SOCIOECONOMIC DISPARITIES LINKED TO HEALTH-RISK BEHAVIORS:
A TREND ANALYSIS-BASED TEST OF FUNDAMENTAL CAUSALITY
(1977-2005)

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SOCIOECONOMIC DISPARITIES LINKED TO HEALTH-RISK BEHAVIORS:
A TREND ANALYSIS-BASED TEST OF FUNDAMENTAL CAUSALITY
(1977-2005)

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Thesis

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ABSTRACT

In this thesis, I sought to examine socioeconomic differences (high SES group versus low SES group) in five health-risk behaviors (smoking, obesity, overweight, alcohol consumption, and lack of exercise) by way of testing the theory of fundamental causes (Link and Phelan 1995). This theory predicts that those of high SES are better positioned (thanks to their resources) than those of low SES to shield themselves from health risks. I conducted trend analyses of data gathered over two decades. I used National Health Interview Surveys (NHIS) collected during the period from 1977 to 2005 (N=178,695) for descriptive analyses, and from 1977 to 2000 (N=147,267) for convergence/divergence analyses (trend estimations).

I expected that all health-risk behavior differentials would widen over time between high and low SES groups (divergence), except for alcohol consumption (convergence). Alcohol consumption is known to be higher among those of high SES; nevertheless, in line with the theory, it was predicted that the high SES group would be moving in the direction of diminishing the gap with the low SES group over time.

Support for the theory of fundamental causes was mixed but portions of the theory were supported. Three hypotheses regarding obesity (divergence), overweight (divergence), and alcohol consumption (convergence) were supported. Predicted probabilities of obesity and overweight increased over time for each group, while they
decreased for alcohol consumption for each group. Two hypotheses for smoking and lack of exercise were not supported. One estimated regression model did not capture any significant smoking trend differences (neither convergence nor divergence); another estimated regression model captured significant converging lack of exercise trends, with decreasing probabilities of lacking exercise over time for each group.

Taken together, the findings are implicative of the persistent SES-health association, and more specifically, one of the many channels through which that association can be maintained – health-risk behaviors. The findings are also suggestive of the importance of addressing social and economic factors that affect diseases (distal factors), besides individually-based factors that are closer to disease in the causal chain (Link and Phelan 1995). If view of that issue, the effects of fundamental causes would otherwise continue to persist in spite of attempts to control more proximal factor effects.
DEDICATION

To my family

&

Rahul
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CHAPTER I
INTRODUCTION

Preventable behavioral health-risk factors (smoking, obesity, overweight, alcohol consumption, and lack of exercise) are the foremost direct causes of disease and avoidable mortality in the United States (Mokdad et al 2004; Weisberg 2002). Further, the prevalence of these behavioral risk factors (and consequently the diseases to which they are related) differs by social statuses such as socioeconomic status (SES). If the risk factors are known, (1) why have people not changed their lifestyles to reduce their disease risk, and (2) to the extent that they have changed risky behaviors, are there also SES differences in the amount of change? In view of these matters, sociological effects of stratification by SES are emphasized in this thesis as answers to these two questions.

I analyze national health information collected over two decades in the United States (U.S.). Specifically, I argue that persons in low SES positions are less likely to change known health-risk behaviors over time than those in high SES who are better positioned (thanks to their resources) to make necessary health-risk behavior changes. I further argue that SES-based divergence in health-risk behaviors will take place, except for alcohol consumption. Alcohol consumption is known to be higher among those of high SES, so convergence is predicted between high and low SES groups over time. SES
carries with it important material and social resources which, if adequately present, would allow one to better change his/her health-risk behavior; however, specific resources are not tested in this thesis as the focus rests solely on SES positioning (whether someone is in high or low SES).

There is much evidence for the existence of the link between health-risk behaviors and premature mortality (Nelson et al. 2002). These modifiable health-risk behaviors also account for a considerable share of U.S. health care costs. The U.S. has been spending more on health care per capita (and both private and public sectors) than any other country (Council on Foreign Relations 2009; Williams and Collins 1995). Preventable health-risk factors affecting morbidity and mortality pose challenges to this day, and past and current decade’s rates of engaging in risky behaviors are not unfolding in a uniform pattern - some decline over time (smoking), some increase (obesity, physical activity/decreased lack of exercise), while some increase only slightly or stay almost constant (alcohol) [Behavioral Risk Factor Surveillance System – BRFSS, Appendices A, C, E, and F].

