ABSTRACT

Class differentials in health have been documented extensively in the sociological literature of the past two decades. Although sociologists have been concerned with analyzing the relationship between social class and health, less attention has been paid to modelling the effects of minimizing social disparities on health outcomes. From a sub-sample (N=1,943) of elderly respondents aged 65 and over, four logistic regression equations where income adequacy was shown to be correlated with morbidity were selected. By adjusting the scores on the income adequacy variable, we were able to model the effect of shifting individuals from lower to higher income groups. The most dramatic results were obtained after all respondents were shifted into the highest income adequacy classification. A more realistic hypothetical model, the transfer of individuals from the lowest income group to the next category, produced the least attractive reduction in morbidity. Obviously, income adjustment alone is insufficient. Findings are discussed in terms of interventions to prevent economic disparity in old age.

ABRÉGÉ

Les différences de classe sociale en matière de santé ont été largement documentées dans la littérature sociologique au cours des vingt dernières années. Bien que les sociologues aient cherché à analyser les rapports entre les classes sociales et la santé, on a prêté moins d'attention à la modélisation des effets de l'atténuation des disparités sociales sur les résultats de santé. À partir d'un sous-échantillon (N = 1 943) de répondants âgés de 65 ans et plus, on a sélectionné quatre équations de régression logistique pour lesquelles on a noté une corrélation entre un revenu suffisant et la morbidité. En ajustant les résultats sur la variable du revenu suffisant, nous avons pu modéliser l'effet du passage des individus d'une catégorie de revenu inférieure à une catégorie supérieure. On a observé les résultats les plus nets après que tous les répondants soient passés dans la catégorie de revenu suffisant la plus élevée. Un modèle hypothétique plus réaliste, soit le transfert des individus de la plus faible catégorie de revenu à la suivante immédiate, a montré la plus faible réduction de la morbidité. Il est clair que l'ajustement du revenu n'est pas suffisant à lui seul. Les résultats sont discutés en termes d'interventions à mener pour prévenir la disparité économique au cours de la vieillesse.

Reducing Economic Disparity to Achieve Better Health: Modelling the Effect of Adjustments to Income Adequacy on Self-Reported Morbidity Among the Elderly in Canada

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There has been a considerable amount of research documenting the existence of class differentials in health among the elderly in the United Kingdom,^{1,2} United States,^{3,4} Western Europe^{5,6} and Canada.⁷⁻⁹ Recently, health policy makers have begun to recognize the need to focus on the underlying social and economic determinants of health.¹⁰ However, to our knowledge, there has been no attempt to model the effect of minimizing social disparities on morbidity with this population. Cairney and Arnold¹¹ demonstrate the effect of income status on a variety of morbid indicators controlling for various lifestyle variables and demographic variables. The findings of this research are congruent with other Canadian work showing income to be the only consistent class predictor of health.¹²⁻¹⁵ The recent emphasis on the correlation between social and economic factors and health raises the question of how might changes in relative income distribution alleviate class disparities in health. In other words, how much

of a reduction in the prevalence of each health condition would be obtained by altering the economic positions of those in most need? To investigate this question, we examine a series of hypothetical models that adjust the income adequacy of a sample of elderly Canadians to test how reductions in economic disparity translate into improved health outcomes.

METHODS AND PREVIOUS FINDINGS

Although the initial analysis has been reported previously,¹¹ a brief summary of the methods and findings are necessary to understand the current study. Data came from the 1991 General Social Survey on Health conducted by Statistics Canada. A sub-sample of respondents (N=1,943) aged 65 and over were available for analysis after a listwise deletion of cases with missing values. Using logistic regression procedures, six different health outcomes were regressed on three indicators of social class (occupation, education, and income adequacy) controlling for sex, age, French ethnic origin, marital status, smoking, drinking, weight, physical activity, and church attendance. Table I provides a description of the independent variables used in the analysis. Since all of the variables except income adequacy were dichotomized, sets of predictors were tested using a technique similar to an incremental F test in OLS regression. Of the six health measures analyzed, only four showed a significant relationship between income and health: self-

