Title: Socioeconomic History & Preventable Disease: A Comparative Analysis of Fundamental Cause Theory

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Abstract: Fundamental cause theory suggests that because persons of higher socioeconomic status have a range of resources that benefit health, they hold an advantage in warding off whatever particular threats to health exist at a given time. Therefore as risk factors that stratify health are eliminated, socioeconomic disparities in health remain. Accordingly, SES should be more strongly associated with diseases that are more preventable than with less preventable diseases, and SES should have a stronger relationship to health in countries where high economic inequality and no universal health insurance leads to greater competition for resources. Using longitudinal data from Canada (National Population Health Study) and the U.S. (Panel Study of Income Dynamics), trajectories of socioeconomic status are identified using latent class analysis and used to predict the odds of experiencing a highly preventable disease compared to a less preventable disease. Preliminary findings indicate that a history of low income increases one's odds of experiencing a highly preventable disease in the U.S., but not in Canada. This suggests that social policies and level of economic inequality may buffer the relationship between socioeconomic resources and the incidence of preventable disease.

Keywords: health inequality, socioeconomic status, fundamental cause theory, comparative

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This paper presents *preliminary* findings extending Willson's previous cross-sectional comparative analysis of fundamental cause theory (Willson 2009). Fundamental cause theory (Phelan and Link 2005; Phelan et al. 2004) is a useful framework for examining health disparities. History has shown us that the mechanisms that link socioeconomic status with health don't operate like most social processes. Health disparities persist and haven't weakened even though the risk factors that have historically stratified peoples' health along socioeconomic lines have been eliminated. In the UK, Canada and the U.S., poor sanitation or infectious disease used to be the main risks that disproportionately affected the poor, and those factors have been greatly improved. But health disparities didn't weaken as a result, new risk factors moved in to take their place.

Phelan and Link (2005) argue that health disparities continue because people of higher socioeconomic status have a broad range of flexible and multi-purpose resources that can be used to the advantage of their health--they hold an advantage in warding off whatever particular threats to health exist at a given time. When research finds something new about the dangers of smoking or high cholesterol, people with high education and income are better positioned to learn about these risks and how to avoid them. This process creates within-country health inequality, but not necessarily between country inequality because people vie for resources within the context and system of a given society. It follows from fundamental cause theory that in societies characterized by less competition for resources, such as those with lower economic inequality and greater access to care, health disparities will be lower than in societies with greater inequality.

Health disparities associated with SES have been documented in both Canada and the United States for decades. It is clear in both countries that a SES-health gradient exists across the entire income distribution such that health tends to be the best among the richer, better educated and more privileged and then deteriorates, step by step, down the rungs of the social ladder (for examples of Canadian studies see Cairney 2000; Humphries and van Doorslaer 2000; Kosteniuk and Dickinson 2003; Orpana and Lemyre 2004; Wilkins and Sherman 1998; U.S. studies by Adler and Ostrove 1999; Adler et al. 1994; Smith and Egger 1992) . But little comparative research has investigated differences in the magnitude of these disparities. There is evidence that the gradient differs in the two countries. For example, although the health status of Canadians and Americans is similar, Americans' health is more polarized, with more Americans reporting either excellent health or fair/poor health compared to Canadians (Sanmartin et al. 2004). In addition, more Americans in the lowest income quintile report poor health, severe mobility limitation, obesity, and unmet health care needs compared to Canadians (Sanmartin et al. 2004).

Although income inequality is clearly present in Canada, the U.S. has higher inequality than Canada (Smeeding 2004). Several studies comparing the relationship between economic inequality and health in Canada and the U.S. have found evidence of the negative effect of inequality on health outcomes (Ross et al. 2000; 2005). These findings need to be interpreted within the context of social policies that may buffer the negative relationship between low-SES and health. Most obvious is Canada's health-care system that provides universal health insurance. This is in contrast to the private health care and private insurance system in United States, in which insurance is tied to

employment and a substantial proportion of the population lacks access to health care. However beyond direct health policy, the U.S. lags behind Canada and other countries in many policy areas that affect health and well-being, such as paid leave for new parents, and other aspects of early childhood care and education, as well as labor policies to reduce low pay and poverty among the working age population, and taxation and transfer policies that have redistributive effects (Heymann et al. 2004; Wolfson and Murphy 1998).

