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A Longitudinal Analysis Of A Healthy Population

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**SELF-REGULATED HEALTH BEHAVIOR AND CHRONIC DISEASE:
A LONGITUDINAL ANALYSIS OF A HEALTHY POPULATION**

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Abstract

This study explores how self-regulated health behaviors affect chronic diseases by following a cohort of respondents who initially report no chronic disease of any sort using the data from the American Changing Lives survey. Self-regulated health behaviors are operationalized as four variables: physical activity, smoking, drinking, and body mass index. Initially, we investigated whether there are differences in health behaviors by gender, race, education level and marital status. A multinomial logistic regression model was estimated to explore the relationships between health behaviors and the emergence of chronic diseases. We found that women, African Americans, lower educated persons, and the unmarried are at higher risk of chronic diseases. Also, self-regulated health behaviors are associated with chronic diseases. These associations appeared in different and interesting ways when we compared the seriousness (or lethality) of chronic diseases.

Introduction

Many studies have attempted to explain variation in health in terms of individual behaviors. But more research is needed that looks at an individual's health as a result of the cumulative effect of social factors and their interrelationship with personal characteristics. The concept of self-regulation may help to better understand the mechanisms involved.

Self-regulation theory offers a promising perspective on human behavior, but sociological and social demographic research on the relationship between self-regulation and health is sparse. Zeidner and her colleagues defined self-regulation as “a systematic process involving conscious efforts to modulate thoughts, emotions, and behaviors in order to achieve goals within a changing environment” (Zeidner et al. 2000: 750). It is reasonable to expect that well-regulated individuals are less likely to engage in risky behavior such as smoking and use of alcohol to excess and more likely to spend time in exercising and maintaining proper weight.

Considering that self-regulation affects individual health cumulatively and often gradually, the analytic focus is on chronic diseases. Healthy life styles are encouraged as a way of avoiding chronic diseases, but there are relatively few related studies that show the impact of self-regulated health behaviors on risk of chronic diseases, especially compared to the studies that address the association of social factors and various health outcomes. Research that explores differentials in relationships for both less serious chronic ailments and more lethal chronic conditions is even more sparse. We believe especially valuable insights may be gained by following overtime a group of adults who are initially free of chronic ailments.

Previous Studies

In many cases, the causes of chronic diseases are not well established. Previous studies suggest that factors such as socioeconomic status, physical environment, and genetic characteristics affect risk of disease, as exogenous factors. Health care by institutions and individual response are believed to mediate the associations (Corin. 1994; Evens and Stoddart. 1994). Individual responses can be divided into two components. One is related to health behaviors, the other is a biological.

The cognitive model of Abraham and Sheeran (2000) suggests several factors are related to intentions regarding health behaviors. It has been found that each factor such as attitude, self-representation, norms, and self-efficacy, explains 20-25% of intention. Intention accounts for approximately 20-25% of the variation in health behavior measures.

Obviously, complex relationships and numerous pathways link the variables in the model. In this study, we adopt the self-regulation concept in order to better understand the processes between intention and health behavior.

Self-regulation is a dynamic motivational system of setting goals, developing and enacting strategies to achieve those goals, and appraising the relative success of efforts. Although self-regulation tends to focus on internal processes and mechanisms, one must take into account that these processes occur in a sociocultural context, and that knowledge of structures of illness, health, and treatment methods reflect experiences with the family, neighborhood, community, and society at large (Cameron and Leventhal. 2003). Moreover, socioeconomic status influences health behaviors and sense of control when people deal with illness or emotional threat. Finally, intentions, per se, likely have little influence unless

they are translated into behavior.

Many studies have focused on the relationship between social variables and health. Generally, men, persons who are married, whites, and the highly educated are healthier compared to females and those who are unmarried, black and less educated. According to Mirowsky and Ross (2003), among these variables, only education correlates positively and consistently with healthy behaviors. Education encourages healthy behaviors by stronger or more effective self-regulation. However, there are few studies that show a clear picture of the association of health (or illness) in the context of self-regulated health behaviors using nationally representative and longitudinal data sets. Chronic diseases are expected to be affected by health behaviors gradually through time. Therefore, longitudinal data sets will facilitate a better understanding of the association of health behaviors and chronic diseases. A stylized conceptual model of this study is shown in Figure 1. As already noted, the factors that affect the risk of chronic diseases are numerous, and are never available in their entirety in any known data sets. In this study, research interest is limited to social variables that affect self-regulated health behaviors.