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rated health, heart disease, respiratory disease and sleeping problems. Table II provides a description and prevalence rate for each condition. Income adequacy was a significant predictor across all four health outcomes. Those in the lowest income adequacy group are more likely to report having "poorer" health or a specific morbid condition compared to those in higher income groups. Education and occupation, however, are significant as sets of predictors for self-rated health only. In order to assess whether the effect of income on health was mediated through risky lifestyle behaviours,^{3,4,17} two separate models were analyzed: one including only social class and demographic variables, the other with lifestyle measures added. The inclusion of lifestyle variables had little or no effect on the relationship between income adequacy and health suggesting that social class is not correlated with lifestyle among the elderly.

For the present analysis, we select those equations that find income adequacy to be significantly associated with health. Table III presents four fitted logistic regression equations that we employ for further analysis:

$$\text{health condition (e.g., heart disease)} = a + b_1(\text{income adequacy}) + b_k(\text{controls})$$

where k is a vector of covariates (including age, gender, lifestyle variables, etc.)

Income adequacy is a measure created by Statistics Canada. It is a five-category variable based upon the total household income, and the number of individuals living in the household at the time of the survey. The criterion for the categories is based upon low income cutoffs.^{18,19} Using this equation, it is possible to examine the hypothetical effect of income adjustments on the prevalence of each outcome by manipulating respondents' scores on income adequacy. For example, income adequacy was coded 1 for the lowest income group, up to 5 for the highest. By substituting a score of 5 for each respondent, it is possible to examine how the prevalence for each condition changes when all respondents are placed in the highest income group. Three such models are tested: first, we shift all respondents

TABLE I Variables Used in the Analysis	
Variables	Descriptions
Age (years)	65-69 70-74 75-79 80 and over *
Gender	Males Females *
Ethnic Origin	French Canadian Other *
Marital Status	Married Separated/Divorced/Widowed/Single*
Education	Elementary School High School Post Secondary*
Income Adequacy	A categorical measure created considering both household income and number of members in each household. Categories are numbered 1 through 5 representing lowest, low, middle, upper middle and highest income groups respectively.
Occupation (categories created from the Pineo, Porter & McRoberts ¹⁶ Classification of Occupation)	Professional Managerial/Technical Skilled labourers Semi-skilled labourers Unskilled labourers *
Church Attendance	Once per week Once per month Few times per year Once per year Never attend*
Physical Activity	Sedentary (less than 500 kcal/week expended) Active* (500 kcal/week or greater expended)
Smoking (Tobacco)	Regular (at least one per day) Occasional (less often than each day) Former (who no longer smoke) Never smoked*
Drinking (Alcohol Consumption)	Regular (at least once per month) Occasional (less than 1 drink per month) Former (none in the preceding 12 months) Never drank*
Weight	Overweight (BMI > 27) Possibly overweight (25 ≤ BMI ≤ 27) Underweight (BMI 20 or less) Acceptable weight * (21 ≤ BMI ≤ 24)
* Reference category for Dummy variables	

TABLE II Description of Health Measures Used and their Prevalence Rates in this Sample (N=1,943)			
Health Measure	Description	Prevalence	
Self-rated Health	Global, subjective measure where respondents were asked to rate their health in relation to others their own age.	'Good'	1415 (72.8%)
		'Fair/Poor'	528 (27.2%)
Heart Disease	Includes angina, heart failure, and rheumatic diseases.	'Yes'	476 (24.5%)
		'No'	1467 (75.5%)
Respiratory Disease	Includes emphysema, chronic bronchitis, persistent cough and shortness of breath.	'Yes'	381 (19.6%)
		'No'	1562 (80.4%)
Sleep Problems	Includes trouble falling or staying asleep.	'Yes'	676 (34.8%)
		'No'	1267 (65.2%)

into the highest income adequacy category; second, we shift individuals from the lowest and low income adequacy categories into the middle income category; and finally, we shift individuals from the lowest into the low income adequacy category.