All of this is well-known. It is also practically impossible to read the daily paper without finding some story about the health dangers of smoking, drinking, lack of exercise or dieting improperly. Similarly, the sheer number of articles available through PubMed on health-risk behaviors grew from 1977 to 2007 (smoking: 1,224 to 8,839; obesity: 1,139 to 10,161; physical activity: 1,689 to 11,343, and alcohol: 1,386 to 2,769).

This leads one to perform trend-disaggregation by social statuses (e.g., SES) and examine whether engaging in a health-risk behavior changes in such a way that those of high SES experience a greater behavior change than those of low SES over the period of
almost three decades (1977-2005). For instance, BRFSS 2005 data on smoking show that the percent engaging in smoking was much higher among those with a high school diploma than those with a college degree (Appendix B). It also appears that there are racial differences, yet another social status difference. For example, BRFSS 2005 data show the highest obesity percentage among African-Americans as opposed to other races (Appendix D). Race (and gender) differences in health-risk behaviors are only descriptively examined in this thesis while SES is statistically tested being that the purpose of the thesis is to primarily examine SES-based health-risk behavior trend differences under a specific theoretical assumption.

Previous indications of SES and race differences in risky behaviors signify that people’s lifestyles are also socially structured. The theory of fundamental causes, established by Link and Phelan (1995), offers an explanation for such structured variations. One of the main aspects predicted by the theory is that those of high SES, as opposed to those of low SES, are better positioned to shield or ameliorate their health by modifying certain health-risk behaviors. Resources, transportable to different situations, are one reason why. Link and Phelan (1995) suggest that, instead of focusing mainly on proximal causes of disease, researchers need to focus on social conditions in which people live and the processes that expose them to risks, seeing “social status” as one of the fundamental causes of disease. “As such, fundamental causes can defy efforts to eliminate their effects when attempts to do so focus solely on the mechanisms that happen to link them to disease in a particular situation” (Link and Phelan 1995:81).

In this thesis, I conduct an empirical test of Link and Phelan’s (1995) theory of fundamental causes as they relate to five health-risk behaviors: smoking, obesity,
overweight, alcohol consumption, and lack of exercise. I expect to provide further support for Link and Phelan’s (1995) theory through trend analysis by social status variables, primarily by SES. It is important to note that the intent is not to negate individually-based factors (e.g., serum cholesterol, diet) or biological/genetic factors of morbidity and mortality, which literature has also supported; it is specifically to test the fundamental cause theory. It may be more likely that genetic factors affect individual variations more than they affect SES health variations, but relationships between those genetic and social factors merit further research (Williams and Collins 1995).

1.1. Review of the Literature

Research increasingly shows that certain health conditions, including chronic, appear to be affected by SES conditions throughout the life cycle (Feinstein 1993; Hayward et al. 2000), and that SES and racial health disparities are increasing (Hayward et al. 2000; Moss 2000). Disparities of these types represent the single most crucial public health issue in the U.S. (Williams and Collins 1995). As Lantz et al. (2001) note, studies conducted in different contexts and geographic areas demonstrate a strong association between SES and health, as well as much evidence that the prevalence of health-risk behaviors is higher among low SES individuals (with less education and income). This accounts for an increased risk of negative health outcomes among these individuals. There are also times when researchers find only a modest proportion of certain risk behaviors accounting for SES differences in mortality (Lantz et al. 1998; Lantz et al. 2001). Even with findings that vary, these and other authors (Barkley 2008)
have acknowledged the perspective that health-risk behaviors can considerably explain SES stratification in health.

