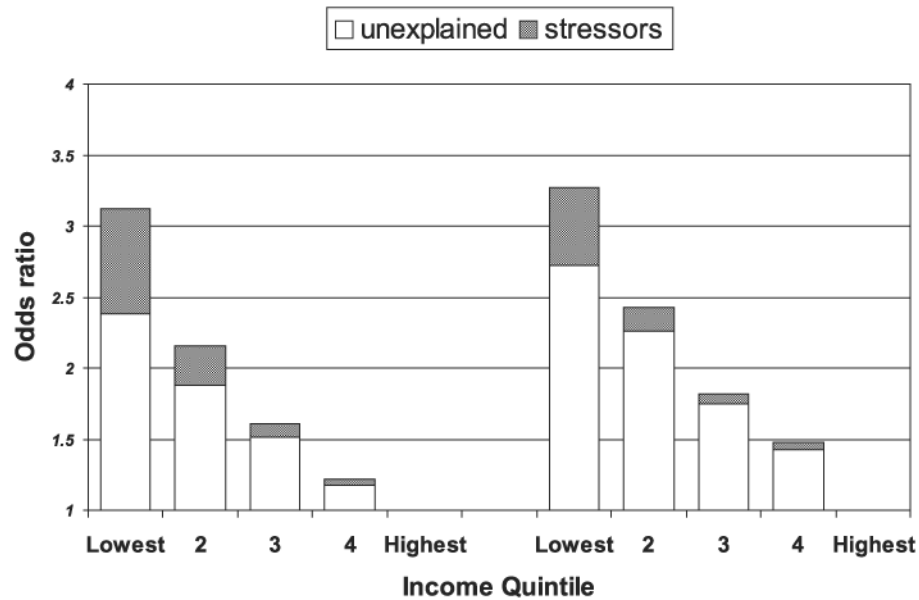
Figure 1. Odds ratios of poor self-rated health for men and women by income quintile controlling for age, social roles and health behaviors, with the shaded area showing proportion of odds ratios explained by to stressors.

with significant odds ratios for poor self-rated health. Finally, partial mediation of the SES-health relationship by exposure to stressors was demonstrated by a reduction in odds ratios when stressors were accounted for in the regression equation.

The observed relationship between income quintile and self-rated health is consistent with the preponderance of results describing the social gradient in health, across Western countries and using related but distinct indicators of SES such as income quintile, occupational prestige and education[1]. The consistent pattern

[1]We also repeated our analyses using education as the socioeconomic indicator and obtained results similar to those presented.

of results is remarkable and emphasizes the pervasiveness of the social gradient in health. However, descriptions of the social gradient in health tell us nothing about what causes this pattern; the results of this study suggest exposure to stressors as one psychosocial pathway which may be an important contributor to SES differences in health.

With the exception of personal stressors, we observed a significant trend of increasing prevalence of stressor exposures with decreasing income quintile for all stressors among men, and for many stressors among women. Our results concur with those of Turner et al. (1995), who reported a linear relationship between SES and number of chronic stressors, and significantly

greater exposure to negative life events among lower SES individuals. In contrast, Stronks et al. (1998) found that only family health problems and poor financial conditions were associated with decreasing education, whereas relationship problems were reported more frequently with increasing education. Cohen et al. (1999) observed decreasing risk of exposure to two or more life events with increasing education or income among an American sample but not among a Finnish sample. Reasons for these differences need to be further explored, but may reflect differences in the structuring of social systems between these countries. Alternatively, inconsistent results across studies may be attributable to different methods of measuring stressor exposures.

Differences in the direction and strength of the distribution of types of stressor exposures across socioeconomic strata may be explained by the location of the stressor within the social system. Stressors which are structural in origin, such as poor neighborhood environments or financial problems, demonstrated a steeper gradient than stressors which are more closely related to the individual and his or her microsystem, such as personal stressors or marital problems. Given the use of income as an indicator of socioeconomic status, this result is consistent with the idea of income as a resource for access to material goods and therefore has the greatest association with financial and neighborhood stressors. Other choices of socioeconomic indicators may yield different saliency of gradients. For example education may be more closely related to stressors that can be avoided with appropriate knowledge or skills, whereas occupational prestige as an SES indicator may be more related to stress at work, due to systematic variations in control as a function of power within occupations.