RESULTS

Table IV reports the effects of transferring everyone into the highest income adequacy category. The results of these hypothetical models suggest that eliminating all categories below the highest income cate-

TABLE III
Logistic Regressions of Four Morbid Conditions on Socioeconomic Status, Demographics, and Lifestyle Variables

Variables	Self-rated Health	Heart Disease	Respiratory Problems	Sleeping Problems
Age (years)				
65-69	-0.13	-0.73 ***	0.04	0.07
70-74	-0.27	-0.58 ***	0.06	0.05
75-79	-0.38	-0.30	0.01	0.01
80 and over	ref	ref	ref	ref
Gender				
Male	-0.34 **	-0.10	-0.02	-0.43
Female	ref	ref	ref	ref
Marital Status				
Married	-0.21	0.19	0.07	0.27*
Other	ref	ref	ref	ref
Ethnic Status				
French	0.14	-0.17	0.44***	-0.40
Other	ref	ref	ref	ref
Education				
Elementary	-0.07	-0.24	0.49	0.31
High School	0.44	-0.11	0.32	0.17
Post Secondary	ref	ref	ref	ref
Income Adequacy	0.23 ***	-0.16 **	-0.20 **	-0.17 **
Occupation				
Professional	0.33	-0.04	-0.19	0.34
Manag./Technical	-0.01	0.03	-0.02	0.33
Skilled	0.09	-0.33	-0.35	0.12
Semi-skilled	0.14	-0.23	0.01	0.06
Unskilled	ref	ref	ref	ref
Not working	0.40	-0.08	-0.18	-0.04
Church Attendance				
Once per week	0.35 *	0.12	-0.27	0.34
Once per month	0.17	0.00	-0.07	-0.15
Few times/year	0.17	0.03	-0.32	-0.28
Once per year	-0.03	0.10	0.20	0.25
Never attend	ref	ref	ref	ref
Sedentary	-0.80 ***	0.18 *	0.58 ***	0.42 ***
Active	ref	ref	ref	ref
Smoking				
Regular	-0.26	-0.16	0.77 ***	-0.22
Occasional	0.15	0.83 ***	0.25	0.03
Former	-0.25	0.41	0.70 ***	0.16
Never	ref	ref	ref	ref
Drinking				
Regular	0.25	-0.24	-0.38	-0.19
Occasional	0.05	-0.21	-0.17	-0.07
Former	0.23	0.00	-0.31	-0.16
Never	ref	ref	ref	ref
Weight				
Overweight	-0.73 ***	0.26	0.67 ***	0.07
Possibly overweight	0.14	0.04	0.09	-0.08
Underweight	-0.37	0.11	0.27	-0.10
Normal weight	ref	ref	ref	ref
Constant	0.87	0.02	-0.27	0.05

This table reports unstandardized regression coefficients.

* p<0.05

** p<0.01

*** p<0.001

gory would have a substantial impact on health among the aged. The most dramatic effect is observed for self-reported health where positioning everyone into the highest income adequacy category results in a 38% proportional reduction in the prevalence of reporting fair/poor health. As well, increasing income adequacy levels among the aged would yield a 34% reduction in the prevalence of respiratory disease, a 27% reduction in the prevalence of heart disease, and a 22% proportional reduction in the prevalence of sleeping problems.

Despite the dramatic decreases which could be obtained by shifting everyone into the highest income adequacy category, this is a highly implausible scenario. A simple calculation, for example, reveals that the average household income for individuals in the highest income adequacy group was \$84,800 per annum whereas those in the lowest income group averaged about \$7200 per annum. Immense sums of money would be required (approximately \$6470 per month per household) to shift those in the lowest income category into

the highest category. In the interest of examining potentially more feasible alternatives, two additional models were calculated: considering both the effect of transferring individuals from the lowest income and the low income adequacy category into the middle income adequacy group, as well as transferring individuals from the lowest income category into the low income adequacy group. Table V presents the findings for these hypothetical scenarios.