Health disparities have further been observed in terms of racial background, as well as age and other sociodemographic variables. Hayward et al. (2000) note that such disparities occur over the lifecycle, with African-Americans facing a greater chance of developing chronic diseases when compared to whites. They find the same in terms of mortality at a young age, suggesting that chronic diseases and mortality combine in shortening the lifecycle of African-Americans and that “these differences are rooted in the fundamental social conditions of life” (Hayward et al. 2000:927).

1.1.1. Socioeconomic Status (SES) and Health

Populations in developed countries, including the U.S., have been witnessing increasing life expectancy and health status improvements; however, in the majority of those countries, mortality rates have been higher for individuals of lower SES than for those of higher SES (Feinstein 1993). This differential mortality has formed a gap between individuals of high SES and low SES which has been related to one’s education, income, and wealth, among other factors. As a result, Feinstein (1993) establishes two dimensions of inequalities in health outcomes in the U.S. The first dimension has two levels: one materialist or resource-dependent and the other non-resource dependent or behavioral. The second dimension relates to inequalities springing from varying experiences during the life cycle, examples of which are differences in smoking, diet, exercise, occupations, as well as to inequalities arising from access to and use of health care services. Both of these dimensions play a role in this thesis.
The SES gradient and domains through which it is associated with health have gained much attention in research (Adler et al. 1994; Williams and Collins 1995). There is much evidence that diminishing health inequalities would mean diminishing societal inequalities, and this process would entail more fundamental macro-level changes (Williams and Collins 1995). High SES individuals are generally the first to alter their health-risk behaviors thanks to their economic and other resources, such as power and prestige (Coleman 1974; Link and Phelan 1995). Individuals of low SES, on the contrary, are more prone to consequent risks of morbidity and mortality (Adler et al. 1994). In this way, it can be said that the domain of health-risk behaviors impacts health in addition to other known domains, such as work, physical and social environment, early life experiences, or personality, all of which have been identified by various authors (e.g., Adler et al. 1994; Elo and Preston 1992; House, Kessler, and Herzog 1990; Kessler et al. 1995; Mirowsky and Ross 1989; Williams and Collins 1995; Wray, Alwin, and McCammon 2005). In essence, it can be inferred that one’s SES position plays a substantial role in influencing one’s health and in understanding the nature of health inequalities (Wray, Alwin, and McCammon 2005).

1.1.2. Race and Health

Besides SES, health inequalities also vary by other social factors, one of which is race (Wray, Alwin, and McCammon 2005). Using the 1990 5% Public Use Microdata Survey, Hayward and Heron (1999) found that Asians lived a longer life with fewer years in poor health, while both African-Americans and Native Americans lived more years characterized by chronic health problems and/or shorter life, when compared to all other
racial groups. Hispanics lived fewer years, with health-problem years being relatively shorter (compressed). When these authors further explored gender differences, it was found that women lived longer than men, but spent more inactive years of their lives (non-disability free years) across all racial groups (with impairments affecting men and women at different times of their life cycle).

In terms of racial variations by disease, Williams and Collins (1995) state that “[a] slower rate of decline among blacks than whites for heart disease is the chief contributor to the widening racial gap in life expectancy…” (P. 360). Race also highly correlates with SES in its influence on health, as these authors find. Other factors also contribute to health disparities, such as historical events and migration to urban areas for economic reasons (areas which may have been initially well-off, but then stagnated, and more low(er) SES groups moved there). Such patterns have an effect on increasing alcohol consumption or smoking (and other risky behaviors) among this portion of the population (Williams and Collins 1995). Overall, the social conditions in which people of different races live contribute to our understanding of health disparities.
CHAPTER II
THE THEORY OF FUNDAMENTAL CAUSES

The theory tested in this thesis is called the social conditions as fundamental causes of disease, formalized by Link and Phelan (1995). House et al. (1990, 1994) originally discussed the fundamental characteristic of the persistence of the SES-disease association. One of the major parts of the theory relates to access and use of important resources (material and non-material) upon which people can make important health decisions and (re)adjustments. This thesis intends to examine Link and Phelan’s (1995) central proposition that people of higher SES make better use of their resources to avoid health risks. This links to Miech’s (2008) study in a way that

… people in the lower social strata are less likely to desist from health behaviors that become culturally redefined as unhealthy [while] … people outside [these] social strata… shape health disparities by \textit{not} engaging in the health outcome of interest. (P. 364)