This study extends the previous empirical research testing fundamental cause theory. In a recent study using US mortality data, Phelan, Link, and their colleagues (2004) found that causes of death for which little is known about treatment or prevention were much more weakly associated with SES than were causes of death that are more preventable. People with greater resources are able to learn about and protect themselves from risks. But if, as a society, we know little about a cause of death, then resources provide less protection.

An important component of this research is an attention to aging in the relationship between socioeconomic resources and the risk of experiencing preventable disease. Previous examinations of fundamental cause theory have not attended to the importance of time in the association of socioeconomic resources and health. This is an important limitation as McDonough and colleagues (2005) for example, found that different long-term patterns of poverty have distinct effects on trajectories of self-rated health. Time is an important dimension that "works in tandem" with social characteristics to produce health inequalities (McDonough et al 2005).

Data and Methods

We use cycles 1994 through 2003 the U.S. Panel Study of Income Dynamics and the comparable cycles of the Canadian National Population Health Survey (cycles 1-5). Both are ongoing longitudinal surveys that are nationally representative. Both surveys include comparable content related to health status and social determinants of health, as well as a range of demographic and economic information. We limited the samples to respondents ages 25 and older in the first cycle to minimize the number who had not completed their education (NPHS *N*=10,159; PSID *N*= 16,617).

Dependent Variable

The dependent variable in this analysis was constructed from questions in the NPHS that ask: "Do you have heart disease diagnosed by a health professional?, and, "Do you suffer from the effects of a stroke diagnosed by a health professional?" Respondents answering yes to either were coded '1' on this variable. In the PSID respondents were asked: "Has a doctor ever told you that you have or had any of the following…" choices included stroke and heart disease. A variable representing a cancer diagnosis was created from an affirmative answer to the question: "Do you have cancer diagnosed by a health professional?" from the NPHS and "Has a doctor ever told you that you have or had cancer or a malignant tumor?" from the PSID. The dependent variable is a dummy indicating that a respondent has been diagnosed with cardiovascular disease (0) or cancer (1).

Cardiovascular disease and cancer are currently two of the largest contributors to mortality, and they have very different relationships to socioeconomic status. Large differences by SES have been found in the incidence of various cardiovascular diseases.

Cancer, though, has a more complex relationship with SES and is much less well understood. In this analysis I am not able to separate types of cancers. While not all cancers are equally preventable and this measure is therefore somewhat limited, the important distinction for the purposes of this study is that cancer is a *relatively* less preventable disease than cardiovascular disease and therefore it's an appropriate measure (Willson 2009).

Independent Variables

The main independent variables of interest in both the Canadian and U.S. models are education and income history as indicators of SES. To increase the comparability of the income measure across the datasets, we measured income as the income quintile into which respondents fell in each survey cycle. Long-term patterns of relative household income were then identified in the longitudinal data through latent class analysis. In both datasets, we identified four main patterns of income history: stably high income, stably low, increasing, and decreasing (see Figures 1 and 2). These last two clusters demonstrate that, in the Canadian data, about 25% of the sample experienced instability and change in their level of income over the 10 years or so of the survey. One group began with income typically falling into the lowest quintiles and experienced upward mobility toward the median. The second group began with income falling into the upper quintiles and experienced downward mobility toward the median. In the U.S. data similar patterns of income history were identified. In the U.S. case, however, a larger percentage of respondents experienced instability in their income – approximately 35% compared to 25% in Canada.

In both surveys we measured education as a series of dummy variables indicating whether the respondent had less than a high school education, a high school education (and this could include additional training beyond high school), or a university degree. In multivariate analyses, education is represented by a dummy variable indicating the respondent has less than a high school degree, compared to higher levels of education (a very conservative measure of the effect of education).

Control Variables

Other characteristics with well-known relationships to health are controlled in the analysis. These include race (white vs. nonwhite), age (25-44, 45-64, 65+), sex, marital history and smoking history. Long-term patterns of marital status were identified in the longitudinal data through latent class analysis. In both datasets, we identified three main patterns of marital history: stably married, never married, and a cluster of respondents who experienced marital transitions. Multivariate analyses compare the stably married to the other clusters. In both datasets two patterns of smoking were identified – those who smoked in two or more cycles and those who were smokers in less than 2 cycles. In the U.S. data, a series of dummy variables was created classifying respondents as having private or employer-provided health insurance, government-provided health insurance (e.g. Medicaid), or no health insurance coverage.