The results of this analysis reveal fairly significant gains made by transferring individuals from the lowest and low income groups into the middle income adequacy group. A 27% proportional reduction is observed for self-rated health. The proportional reductions for the prevalence of respiratory disease, cardiovascular disease and sleeping problems are 18%, 14% and 14% respectively. As the table illustrates, simply shifting individuals from the lowest to the low income adequacy category provides substantially less change for cardiovascular disease (6% proportional reduction), respiratory problems (8%) and sleeping problems (5%). Fairly substantial reductions in the prevalence of reporting poor/fair self-rated health, however are obtained (15% proportional reduction) by shifting individuals from the lowest to the low income adequacy category.

DISCUSSION

The present study addresses a deficit in prior class-based analyses of morbidity and mortality viz., the lack of attention paid to assessing the effect of reducing income inequalities on health by medical sociologists and social epidemiologists. However, we are not suggesting that a reduction in the prevalence of disease or the alleviation of existing conditions can be achieved by increasing everyone's income. If only the solution were that simple. Rather, we have attempted to provide an estimate of the proportion of disease prevalence that can be attributed to income adequacy differentials in a sample of seniors in Canada. Moreover, the relationship of income to health is a complex one. Income adequacy should be considered an indicator of what has been termed relative deprivation.²⁰ As

Cassel²¹ observed many years ago, it is not social class per se, but the noisome environments associated with poverty which gives rise to disease. Although income is a powerful determinant of placement in such environments, income is not the only risk factor in the etiology of these conditions. By focusing only on income distribution, policy makers run the risk of ignoring other crucial social factors which influence population health. This notwithstanding, income and changes to income are significant determinants of health and well-being among the elderly.^{7,11}

Those interventions most likely to succeed in improving the overall health of the population must address underlying social inequities.²² It must be recognized that income inequalities in old age are the result of economic disadvantage throughout the life course. For example, earnings in middle age will influence income after retirement. Therefore, in an effort to reduce health problems among the elderly, inequalities in early cohorts must be targeted for intervention. It is important for policy makers to realize that current social interventions among younger cohorts will undoubtedly have health consequences in the future. This is an especially salient issue today where unemployment rates among the young remain high. The repercussions of unemployment may not only have proximal effects on health;^{23,24} long-term unemployment among the young delays the opportunity to save for retirement. This, coupled with the continued erosion of the public pension system, could lead to economic disparity and subsequent poor health in old age. While the seeds of disadvantage are planted early in life, the consequences may not be felt until much later.

TABLE IV
The Percentage Changes in the Prevalence of Four Morbid Conditions Associated with Transferring All Respondents into the Highest Income Adequacy Category

Health Conditions	Number of Respondents from Sample with Condition		Number of Respondents with Condition after Eliminating the Lowest, Low, Middle and Upper Middle Income Adequacy Categories		% Proportional Reduction
	n	%	n	%	
Self-rated Health*	528	(27)	330	(17)	37.5%
Respiratory Disease	381	(20)	253	(13)	34.0%
Heart Disease	476	(24)	350	(18)	26.5%
Sleep Disorders	676	(35)	528	(27)	22.0%

* indicates % of respondents who reported 'poor' self-rated health.

Interventions, then, which target youth unemployment may help to prevent inequalities in health among the aged.