(Figure 1 about here)

Research Design

Research Questions. This study focuses on two substantive issues. The first question is, how are social factors related to an individual's self-regulation as expressed in health-related behaviors? To address this question, the relationship of self-regulated health behaviors with financial condition and education level is investigated as well as sociodemographic variables such as race, marital status, etc. We use t-tests to determine

whether self-regulated health behaviors vary significantly by sociodemographic characteristics. Secondly, what are the effects of this self-regulation on risk of chronic disease? These relationships are investigated with multinomial logistic regression models.

As noted earlier, the conceptual model on which our analysis is based involves motivation and internal processes. Although there are no measures of motivations or attitudes in our data, it is logical to assume that avoidance of smoking, moderation in the consumption of alcohol, a regimen of appropriate physical activity and maintenance of a healthy body mass index are based on the motivation to achieve a healthy life style. One can certainly assume that persons who smoke, abuse alcohol, lead sedentary life styles and/or have unhealthy diets are not forced into these unhealthy behaviors. Thus, almost by definition, avoidance of such unhealthy activities and engaging in healthy behaviors imply self-regulation, although the exact source of motivation may not be known.

Data and Methods. The data are from the national three-wave panel “Americans’ Changing Lives” (ACL) surveyⁱ. The survey was designed to investigate a wide range of activities and social relationships of American adults. Surveys were conducted in 1986, 1989, and 1994. Wave I interviewed 3,617 persons ages 25 and older. The attrition rates are 21% from Wave I to Wave II, and 29% from Wave I to Wave III. That is, the numbers of respondents are 2,867 and 2,562 in Wave II and III, respectively.

This study was designed to examine the relationships between self-regulated health behaviors and the development of chronic diseases among respondents who were reportedly free of chronic ailments at the time of the first interview. We employ data from Wave I and Wave III. It is important to note that we began with a group of respondents who

initially reported being free of chronic diseases. Such a strategy allows a more precise examination of the emergence of chronic disease by observing health status over the longest time period possible with these data. The longitudinal aspect of the analysis and the opportunity to follow a group of persons who were the most robust respondents at Wave I set this study apart from most previous work in this area.

The methodological strategy of estimating the association of chronic diseases with self-regulation is to select the 1,249 cases that did not have a chronic disease at Wave I (after weighting). Beginning only with persons who are free of chronic diseases in the first wave allows for a prospective study that facilitates the inference of causality over the time interval. However, it is possible that some people may have had chronic diseases but simply have not known it at Wave I. Therefore, we control health satisfactionⁱⁱ to minimize this possible error. Essentially the latter item asks respondents to assess their health at Wave I.

The reason that we use the health satisfaction variable instead of ‘self-rated health’, which is widely used as an indicator for general health condition, is that health satisfaction, for our purposes, is a more reliable indicator. Although self-rated health is known to be strongly related to health status, it is also affected by age. For example, older people have more health problems, but tend to be more positive in rating their health compared to younger people with the same problems (Kenneth and Yu. 1995). In addition, self-rated health might not clearly reflect the relationship between the body mass index and health. That is, it is possible that people rate their health as good, even though they might not be satisfied with their health condition if they are overweight (or underweight).

Because we have limited the sample to those surviving at Wave III and who reported no chronic disease at Wave I, we are essentially focusing on the important question of how

health behaviors impact the healthiest people. This means that we have excluded Wave I respondents who died during the interval between Wave I and Wave III and those who could not be located at later waves, and any who, though located, refused continued participation. This avoids certain methodological problems that accompany sample attrition and allows us to observe the impact of behaviors on those who are initially largely disease free. However, this approach means that we are able to generalize only to the more robust proportion of the population. Those in our sample may also be less geographically mobile than the group lost to the sample because they could not be found at later wavesⁱⁱⁱ. The analysis is also limited to blacks and whites. Other non-whites are included in the category for blacks because the number of persons in other racial groups was too small to support the analysis as a separated racial group^{iv}.

Using these data, multinomial logistic regression models were estimated. Since responses to the questions about chronic diseases are dichotomous and chronic diseases vary in terms of lethality, multinomial logistic regression is a more efficient approach than a series of binomial logistic models. In addition, it provides more accurate estimates especially when the sample sizes are limited. The results are presented directly in terms of the logistic coefficients, not in terms of the exponentiated coefficients (odds ratios).