Link and Phelan (1995) use the example of smoking and note that upper status people were likely to start smoking but also more likely to stop than people of lower SES. This began during the 1960’s when the association between higher rates of smoking and lower SES individuals surfaced. This new knowledge was one way in which a fundamental concept emerged. With the changing role of the smoking mechanism (or
other health-risk behavior variables in the SES-disease association, it became obvious that “their connection to [SES] changed when knowledge about their importance in health became available” (Link and Phelan 1995:87, building on Lieberson’s 1985 idea). A social cause can also affect multiple outcomes (Cassel 1976; Link and Phelan 1995).

Link and Phelan (1995) call greater social causes “fundamental causes” of disease, counting SES, monetary and social resources (money, power, prestige, social connectedness), and other social factors/statuses (race/ethnicity, gender) as examples of those. They are fundamental because they

… involv[e] access to resources… that help individuals avoid diseases and their negative consequences through a variety of mechanisms. Thus, even if one effectively modifies intervening mechanisms or eradicates some diseases, an association between a fundamental cause and disease will reemerge. (Link and Phelan 1995:81)

Much literature has grown around the theory of fundamental causes, and there has been considerable support for this theoretical direction (Miech 2008; Phelan et al. 2004).

In total, the theory is driven by contextualizing risk factors and fundamental causes which, in order to appear, require a change over time (in the diseases) condition.

2.1. Preventable Health-Risk Behaviors

Preventable health risk behaviors – smoking, obesity, overweight, alcohol consumption, and lack of exercise form a domain that is one of the vital determinants of [co]morbidities and mortality (Williams and Collins 1995). These modifiable lifestyle behaviors have been linked to many diseases including cardiovascular diseases, diabetes, hypertension, and ischemic stroke (Boden-Albala and Sacco 2000). When combined, the
deteriorating effects of these behaviors on general health can be even more severe. Link and Phelan (1995) point out that

… [these] individually-based risk factors must be contextualized, by examining what puts people at risk of risks… [and] that social factors such as socioeconomic status and social support are likely ‘fundamental causes’ of disease… (P. 80)

Research continually demonstrates that SES conditions (among others) “constrain lifestyle choices and increase disease and mortality risk,” thus, being aware of the SES link with health behaviors would strengthen the impact of health programs intended to aid certain social stratum (Rimal 2002:322). Low SES individuals may have also experienced some gains over the years in bettering their health status, but it may be that those of high SES have experienced higher or faster gains, all of which remains to be explored in this thesis.

2.1.1. Smoking

Smoking is known to be the leading cause of preventable mortality in the U.S. and worldwide (Yaukey, Anderton, and Hickes Lundquist 2007). About 20 percent of the population nationwide engaged in smoking in 2007 (Appendix A), the behavior that is greatly associated with developing carotid atherosclerosis (plaques), for instance (Boden-Albala and Sacco 2000). Furthermore, it is known that those who smoke typically engage in multiple risk behaviors (Kendzor et al. 2008).

There is evidence that race/ethnicity is a significant predictor of engaging in multiple risk behaviors. Kendzor et al. (2008) found that the odds of engaging in such behavior were higher among Latinos and African-Americans than Caucasians, even when gender, age, education, income, smoking, and other variables were present in the model.
Additionally, Siegel and Faigeles (1996) found that ethnicity and education (as a primary chosen measure of SES) predicted smoking, with whites and African-Americans being more likely to smoke than Latinos. A strong inverse association between education and smoking was found in nearly all ethnic and gender subgroups. This leads me to hypothesize that high and low SES groups will be more likely to experience divergence in smoking over time than convergence. As for gender, Wray, Alwin and McCammon (2005) found that women (and married adults) were considerably less likely to currently smoke (or to have smoked in the past) when compared to men (and unmarried adults), and higher SES contributed to reducing smoking in midlife and older age.