For the multivariate analysis, the sample is limited to those respondents reporting a diagnoses of one the two diseases of interest, and excludes the small number of respondents reporting both. This resulted in a final sample of 726 respondents from the NPHS and 1,737 from the PSID.

Examining a sample of respondents who reported the diagnosis of one of two diseases reduces the original sample size and introduces the possibility of selection bias. To assess the extent of selection bias, we first estimated probit models predicting the diagnosis of either disease compared to no diagnosis of either disease. The predicted probabilities can be interpreted as propensity scores (Rosenbaum and Rubin 1983) and are included as a control function in the main model (Heckman and Robb 1985; Shadish 2002; Winship and Sobel 2004; Willson et al. 2007). When used this way, the propensity score models the selection mechanism and provides consistent estimates. The extent of selection is determined by comparing the coefficients of models including the control function to those that do not. In the U.S. model, the propensity score was statistically significant though results changed only slightly upon its inclusion in the model. Therefore, it was retained in final models. The propensity score was not significant in the Canadian model and results are presented without its inclusion.

Results

Figures 3 through 6 display the proportion of sample members experiencing cardiovascular disease or cancer according to income history and level of education. Figure 3 demonstrates that, regardless of income history, a much higher proportion of Canadian respondents are diagnosed with cardiovascular disease than cancer. When compared to Figure 4, it is evident that the proportions are more closely equal for respondents with histories of stably high or increasing income and that cardiovascular disease is much more common among those with stably low or decreasing income.

Similar patterns emerge with regard to education. Figure 5 demonstrates that regardless of level of education, a much higher proportion of respondents are diagnosed with cardiovascular disease. In contrast, in the U.S. sample (Figure 6), at each increasing level of education, respondents become increasingly likely to experience a diagnosis of cancer, until the percentages become roughly equal for those with a university education.

We used logistic regression to compare the odds ratios of experiencing each disease as a function of education, household income history and the control variables. For example, if education significantly reduces the odds of experiencing cardiovascular disease compared to cancer, support is found for the theory of fundamental causes. If this association is weaker in Canada compared to the U.S., it will indicate that social contexts related to policy and inequality are effective in buffering the health effects of socioeconomic status.

To summarize the results presented in Table 1, in the model using Canadian data, the coefficient for income history was not significant, indicating that in Canada, a history of low income compared to other patterns was not a significant predictor of cardiovascular disease compared to cancer. However, educational differences do play a role in the likelihood of experiencing a highly preventable vs. less preventable disease. Not having a high school degree, compared to having at least a high school degree, increased the significantly increased the odds of experiencing cardiovascular disease compared to cancer (odd ratio = 1.95).

Turning to the U.S. data, having a history of low income compared to stably high, increasing, or decreasing income, significantly increases one's odds of experiencing cardiovascular disease compared to cancer (odds ratio = 1.39). Similarly, the U.S. data

indicates that compared to higher levels of education, those without a high school degree are twice as likely to experience cardiovascular disease compared to cancer (odds ratio: 2.104). Coefficients for variables representing categories of insurance coverage were not significant and were therefore dropped from the model.

Conclusions

The findings support the predictions of fundamental cause theory. The findings also suggest that a country's social policies and level of economic inequality may buffer the relationship between socioeconomic resources and the experience of disease. Based on these results we can speculate on the mechanisms and specific social conditions that lead to differing outcomes. One of the most obvious social conditions that potentially contributes to this outcome is cross-national differences in access to health care among disadvantaged groups. However, access to medical care is one resource of many related to better health, and we should not make the assumption that differential access is the *source* of health disparities. More broadly, public policies that reduce inequality – in other words, provide for more equal access to resources – are an important difference between Canada and the United States that affects the role of socioeconomic resources in preventing disease.

This work is preliminary and in addition there are limitations that must be kept in mind when drawing conclusions based on the results. Other economic indicators, exposures, susceptibilities and outcomes should be explored comparatively to improve our understanding of the mechanisms that link social disadvantages to health. We should not conclude that a relationship between SES and the experience of diseases with low and

high preventability does not exist in Canada. It is clear that health disparities are present in Canada and other disease outcomes may have returned different results.