Measurement

Precursors. We include sociodemographic and socioeconomic variables, such as age, gender, race, education, marital status, and economic hardship as controls. Age is measured as a continuous variable, and education is measured as a set of dummy variables. Gender, race, and marital status variables are dichotomies.

To control economic factors, we used an economic hardship variable, constructed using three questions. Respondents were asked: How satisfied are you with (your/your family's) present financial situation? How difficult is it for (you/your family) to meet the monthly payments on your (family's) bills? And in general how do your (family's) finances usually work out at the end of the month? For the first question, respondents selected one of five choices: completely satisfied, very satisfied, somewhat satisfied, not very satisfied, and not at all satisfied. The choices to the second question are 'extremely difficult', 'very difficult', 'somewhat difficult', 'slightly difficult', and 'not difficult'. To the third question, respondents chose among 'some money left over', 'just enough money', and 'not enough money'. The first question was coded 1 to 5 ('completely satisfied' to 'not at all satisfied'). The second question was scored in the same direction as the first item; that is, high values indicate a higher level of financial stress for the respondents. The third question was coded 1 to 3. The operationalization of this variable was the recode provided in the ACL data files which averages the means for the three items.

Major Explanatory Variables. In this study, self-regulation was operationalized as types of health behavior: physical activity, drinking alcohol, smoking cigarettes, and the body mass index. The physical activities measure was constructed with three questions: 1) how often do you work in the garden or yard, would you say? 2) how often do you engage in active sports or exercise? And 3) how often do you take walks? Response categories are 'often', 'sometimes', 'rarely' or 'never'. This variable is also the recode provided in the ACL data files which takes the arithmetic means of these three items.

Consumption of alcohol was operationalized as a set of dummy variables using three

categories of consumption during the past month, viz., non-drinker, moderate drinker (less than 60 cans of beer, glasses of wine, or drinks of liquor)^v, and heavy drinker (60 or more drinks). Also, respondents were classified as never smoked, current smoker, and past smoker at the time of the third interview. This measure allows assessment of change in smoking behavior between Wave I and III. Unlike the case with drinking, a non-negligible number of respondents quit smoking after Wave I. Some of the respondents who quit smoking between Wave I and Wave III likely did so because of health concerns (including perhaps the onset of disease).

To tap self-regulation as related to eating habits, we use the body mass index. There are five categories for this variable, which are ‘under weight’ (lowest 5% of cases), ‘low normal’ (next to lowest 25%), ‘mid-normal’ (middle 30%), ‘high normal’ (next to highest 25%), and ‘over weight’ (highest 15%). The categories were developed separately for males and females, computed as weight (in pounds) divided by height (in inches squared).

In the ACL data set, ages of respondents ranged from 25 to 95, and the mean age was 53.6. However, after selecting persons who did not have any chronic disease at Wave I and who remained in the sample at Wave III, the age range became 25 to 92, and the mean age was 38.65. This supports the conclusion stated above that chronic disease risk increases with age. Table 1 provides descriptive statistics for all variables (Total $N = 961$).

The fact that respondents did not report any chronic symptoms at Wave I does not mean that all such persons were actually free of chronic diseases. Also, it is possible that people in our sample might have had some chronic diseases at Wave I and died before Wave III, even though all cases in our sample reported being free of chronic ailments at Wave I. We try to reduce this potential problem by controlling health satisfaction at Wave I.

For this variable, respondents were asked ‘how satisfied are you with your health?’ and the answers were measured by five possible responses, which are ‘completely satisfied’, ‘very satisfied’, ‘somewhat satisfied’, ‘not very satisfied’, and ‘not at all satisfied’. In the analysis, the higher values of this variable indicate higher levels of health satisfaction.

Means and standard deviations describe the continuous variables: age, financial situation, physical activity, the body mass index and health satisfaction. Percent distributions characterize the other (categorical) variables (see Table 1).

(Table 1 about here)

Dependent Variables. The dependent variable is whether people have any kind of chronic disease at Wave III. Some conditions are relatively minor, such as foot problems or urine beyond control while some others are leading causes of death such as heart disease or cancer.