It has been argued that the systemic stressors of financial stressors and a poor neighborhood environment contribute to the social gradient in health through material pathways as opposed to psychosocial ones (Lynch et al., 2000). For example, financial problems could result in an inability to buy nutritious food or to pay for adequate heating. However, these stressors also confer health risk through stress mechanisms, as they indeed result in considerable psychological distress (MacFayden, MacFayden, & Prince, 1996). Furthermore, systemic stressors could generate other secondary stressors at system levels more proximal to the individual. Therefore, intervening at the level of "upstream" stressors through material/structural interventions may prevent the development of "downstream" stressors which normally require intervention at the level of the individual.

Reporting of exposure to stressors was consistently associated with higher odds ratios of poor self-rated health, even after adjusting for income quintile. Both Stronks et al. and Cohen et al. also observed increased

health risk associated with increasing stressor exposure. However, given the cross-sectional nature of this study, these associations must be interpreted with caution as it is possible that poor health results in an increase in reporting stressor exposures. For example, health problems may cause an individual to incur large expenses associated with the health problem, resulting in financial problems. For this reason, longitudinal studies which examine changes in health status would provide stronger evidence supporting the hypothesized psychosocial mechanisms.

Including exposure to stressors in the model of the relationship between income quintile and poor self-rated health decreased the odds ratios across all groups; however, significant associations persisted as did the graded nature of these relationships. This provides correlational evidence for partial mediation of income effects on health through psychosocial pathways: greater reported stressors appear to contribute to the higher prevalence of poor self-rated health among lower income groups as compared to the highest income group. Although it is not possible to statistically discriminate between mediation and confounding, because exposure to stressors are conceptualized as arising from the living contexts associated with one's socioeconomic status, and because they are plausible causes of poor health, these results should be interpreted as an instance of mediation (Rothman & Greenland, 1998). Moreover, the present analyses may have underestimated the contribution of stressors to the social gradient in health by adjusting for behavioral factors. Changes to health behaviors resulting from stressor exposure have been reported and are postulated to be one mechanism through which stress affects health. Therefore some of the contribution of exposure to stressors to the social gradient in health may have been removed due to this, resulting in a conservative estimate of the mediating effect of exposure to stressors.

Several limitations of this study must be highlighted. First, due to the cross-sectional nature of this study, the results should not be interpreted as causal associations. Future analyses of the NPHS dataset should examine changes in self-rated health over time as well as incident reports of disease to better establish causal sequence. Second, the self-report nature of the data raises concerns of reporting biases and shared methods variance. In the domain of stress research, considerable attention has been given to the possible confounding of self-reports of stressor exposures and of health problems by negative affectivity (Watson & Pennebaker, 1989). Furthermore, negative affectivity appears to be more common among lower SES individuals (Adler, Epel, Castellazzo, & Ickovics, 2000). However, some authors have argued that negative affectivity has a substantive role linking stressors exposures to ill-health, and therefore adjust-

ing for it may lead to an underestimation of actual effects (Spector, Zapf, Chen, & Frese, 2000). Use of contextual or observer-based measurement of stressors would address the possibility of reporting biases; however this is not feasible in large population-based studies. Finally, these results should be interpreted with the caveat that alternative explanations driven by unmeasured factors can not be excluded.

Given the results presented in this study, which concur with those presented by other researchers in several countries, further research into the psychosocial explanation of the social gradient in health is warranted. The important proportion of the relationship between SES and health explained by psychosocial stressors suggests that interventions that reduce the chronic stressor burden may contribute to the reduction of socioeconomic gradients in health. Interventions which target material and structural factors which give rise to these stressors may be particularly important.

References

Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S. L. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist, 49*(1), 15–24.

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology, 19*(6), 586–592.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173–1182.

Baum, A., Garofalo, J. P., & Yali, A. M. (1999). Socioeconomic status and chronic stress: Does stress account for SES effects on health? *Annals of the New York Academy of Sciences, 896,* 131–144.

Baum, A., & Posluszny, D. M. (1999). Health psychology: Mapping biobehavioral contributions to health and illness. *Annual Review of Psychology, 50,* 137–63.

Brown, G. W., & Harris, T. O. (1978). *The social origins of depression.* London: Tavistock.

Brown, G. W., & Harris, T. O. (1989). *Life events and illness.* New York: Guilford.

Brunner, E. (1997). Socioeconomic determinants of health: Stress and the biology of inequality. *British Medical Journal , 314,* 1472–1476.

Cohen, S., Kaplan, G. A., & Salonen, J. T. (1999). The role of psychological characteristics in the relation between socioeconomic status and perceived health. *Journal of Applied Social Psychology, 29*(3), 445–468.

Davis, K. & Moore, W.E. (1945). Some principles of stratification. *American Sociological Review, 10,* 242–249.