Fundamental cause theory emphasizes that to improve population health and reduce health disparities we have to move beyond a focus on individually-based risks linked to specific diseases, and instead focus on altering the social conditions that affect determinants of health and disease. The findings suggest that under differing social conditions the strong relationship between low SES and the experience of a disease that is highly preventable is weakened. Individual advantages related to SES are linked to health advantages across the life course, but as life course researchers note, this relationship is also shaped by public policy decisions and institutions (Crystal 2006). Policies that accentuate economic equality may buffer the effects of a lack of social resources on health. And viewed this way, the relationship between health disparities and economic disparities reflects policy choices and is not solely the result of a natural and inevitable process (Crystal 2006).

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Table 1. Logistic Regression of Experiencing Cardiovascular Disease vs. Cancer, NPHS and PSID (weighted).

	Canada		US	
	B	**Exp(B)**	**B**	**Exp(B)**
Constant	1.53**	4.63	1.018*	10.21
< high school (vs. all other categories)	.67*	1.95	.63**	1.88
Stably low income (vs. all other categories)	.42	1.52	.33*	1.39
Age: (vs. Old)				
Young	-.75*	.47	-1.95*	.142
Middle	-.42	.66	-1.06*	.345
Marital History (vs. married)				
Never married	.03	1.03	-.45	.64
Transitions	.10	1.11	.22	1.25
Smoker (vs. nonsmoker)	-.30	.74	.36*	1.44
White (vs. nonwhite)	.17	1.12	-.60**	.55
Female (vs. male)	-.29	.75	-.77***	.47
Propensity score	---	---	-2.85*	.058

Note: * p<.05; **p<.01; ***p<.001

Figure 1. Income History Clusters, NPHS.