Some international studies, like the work of Lee et al. (2008), using a Canadian sample, found support for mediating effects of health-risk behaviors in the SES-health association. A study based on national health surveys in Australia, 1989-2001 found evidence that those of low SES were more likely to smoke, or be obese (Najman and Toloo 2006). Speaking at the domestic level, Govil et al. (2008) observed a similar finding among coronary heart disease patients such that, at baseline, those of lower SES (measured primarily in terms of lower education) were more likely to be disadvantaged than those of higher SES. Williams and Collins (1995) made a similar note and added that there has been a greater likelihood of blue collar and service workers smoking non-filter cigarettes than professional managerial workers, with African-Americans being incongruently in the former group (and also using higher tar content cigarettes).
2.1.2. Obesity and Overweight

Obesity has been the second leading preventable cause of disease (US Department of Health and Human Services 2001), and rates of obesity are rather startling due to many reasons. One is the effect of obesity on morbidity and mortality (World Health Organization, 2000) with increasing risks of several diseases (especially due to poor diets rich in fats, salts, and sugars), such as coronary heart disease, Type II diabetes, cancers, hypertension, liver disease, osteoarthritis, and others (Boden-Albala and Sacco 2000; Centers for Disease and Control (CDC) 2009). Health costs related to obesity were estimated at $117 billion in 2000 (CDC 2009).

In their systematic review and meta-regression analysis of obesity in the U.S. (1990-2006), Wang and Beydoun (2007) note that the prevalence of obesity (using BMI measures) in the U.S. increased during the last three decades, and large disparities among different population groups existed. Using linear regression models, they found that obesity prevalence increased from 13 percent to 32 percent from the 1960’s to 2004 in the case of adults. Wang and Beydoun (2007) also report that 66 percent of adults were overweight and obese (both measured as BMI, with cut-off points of 25 and 30 respectively), while 16 percent of children and adolescents were overweight and 34 percent were at risk of being overweight.

Minority and low SES groups were not all affected the same. For example, in 2003-2004, non-Hispanic Blacks were most affected (76.1 percent), and non-Hispanic Blacks and Mexican-Americans together had a 10 percent higher prevalence than non-Hispanic Whites (75.8 percent versus 64.2 percent). Even though the prevalence of obesity increased in all SES groups, the patterns of SES disparity trends remained
complex when age, education, and other variables were taken into account (Wang and Beydoun 2007). Finally, by 2015, these authors find that 75 percent of adults will be overweight and obese, and 41 percent will be obese. Racial and ethnic differences were found to be much smaller among men than among women. Non-Hispanic Black women were most affected when compared to other racial groups, especially women of forty years of age and older. Rimal (2002) also found supportive evidence for these racial and gender differences with women gaining more weight than men.

A series of BRFSS-based studies (e.g., 1993-2001) found worsening health across most social groups, and especially those without more than a high school education (Zack et al. 2004). Further, Nelson et al. (2002) found that obesity increased in all U.S. states in a study based on the BRFSS (1991-2000). Previously, Truong and Sturm (2005) found that each SES group was marked by weight gains based on BRFSS (1986-2002) surveys; however, those with a college degree gained less than others without that degree. Liu and Hummer (2008) found similar evidence for these educational differences in health in general. Based on these reviews, I hypothesize that high and low SES groups will be more likely to experience divergence in obesity trends over time. That is, obesity differentials by SES are more likely to widen. Divergence is also expected for overweight. On a descriptive level, it remains to be investigated in this thesis how much obesity trends over a much longer period of time (almost three decades) will be understood in terms of SES and racial differences after data become disaggregated (e.g., Appendix C reflects the 1995-2007 overall trend). Obesity and overweight are studied as separate outcomes in this thesis in order to form a better judgment of the weight issue across the time period chosen.
2.1.3. Alcohol Consumption

Besides smoking, obesity, and overweight, alcohol consumption is another health-risk behavior that can have considerable effects on preventable mortality. Alcohol consumption can lead to liver disease, cardiovascular problems, decreased cognitive functioning, and many other issues (Boden-Albala and Sacco 2000). More people consumed alcohol during the past 30 days than did not in the U.S., in 2007 (BRFSS data).