To estimate how self-regulation, proxied by health behaviors, is associated with chronic diseases, we created a dependent variable with three categories, measured at Wave III. The first category consists of those who did not have any chronic ailments. The second indicates those who had “mild” chronic diseases, and the third group consists of respondents who reported one or more of the five most lethal chronic diseases. For example, the “mild category” includes ‘arthritis’, ‘hypertension’, ‘foot problems’, ‘broken bones’, and ‘urine beyond control’. On the other hand, ‘stroke’, ‘lung disease’, ‘heart attack’, ‘cancer’, and ‘diabetes’ are included in the third category, based on leading causes of death among U.S. adults (Kochanek et al. 2004).

Table 2 shows the distribution of chronic diseases, according to both absolute and relative frequencies.

(Table 2 about here)

Results

Before estimating regression models, we investigated the distribution of health behaviors and chronic disease by various risk factors, including gender, race, education level, and marital status. Table 3 shows the differences by gender. According to this table, men are more likely involved in physical activity, cigarette smoking, and alcohol drinking than women. However, women tend to have more chronic diseases and maintain a lower body mass index compared to men. All these differences are significant statistically.

(Table 3 about here)

Table 4 focuses on differences between Blacks and Whites. Race differences also exist, but only physical activity and chronic diseases are significant. Whites report more physical activity, and Blacks have more chronic diseases than Whites. The differences in cigarette smoking, alcohol drinking and the BMI are not statistically significant in Table 4.

(Table 4 about here)

The next tables show the differences by social variables including education and marital status. There are two tables related to education. The first (Table 5) is a comparison of the lowest educated group with all others, and the other (Table 6) is a comparison of the highest educated group with all others.

The lowest educated group was composed of those who completed 8 years or less education. The 'others' were those who completed more than 8 years education. The differences are consistent except for alcohol drinking. The lowest educated group is less

physically active and more apt to smoke cigarette, but less likely to consume alcohol. They have more chronic diseases than their counterparts.

(Table 5 about here)

In Table 6, the most highly educated respondents report more physical activity. They smoke less, and their body mass indexes are lower on average. Also, they are at less risk of chronic diseases than the less educated. The difference between these two groups in alcohol consumption is not significant.

(Table 6 about here)

Table 7 shows that, with the exception of the body mass index, married people are advantaged compared to the unmarried people. Married adults are also less likely to suffer from chronic diseases.

(Table 7 about here)

Based on the above tables, all sociodemographic variables seem to be related to individuals' health behaviors and health status. However, the differences of health behaviors and health status appear most clearly and consistently by gender and education level. The next table (Table 8) presents the results of the multinomial logistic regression.

(Table 8 about here)

Model 1 of Table 8 includes only the race variable. Age, sex and marital status are included in Model 2. Education and economic hardship are added in Model 3. Model 4 adds health behaviors: physical activity, smoking and drinking. Considering that body mass may itself be a function of health behaviors, it is added in Model 5. Model 6 controls health

satisfaction at Wave I along with all other risk factors. Each model shows the estimates of two categories, which are those who reported one or more “mild” chronic conditions and those who had one or more serious chronic diseases. The reference group consists of respondents who did not report any chronic disease.

Table 8 shows that the risk of all chronic diseases is greater among older persons, women, and the unmarried, while marital status is generally not statistically significant. For health behaviors, the regression coefficients are generally consistent. That is, physical activity has a negative effect on all chronic diseases, and those who smoke are at higher risk of chronic diseases. It may seem surprising that past smokers are at greater risk of chronic diseases than current smokers. A plausible explanation is that a number of people who developed serious chronic diseases quit smoking when the disease was diagnosed. It is clear that ‘over weight’ people have higher odds of chronic diseases. Interestingly, chronic diseases are less likely for lower levels of the body mass index, and all coefficients are significant.

On the other hand, the effects of some variables differ depending on the types of chronic diseases. For example, Table 8 shows that Blacks are at a higher risk of “mild” chronic diseases than Whites, but the coefficients for serious chronic diseases are negative. Also the coefficients of education variables are consistent for serious chronic diseases, while they are not for minor chronic diseases. Moreover, it appears that heavy drinkers are less apt to have serious chronic diseases compared to non-drinkers.

Plausible, but of course not definitive, explanations for the unexpected findings may be offered. For example, it may be that, due to less health care access, Blacks are more likely not to know whether they had chronic diseases at the first wave and also perhaps they

were more likely to die before the third wave due to late diagnosis and/or lack of care. The finding that women are at higher risk of chronic diseases is not necessarily surprising. It has been shown that women are more likely to be aware of illnesses and health statuses than men. Women are more perhaps apt to have chronic diseases detected due to the greater tendency to visit a physician, and thus, to be more aware of morbidity (Verbrugge. 1985).