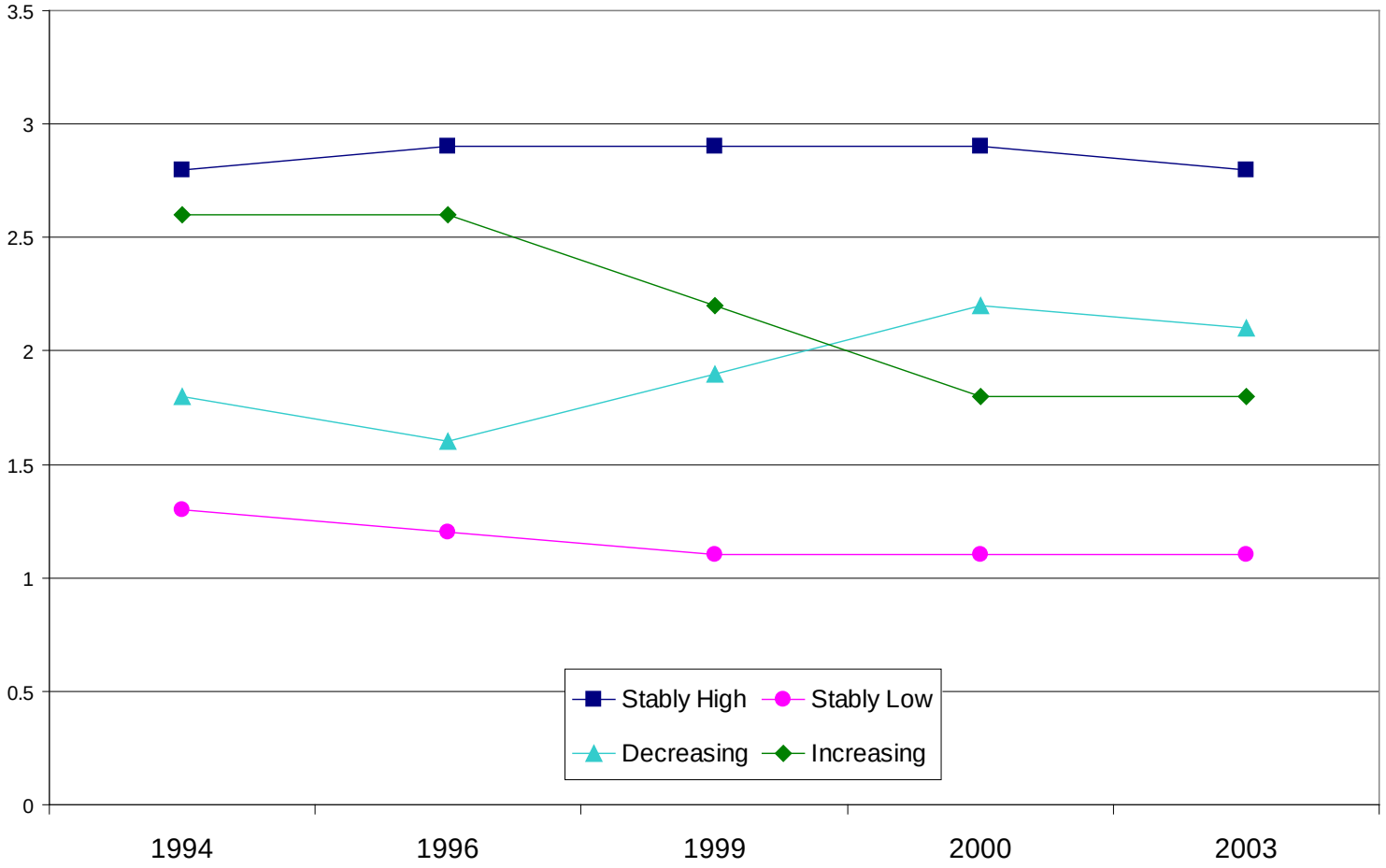

Figure 2. Income History Clusters, PSID.