Health policy development could benefit from analyses that examine the effect of social disparity on health. As Rachlis and Kushner²⁵ note, the Canadian health care system is in great difficulty because of ever-increasing expenditures relative to the Gross Domestic Product (GDP). In gerontology, economists and sociologists have addressed this concern by considering how much of a burden the elderly will place on the system in the future.^{26,27} Planning and allocation of services with limited resources is already a reality. Class-based analyses of the kind presented here could greatly contribute to this project. For example, the ability to predict the prevalence of specific diseases such as cardiovascular and respiratory problems by income adequacy would allow policy planners to assess the extent to which specific groups (i.e., low income groups) will place demands upon the system. Further study may also contribute to a better understanding of social class-based

differentials in health in general which in turn could contribute to the goal of disease prevention through public health measures. As Mechanic and Aiken²⁸ have noted, the role of social science should be to influence policy makers and the general public to change the way they think about social and health problems. We believe that by demonstrating the independent effects of income adequacy on health through analyses such as the one conducted here, policy makers and others can be convinced of the impact of social conditions on the health of the elderly.

Finally, it is important to note that our results rest on the assumption that income attainment is causally prior to health status. However, an equally plausible assumption is that health status determines income. Since these data are cross sectional, it is not possible to test this alternate hypothesis. However, previous longitudinal research with a sample of elderly Canadians has shown that income is causally prior to the onset of health problems.⁷ Moreover, although selection effects

TABLE V
Percentage Changes in the Prevalence of Four Morbid Conditions After Eliminating the Lowest and Low Income Adequacy Groups

Health Conditions	Number of Respondents from Sample with Condition		Number of Respondents with Condition After Eliminating the Lowest Income Category		% Proportional Reduction	Number of Respondents with Condition After Eliminating the Lowest and Low Income Categories		% Proportional Reduction
	n	%	n	%		n	%	
Self-rated Health	528	(27)	447	(23)	15.3%	387	(20)	26.7%
Heart Disease	476	(24)	447	(2)	6.1%	408	(21)	14.3%
Respiratory Disease	381	(20)	350	(18)	8.1%	311	(16)	18.4%
Sleep Problems	676	(35)	641	(33)	5.2%	583	(30)	13.8%

can never be entirely discounted, the consensus in the literature is that the dominant effect is that of social factors on health.^{29,30} Further research with longitudinal data would allow for the proper calculation of attributable risk³¹ and hence provide a more reliable estimate of the proportion of disease occurrence that could be eliminated by reducing income inequalities.