With respect to drinking, the unexpected result is something of a data artifact. That is, there were no respondents who were heavy drinkers and who also had a serious chronic disease. If people have an especially serious diseases, they may be unable to drink heavily, or they may tend to quit, or at least reduce, drinking. Nevertheless, it is not completely clear why non-drinkers fare better than moderate drinkers. It is certainly plausible that person with serious chronic diseases often try to improve their health by adopting healthy behaviors (i.e., reducing smoking and consumption of alcohol). It is possible that health behaviors such as smoking and alcohol consumption tend to be underreported, and exercise may be overreported because of social desirability (Newsom et al. 2005). Also, the effects of the body mass index may be overestimated if being overweight is viewed as less socially acceptable than being “thin”.

Summary & Future Directions

This study was designed to explore the association of self-regulation and chronic diseases in a sample of healthy individuals. Self-regulation is a complicated concept, and because of data limitations, it is difficult to observe and measure in population-based research in the social sciences. In this study, we proxied self-regulation through health behaviors including physical activity, smoking, drinking and the body mass index. To

estimate the association of these health behaviors and chronic diseases, we used 10 chronic conditions categorized as “mild” and “serious” and adopted a multinomial logistic regression approach. For multinomial logistic models, we classified respondents into three groups to distinguish respondents who have no chronic disease, those with less serious chronic conditions, and those with the more lethal chronic diseases.

The results support the findings of previous studies in that men, Whites, younger, educated, married, and more affluent persons are less apt to have chronic diseases, compared to women, Blacks, and older, less educated, unmarried, and less affluent persons. Self-regulated health behaviors clearly affect risk of chronic disease. It was also found that these self-regulated health behaviors are closely related to socioeconomic status, especially education. More highly educated people tend to engage in more physical activity, less drinking and smoking, and to have a lower body mass index. They are less likely to suffer chronic ailments. Also, it was found that economic hardship increases the risk of less serious chronic diseases, but is not significantly related to the more serious conditions. The latter finding should be the focus of future research.

While age and smoking are related as expected to risk of serious chronic diseases, the direction of the coefficients of economic hardship is reversed. This may be yet another instance of “selectivity.” That is, persons with more life threatening conditions may lack the resources to access health care and thereafter be more likely to have “left the sample” due to death before the third wave of the interview. Also, the effect of drinking on serious chronic diseases is different from what we was expected. As we mentioned earlier, we suspect that these results emerge from the greater probability of “negative selectivity.” These problems might be alleviated in future studies by data sets that are larger and that

contain additional items to operationalize other risk factors. In addition, psychological variables should be helpful in understanding the processes of interest.

Table 1. Descriptive Statistics of Variables

	Mean	S.D.
Age at Wave I	38.65	13.13
Financial Chronic Stress at Wave I	-0.01	1.08
Physical Activity at Wave I	0.23	1.02
Body Mass Index at Wave I	3.04	1.21
Health Satisfaction at Wave I	4.06	0.85
	Weighted Percent Distribution (%)	Unweighted Sample Size (N)
Sex		
Male	47.04	453
Female	52.96	508
Race		
White	86.66	699
Black	13.34	262
Education at Wave I		
Less than high school	13.42	155
High school	32.46	310
Some college	54.12	496
Marital Status at Wave I		
Married	72.06	900
Not married	27.94	349
Smoking Cigarette		
Current smoker	29.04	363
Past smoker	25.89	323
Never smoked	45.07	563
Drinking Alcohol at Wave I		
Non-drinker	29.48	368
Moderate drinker	60.11	751
Heavy drinker	10.41	130
Total Size of Sample	1,249	961

Note: Means and SDs are weighted.