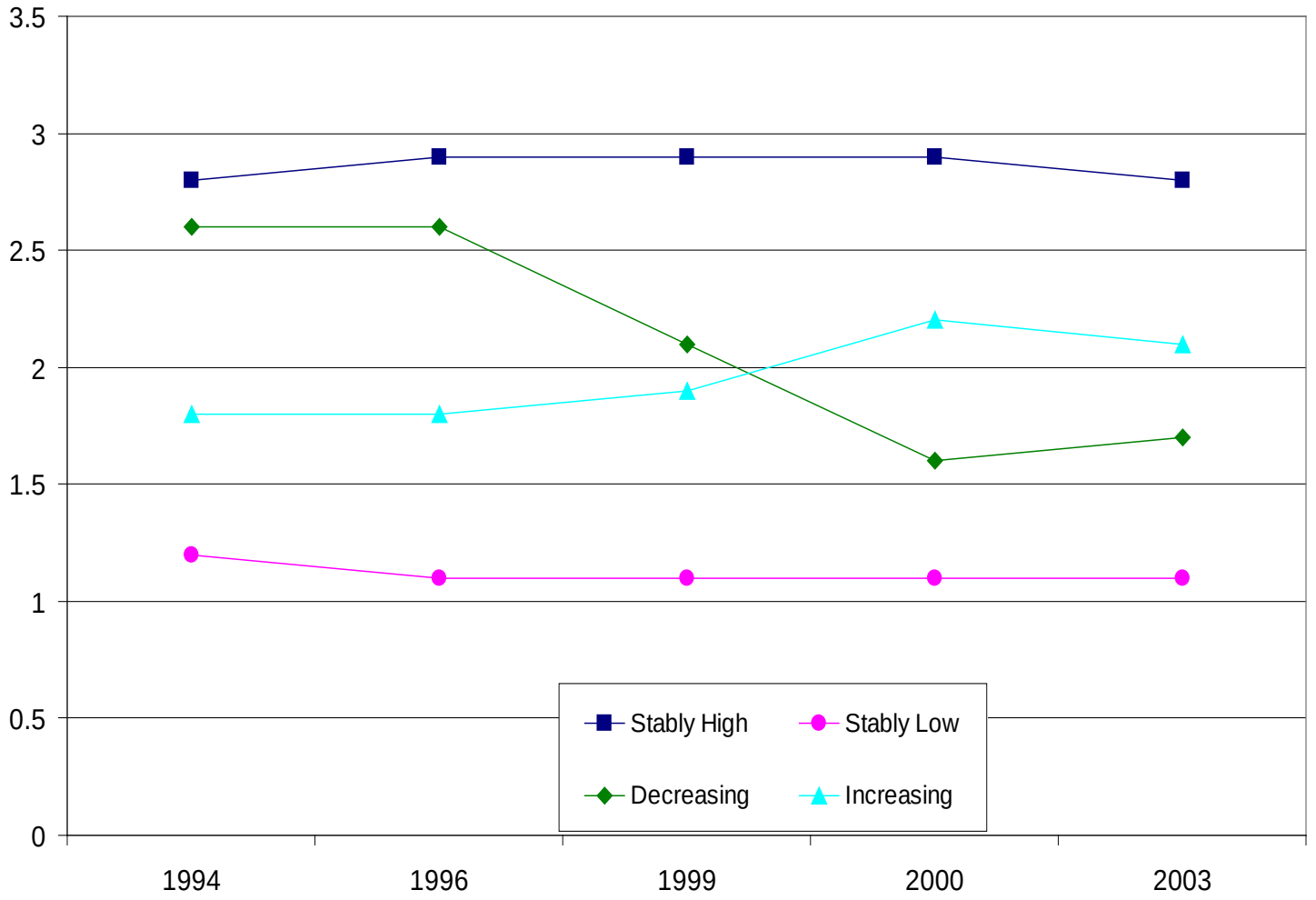

Figure 3. Income History by Disease, NPHS.

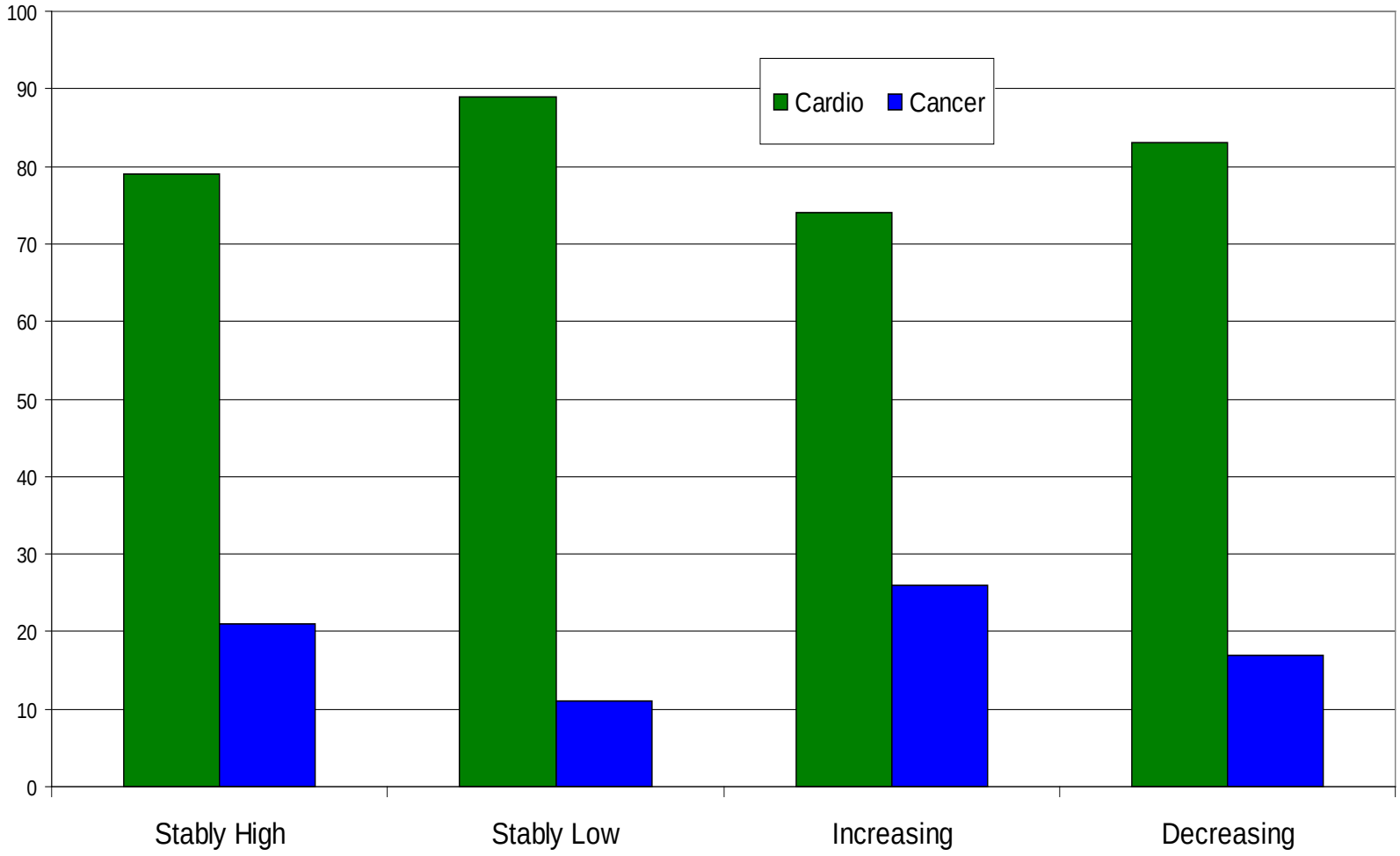

Figure 4. Income History by Disease, PSID.