In line with the previous discussion on the other three health-risk behaviors, some people who consume alcohol also engage in other health-risk behaviors, such as smoking (Kendzor et al. 2008). The comorbid use of both alcohol and smoking can have a synergistic effect on certain diseases (Jackson 1999-2001). While alcohol consumption has been studied across all age groups, there is an abundance of work focusing on youthful consumption. Adding the effect of race/ethnicity, Stiliwell, Boys, and Marsden (2004) found that White youth (primarily of English and Irish origin) were more likely to engage in excessive drinking and undergo negative consequences than Black youth (of African and Caribbean origin).

Some studies also find measures of SES as predictors of alcohol use, while others find comorbid risks of alcohol use among pregnant and illicit drug-using women of low SES (Sharpe and Velasquez 2008). Additionally, low SES individuals (e.g., blue collar men) used alcohol as a coping mechanism (more than women or white collar men), as noted by Bautzmann et al. (2008). Women, in general, drink less than men, even though alcohol consumption is higher for both genders in high SES (income) levels compared to other levels. It is especially high among higher SES whites (Bautzmann et al. 2008). I expect, then, that high and low SES groups will be more likely to experience
narrowing alcohol differentials over time (convergence), such that the high SES group will be higher on alcohol consumption but getting nearer to closing the gap with the low SES group.

2.1.4. Lack of Exercise

Lack of exercise is another health-risk behavior. Being physically active has protective effects from many diseases including heart disease, diabetes, obesity, and other diseases (Boden-Albala and Sacco 2000; CDC - Physical Activity and Health: Report of the Surgeon General 1999). The general recommendation is that people should engage in moderately intense physical activity for at least thirty minutes on most days in a week (1995 Dietary Guidelines for Americans, adopted from the Surgeon General). The physical activity trend for 2001-2007 is presented in Appendix F.

Lack of exercise can be a result of many things, such as sedentary lifestyle, watching too much television, injury, or it can even be a negative moderator. Krueger and Chang (2008) found that physical inactivity (coping moderator) increased the effect of stress on mortality among low SES individuals, but not among middle or high SES individuals. Lantz et al. (1998) examined the extent to which certain health-risk behaviors explained the SES and all-cause mortality association. They found that the risk of dying was high among low and middle income individuals after accounting for four health-risk behaviors (cigarette smoking, alcohol drinking, sedentary life style, and relative body weight). They add that even though health-risk behaviors play a part in the SES-health association, there are also many other factors that contribute to SES
disparities in mortality; disparities which would still persist in spite of improved health-behaviors among lower strata.

Turning to education, it is well-known that those with a college education or more tend to exercise more frequently than those with less education (Liu and Hummer 2008; Truong and Sturm 2005). Nutrition concerns [dieting habits] and exercise habits have also remained strongly associated (Rimal 2002). Based on this review, as well as a slight moderate physical activity increase founded on BRFSS data (Appendix F), I expect that high and low SES groups will be more likely to experience divergence in lack of exercise over time.

2.2. Health-Risk Behaviors Over Time

Although health-risk behaviors can be characterized as lifestyles, they can also change over time. Public health information has been widely disseminated over the last 30 years and we have witnessed large-scale media and government campaigns to change health-risk behaviors. Still, people do not experience these changes at the same rates. Because higher status individuals have more “access to broadly serviceable resources” (Link and Phelan 1995:87), allowing them to acquire and utilize information better than low status persons, they will be expected to change their health-risk behavior more quickly. Availability of resources facilitates health-risk behavior change and public health information figures among those resources. High SES individuals who possess those resources will, thus, be able to more effectively make use of public information such that their health improves. These aspects principally motivate the hypothesis.
I do not however test any hypothesis with data about what individuals know or do not know about health risks. I am inferring this based on observable changes in health-risk behavior rates over time. I also use PubMed citation numbers (increasing over time) as one broad indicator that more attention is being paid to health risks.

2.3. Hypotheses

H1: High SES groups will be more likely to decrease smoking over time than low SES groups, creating divergence with low SES groups.

H2: High SES groups will be more likely to reduce their level of obesity over time than low SES groups, creating divergence with low SES groups.