Table 2. Chronic Diseases at Wave III

		Weighted Percentages (%)	Unweighted Sample Size (N)
1	Arthritis	15.30	161
2	Foot problems	13.60	145
3	Hypertension	9.74	122
4	Broken bones	3.12	31
5	Urine beyond control	2.78	33
6	Lung disease	2.78	28
7	Heart Attack	2.77	30
8	Cancer	1.99	26
9	Diabetes	0.99	12
10	Stroke	0.65	11

Table 3. Means and Standard Deviations for Variables by Gender

Variables	Men			Women			T-Test
	Mean	S.D.	N	Mean	S.D.	N	t
Physical activity	0.32	0.86	662	0.13	0.91	587	3.830***
Cigarette smoking	6.07	11.35	662	4.73	8.98	587	2.325*
Alcohol drinking	26.94	43.46	662	8.56	18.66	587	9.899***
Body Mass Index	3.11	1.06	662	2.95	1.05	587	2.582**
Chronic diseases at Wave III	0.46	0.79	662	0.62	0.83	587	-3.458***

* p ≤ .05 ** p ≤ .01 *** p ≤ .001

Table 4. Means and Standard Deviations for Variables by Race

Variables	White			Black			T-Test
	Mean	S.D.	N	Mean	S.D.	N	t
Physical activity	0.26	0.88	1,082	0.06	0.93	167	2.483*
Cigarette smoking	5.59	10.59	1,082	4.47	8.35	167	1.547
Alcohol drinking	18.70	36.29	1,082	15.65	28.17	167	1.248
Body Mass Index	3.03	1.05	1,082	3.09	1.11	167	-0.692
Chronic diseases at Wave III	0.53	0.80	1,082	0.59	0.91	167	-0.825*

* p ≤ .05

**Table 5. Means and Standard Deviations for Variables by Education:
Lowest Educated Compared to All Other Education Group**

Variables	8 years or less			Others			T-Test
	Mean	S.D.	N	Mean	S.D.	N	t
Physical activity	-0.14	1.10	168	0.29	0.84	1,081	4.781 ***
Cigarette smoking	8.07	12.02	168	5.03	9.97	1,081	-3.110 **
Alcohol drinking	15.79	39.19	168	18.68	34.69	1,081	0.900
Body Mass Index	3.03	1.10	168	3.04	1.05	1,081	0.040
Chronic diseases at Wave III	0.77	1.13	168	0.5	0.75	1,081	-3.059 **

** p ≤ .01 *** p ≤ .001

**Table 6. Means and Standard Deviations for Variables by Education:
Highest Educated Compared to All Other Education Group**

Variables	16 years or more			Others			T-Test
	Mean	S.D.	N	Mean	S.D.	N	t
Physical activity	0.39	0.79	349	0.17	0.92	900	-4.311 ***
Cigarette smoking	2.43	7.72	349	6.61	10.95	900	7.585 ***
Alcohol drinking	16.29	20.85	349	19.07	39.52	900	1.162
Body Mass Index	2.93	1.01	349	3.08	1.07	900	2.182 *
Chronic diseases at Wave III	0.47	0.70	349	0.56	0.85	900	1.841 †

† p ≤ .1 * p ≤ .05 *** p ≤ .001

Table 7. Means and Standard Deviations for Variables by Marital Status

Variables	Married			Unmarried			T-Test
	Mean	S.D.	N	Mean	S.D.	N	t
Physical activity	0.27	0.87	900	0.12	0.92	349	-2.688 **
Cigarette smoking	5.22	10.31	900	5.99	10.33	349	1.176
Alcohol drinking	17.66	36.61	900	19.93	31.74	349	1.084
Body Mass Index	3.06	1.05	900	2.98	1.08	349	-1.180
Chronic diseases at Wave III	0.50	0.78	900	0.63	0.88	349	2.377 *

* p ≤ .05 ** p ≤ .01

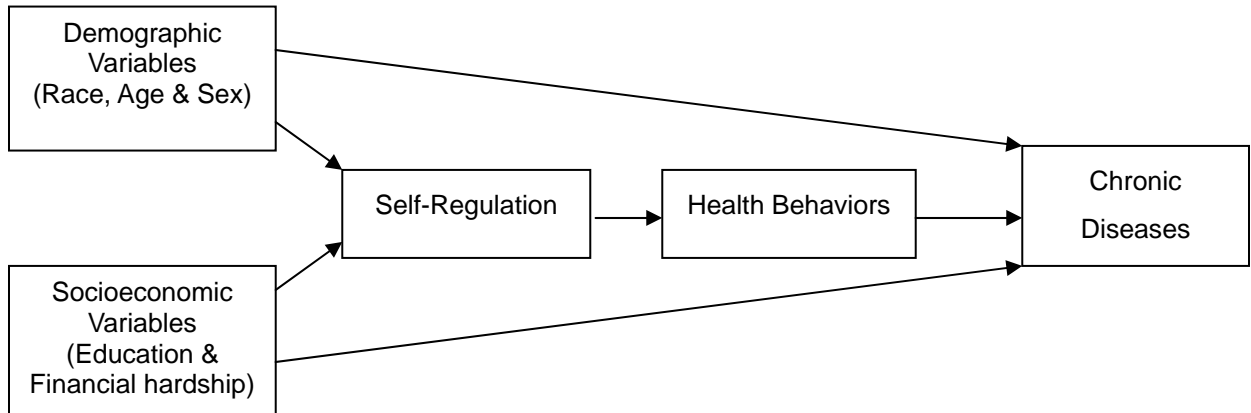
Table 8. The Multinomial Logistic Regression Coefficients for Chronic Conditions