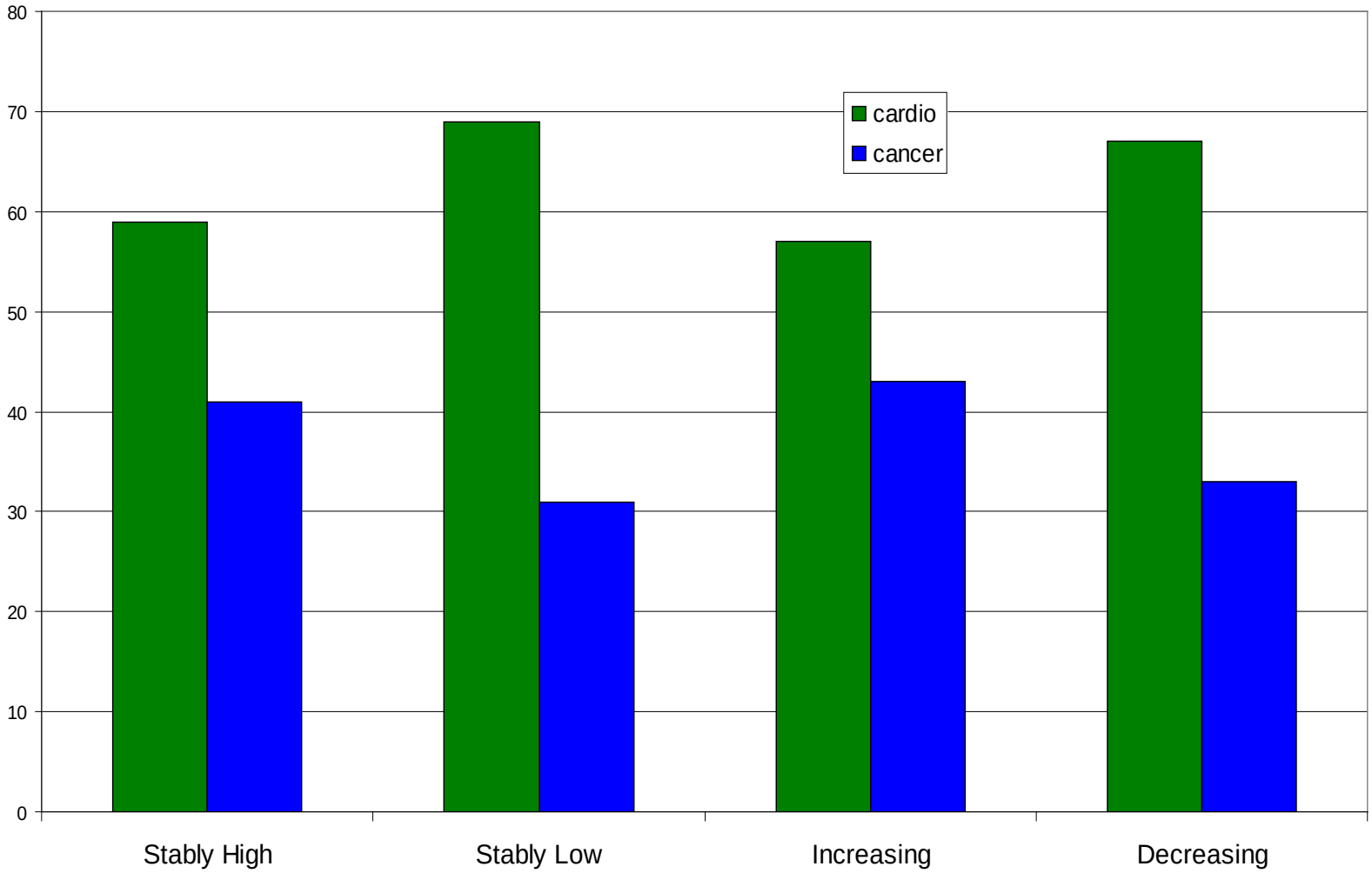

Figure 5. Education by Disease, NPHS.