REFERENCES

- Victor CR. Inequalities in health in old age. *Age and Ageing* 1989;18:387-91.
- Arber S, Ginn J. Gender and inequalities in health in later life. *Soc Sci Med* 1993;36(1):33-46.
- House JS, Kessler RC, Herzog AR, et al. Age, socioeconomic status and health. *Milbank Q* 1990;68(3):383-411.
- House JS, Kessler RC, Herzog AR, et al. In: Schaie KW, Blazer D, House JS (Eds.), *Aging, Health Behaviours, and Health Outcomes*. New Jersey: Lawrence Erlbaum Associates, 1992;1-32.
- Olausson PO. Mortality among the elderly in Sweden by social class. *Soc Sci Med* 1991;32(4):437-40.
- Thorslund M, Lundberg O. Health and inequalities among the oldest old. *J Aging and Health* 1994;6(1):51-69.
- Hirde JP, Brown SK, Forbes WF, et al. The association between self-reported income and perceived health based on the Longitudinal Study of Aging. *Can J Aging* 1986;5(3):188-204.
- Hirde JP, Forbes WF. Estimates of the relative risk of mortality based on the Ontario Longitudinal Study of Aging. *Can J Aging* 1989;8(3):227-37.
- Forbes WF, Hayward LM, Agwani N. Factors associated with the prevalence of various self-reported impairments among older people residing in the community. *Can J Public Health* 1991;82(4):240-44.
- Canada Health Action: Building on the Legacy. The Final Report of the National Forum on Health. Minister of Public Works and Government Services, Ottawa, 1997.
- Cairney J, Arnold B. Social class, health and aging: Socioeconomic determinants of self-reported morbidity among the non-institutionalized elderly in Canada. *Can J Public Health* 1996;87(30):199-203.
- Wigle DT, Mao Y. Mortality by Income Level in Urban Canada. Health Protection Branch, Health and Welfare Canada, Ottawa, 1980.
- Millar WJ. Sex differentials in mortality by income level in urban Canada. *Can J Public Health* 1983;74(5):329-34.
- Hay DI. Socioeconomic status and health status: A study of males in the Canada Health Survey. *Soc Sci Med* 1988;27(12):1317-25.
- Hay DI. An Explication of the Relationship Between Income and Health Status. Toronto: University of Toronto, 1992. PhD Thesis.
- Pineo P, Porter J, McRoberts HA. The 1971 Census and the socioeconomic classification of occupations. *Can Rev Sociol Anthropol* 1977;14:91-125.
- Blaxter M. *Health and Lifestyles*. London: Routledge, 1990.
- Statistics Canada. Income Distributions by Size in Canada. Ottawa: Ministry of Supply and Services, 1980.
- Statistics Canada. Rebasing Low Cut-Offs to 1978. Technical Reference Paper (Cat. No. 8-3302-519). Ottawa: Minister of Supply and Services, 1983.
- Townsend P, Phillimore P, Beattie A. *Health and Deprivation*. London: Croom Helm, 1988.
- Cassel J. The contribution of the social environment to host resistance. *Am J Epidemiol* 1976;104:187-223.
- Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Soc Behav* 1995;80-94.
- Kessler RC, House JS, Turner JB. Unemployment and health in a community sample. *J Health Soc Behav* 1987;28:51-59.
- Pearlin LI, Lieberman MA, Menaghan EG, Mullan JT. The stress process. *J Health Soc Behav* 1981;22:337-56.
- Rachlis M, Kushner C. *Second Opinion: What's Wrong with Canada's Health Care System and How to Fix It*. Toronto: Harper Collins, 1989.
- Shapiro E, Roos NP. Predictors, patterns and consequences of nursing home use in one Canadian province. In: Marshall VW, (Ed.), *Aging in Canada: Social Perspectives* 2nd Edition. Toronto: Fitzhenry & Whiteside, 1992.
- Denton FI, Li SN, Spencer BG. How will population aging affect the future costs of maintaining health care standards. In: Marshall VW (Ed.), *Aging in Canada: Social Perspectives* 2nd Edition. Toronto: Fitzhenry & Whiteside, 1992.
- Mechanic D, Aiken LH. Social science, medicine and health policy. In: Aiken LH, Mechanic D, (Eds.), *Applications of Social Science to Clinical Medicine and Health Policy*. New Brunswick, NJ: Rutgers University Press, 1986;1-9.
- Stern J. Social mobility and the interpretation of social class mortality differentials. *J Social Policy* 1983;12:27-49.
- Blane D, Smith GD, Bartley M. Social selection: What does it contribute to social class differences in health? *Sociology of Health and Illness* 1993;15(1):1-15.
- Kelsey JL, Whittemore AS, Evans AS, Thompson WD. *Methods in Observational Epidemiology* 2nd Edition. New York: Oxford University Press, 1996.

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ANNOUNCEMENT

BIOP '99

Biological Implications of Pathogenicity (BIOP) - An organization devoted to advancing the understanding of infectious processes presents a one-day symposium

Towards Reducing Disease Transmission

25 February 1999

Toronto, ON

This one-day symposium hosted by the School of Environmental Health, Ryerson Polytechnic University will consist of consecutive sessions A and B:

Session A: Food Borne Disease Transmission (morning session)

The topics for presentation include discussion of problems, Significance of E. coli 0157:H7, Food borne parasites, Viruses in the environment, and Methods evaluating transmission.

Session B: Host Control of Disease Transmission (afternoon session)

The topics for presentation concern Nutrition and immunity, Natural immunity, Involvement of prions, and Host control enhancement.

For further details, please see Coming Events/Activités à venir on page 396.