Elstad, J. I. (2000). *Social inequalities in health and their explanations.* Oslo, Norway. Norweigian Social Research

Evans, R. G., Barer, M. L., & Marmor, T. R. (1994). *Why are some people healthy and others not? The determinants of health of populations.* New York: A. de Gruyter.

Fotinatos-Ventouratos, R., & Cooper, C. L. (1998). Social class differences and occupational stress. *International Journal of Stress Management, 5*(4), 211–222.

Gottlieb, N. H., & Green, L. W. (1984). Life events, social network, life-style, and health. *Health Education Quarterly, 11*(1), 91–105.

Graham, H. (1994). *When life's a drag.* London : Her Majesty's Stationery Office.

Hansen, M.S., Fink, P., Frydenberg, M., Oxhoj, M. (2002). Use of health services, mental illness, and self-rated disability and health in medical inpatients. *Psychosomatic Medicine, 64,* 668–675.

Hemingway, H., & Marmot, M. (1999). Psychosocial factors in the aetiology and prognosis of coronary heart disease. *British Medical Journal, 318,* 1460–1467.

Holmbeck, G. N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. *Journal of Clinical and Consulting Psychology, 65*(4), 599–610.

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior, 38*(1), 21–37.

Karasek, R., & Theorell, T. (1990). *Healthy work : Stress, productivity, and the reconstruction of working life.* New York: Basic Books.

Lynch, J. W., Kaplan, G. A., & Salonen, J. T. (1997). Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Social Science and Medicine, 44*(6), 809–19.

Lynch, J. W., Davey Smith, G., Kaplan, G. A., & House, J. S. (2000). Income inequality and mortality: Importance to health of individual income, psychosocial environment, or material conditions. *British Medical Journal, 320,* 1200–1204.

MacFayden, A. J., MacFayden, H. J., & Prince, N. J. (1996). Economic stress and psychological well-being: An economic psychology framework. *Journal of Economic Psychology, 17,* 291–311.

MacKinnon, D. P., & Dwyer, J. H. (1993). Estimating mediated effects in prevention studies. *Evaluation Review, 17*(2), 144–158.

Manor, O., Matthews, S., & Power, C. (2001). Self-rated health and limiting longstanding illness: Inter-relationships with morbidity in early adulthood. *International Journal of Epidemiology, 30,* 600–607.

Marmot, M. J., Shipley, M. J., & Rose, G. (1984). Inequalities in death: Specific explanations of a general pattern? *Lancet, 1,* 1003–1006.

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine, 338*(3), 171–179.

Menard, S. (2002). *Applied Logistic Regression Analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Pearlin, L. I. (1989). The sociological study of stress. *Journal of Health and Social Behaviour, 30*(3), 241–256.

Pincus, T., Callahan, L. F., & Burkhauser, R. V. (1987). Most chronic diseases are reported more frequently by individuals with fewer than 12 years of formal education in the age 18–64 United States population. *Journal of Chronic Diseases, 40*(9), 865–74.

Rothman, K. J., & Greenland, S. (1998). Precision and validity in epidemiologic studies. K. J. Rothman, & S. Greenland (Eds.), *Modern Epidmiology* (pp. 115–134). New York: Lippincott.

Schnall, P. L., Landsbergis, P. A., & Baker, D. (1994). Job strain and cardiovascular disease. *Annual Review of Public Health, 15,* 381–411.

Spector, P., Zapf, D., Chen, P., & Frese, M. (2000). Why negative affectivity should not be controlled for in job stress research: Don't throw the baby out with the bath water. *Journal of Organizational Behavior, 21,* 79–95.

Statistics Canada. (1996). *1994–1995 NPHS Public Use Microdata Documentation.* [CD-ROM]. Ottawa: Minister of Supply and Services Canada.

Stronks, K., van de Mheen, H., Looman, C. W., & Mackenbach, J. P. (1998). The importance of psychosocial stressors for socio-economic inequalities in perceived health. *Social Science and Medicine, 46*(4–5), 611–23.

Susser, M., Hopper, K., & Watson, W. (1985). *Sociology in medicine* (3rd ed.). New York: Oxford University Press.

Tambay, J.-L., & Caitlin, G. (1995). Sample design of the National Population Health Survey. *Health Reports, 7*(1), 29–38.

Turner, R. J., Wheaton, B., & Lloyd, D. A. (1995). The epidemiology of social stress. *American Sociological Review, 60*(1), 104–125.

Watson, D., & Pennebaker, J. W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review, 96*(2), 234–54.

Wheaton, B. (1994). Sampling the stress universe. In W. R. Avison, & I. H. Gotlib (Eds), *Stress and mental health: Contemporary issues and prospects for the future.* (pp. 77–114). New York: Plenum.