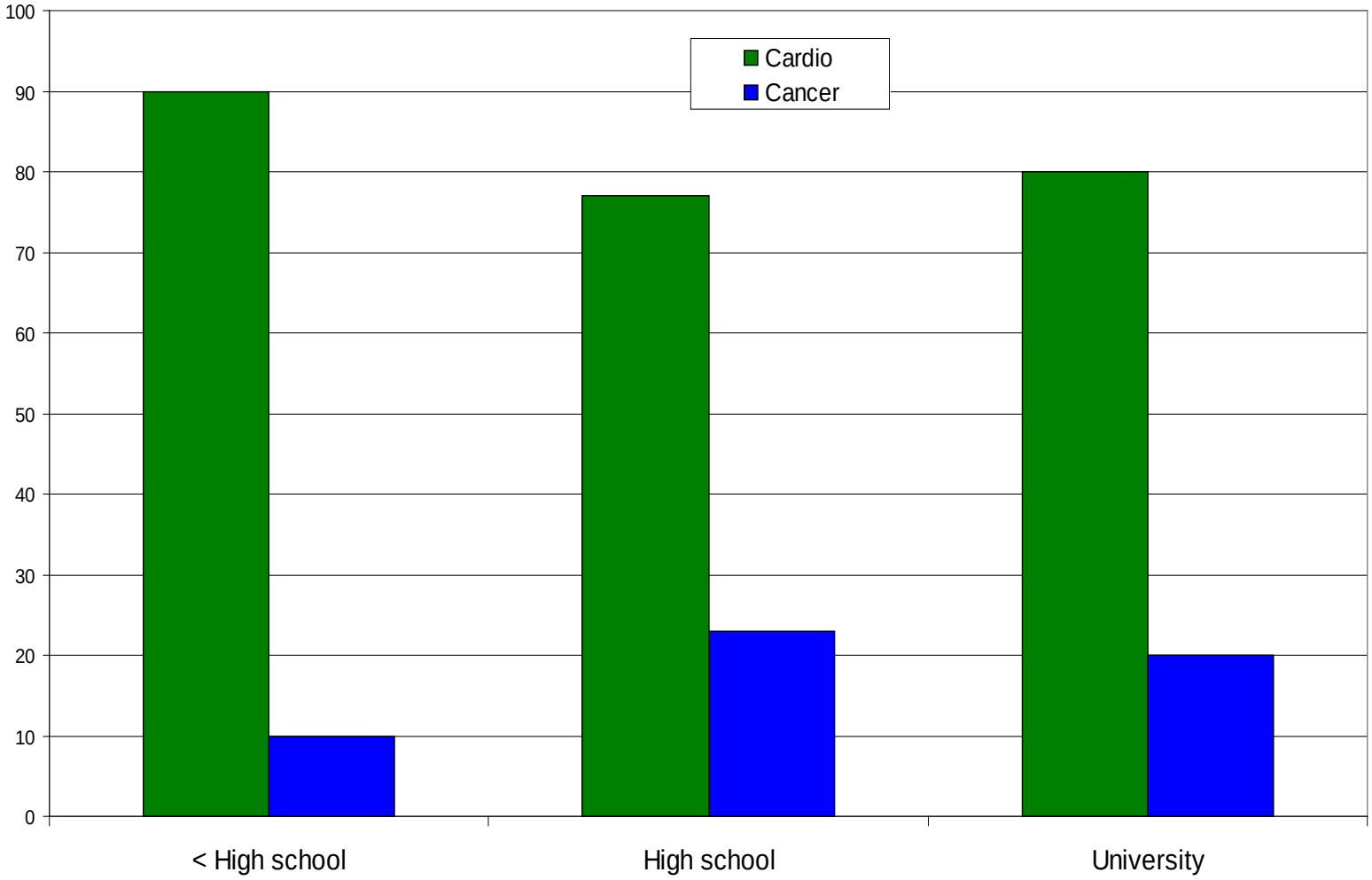

Figure 6. Education by Disease, PSID.