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	1 ^a	2 ^a	1	2	1	2	1	2	1	2	1	2
<i>Race (White)</i>												
Black	0.240	-0.288	0.285 †	-0.109	0.276	-0.087	0.229	-0.088	0.216	-0.123	0.264	-0.087
<i>Age</i>												
			0.043 ***	0.071 ***	0.046 ***	0.069 ***	0.046 ***	0.069 ***	0.044 ***	0.068 ***	0.045 ***	0.069 ***
<i>Gender (male)</i>												
Female			0.546 ***	0.130	0.542 ***	0.094	0.602 ***	0.053	0.672 ***	0.123	0.651 ***	0.112
<i>Marital Status (unmarried)</i>												
Married			-0.286 *	-0.361	-0.222	-0.384	-0.165	-0.355	-0.189	-0.361	-0.210	-0.377
<i>Education (less than high school)</i>												
High school					-0.292	0.184	-0.231	0.170	-0.332	0.112	-0.346 *	0.100
Some college or more					-0.088	-0.089	0.025	-0.098	0.003	-0.089	-0.026	-0.108
<i>Economic hardship</i>												
					0.208 **	-0.068	0.212 **	-0.076	0.185 **	-0.097	0.170 *	-0.105
<i>Physical activity</i>												
							-0.230 **	-0.138	-0.203 **	-0.112	-0.192 *	-0.114
<i>Smoking (Never smoked)</i>												
Current smoker							0.027	0.639 *	0.046	0.643 *	-0.018	0.604 *
Past smoker							0.169	0.904 ***	0.201	0.947 ***	0.167	0.922 ***
<i>Drinking (Non drinker)</i>												
Moderate drinker							0.012	0.183	0.050	0.206	0.040	0.200
Heavy drinker							0.440 †	-1.378 *	0.485 †	-1.318 *	0.447 †	-1.340 *
<i>BMI (over weight)</i>												
Under weight									-1.231 **	-0.946	-1.198 **	-0.916
Low normal									-0.985 ***	-1.136 **	-0.908 ***	-1.090 **
Mid-normal									-0.751 ***	-0.990 **	-0.698 **	-0.951 **
High normal									-0.664 **	-0.786 *	-0.627 **	-0.751 *
<i>Health satisfaction at Wave I</i>												
											-0.240 **	-0.154
Intercept	-0.752 ***	-1.934 ***	-2.472 ***	-4.662 ***	-2.510 ***	-4.575 ***	-2.709 ***	-5.032 ***	-1.909 ***	-4.178 ***	-0.964 †	-3.578 ***
-2 Log Likelihood	2174.319		2051.650		2045.583		1996.245		1971.685		1964.627	

† p ≤ .1 * p ≤ .05 ** p ≤ .01 *** p ≤ .001

^a Note: 1 refers those who report chronic conditions except for five serious chronic diseases at Wave III, and 2 refers only those who have five serious chronic diseases at Wave III.

Figure 1. Conceptual Model of Sociodemographic Variables and Chronic Diseases



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Endnotes

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- ⁱⁱ For more detail about health satisfaction variable, see the measurement section for 'major explanatory variables' in this paper.
- ⁱⁱⁱ Whatever the situation regarding spatial mobility, and some tentative inferences can be drawn about respondents who "disappeared" based on their characteristics recorded at Wave I, nothing at all is known about their health at Wave III.
- ^{iv} Other non-whites include Hispanic, Asian population, as well as other racial groups. They are 59 out of 1,249 in our sample.
- ^v Units for the drinking refer to 'cans of beer', 'glasses of wine', or 'drinks of liquor' in last month.