H3: High SES groups will be more likely to reduce their level of overweight over time than low SES groups, producing divergence with low SES groups.

H4: High SES groups will be more likely to reduce their alcohol consumption over time than low SES groups, producing convergence.

H5: High SES groups will be more likely to decrease lack of exercise over time than low SES groups, creating divergence with low SES groups.
CHAPTER III
DATA AND METHODS

3.1. Data and Sample

The data for this thesis come from the National Health Interview Survey (NHIS) collected in six different years (1977, 1985, 1990, 1995, 2000, and 2005). NHIS is one of the collection systems of the National Center for Health Statistics (NCHS), the main health statistics agency in the nation. Its health statistics are vital to research on health care. As with other systems, NHIS contributes to the understanding of trends in health care status and delivery through longitudinal studies and to the way of identifying health disparities by SES, demographic, and other relevant characteristics. At the same time, it brings public officials up to date on the necessity of making policy changes and provides support for biomedical and health services research.

A variety of steps were followed to ensure data validity including the merging of datasets and identification of common variables across data collection periods. There are five-year increments for datasets between 1985 and 2005. The first two waves, 1977 and 1985, reflect a seven-year time period. While data were collected during other time periods, there was an interest to start with the late 1970’s and the need for common variables, necessitating the time periods chosen.
The data for the first four data periods (1977, 1985, 1990, and 1995) were initially downloaded into SAS and then imported into SPSS. This rather laborious process involved using SAS input statements and executable files to generate individual SAS datasets which were then imported into SPSS. Prior to this, time had to be spent reviewing codebooks to determine which datasets had commonly worded questions and equivalent response categories. If response categories were different, procedures had to be developed to determine if those categories could be recoded to gain equivalency without losing information. Data for the remaining two years (2000 and 2005) were readily available for adaption to SPSS.

The next step involved generating another set of datasets with just common variables to meet the intent of this thesis. Thus, a careful extraction of those variables from larger datasets and detailed (re)examinations of how closely they were measured were essential in the process. Sample sizes in each dataset ranged from 17,317 individuals to 41,104 individuals across the six years chosen (1977=22,842; 1985=33,630; 1990=41,104; 1995=17,317; 2000=32,374; 2005=31,428). Common variable datasets were pooled into one final dataset and used for convergence/divergence analyses. The sample size of the pooled dataset is 147,267, excluding the last year (2005).

Because this thesis focuses on SES disparities, pooled data include the first five years (1977-2000) and exclude the year 2005 because no direct individual SES status measure was available in that year for all respondents (the survey asked for individual in the family with highest education). However, data for all six years (1977-2005) were utilized for the descriptive analysis (N=178,695) that precedes the logistic regression
analyses. This thesis first examines descriptive percentages of those engaging in the preventive health behaviors over the appropriate time periods. Then, logistic regression models are used to estimate diverging or converging trends on all health-risk behaviors for high and low SES groups.

3.1.1. Dependent Variables

Each of the five health-risk behaviors – obesity, overweight, smoking, alcohol consumption, and lack of physical exercise represents a dependent variable. Since the equivalency of physical exercise measures demanded the most attention, I will start with explaining how such equivalency was reached. For lack of exercise, several equivalent measures were first identified across the years of 1985, 1990, and 1995, in terms of eleven activities/sports engaged in “during the previous two weeks”: jogging or running, aerobics or aerobic dancing, tennis, biking, swimming or water exercises, basketball, baseball or softball, football, soccer, volleyball, and handball/racquetball/squash. A large increase in heart rate was presumed for engaging in these sports. The same was not assumed for some other activities/sports, such as walking, gardening or yard work, and weight lifting or training, and these were not included in the analysis as a result. Physical exercise is expressed in terms of intensity/degree of vigorous exercise for 2000 and 2005 (“slight to moderate,” and “large”) as opposed to it being captured through particular sports for 1985, 1990, and 1995.

Even though the literature review reveals that at least a moderate level of exercise for thirty minutes on most days in a week is recommended, it was not possible to use
moderate increase in heart rate of breathing because it was measured differently in 2000 and 2005. Since slight and moderate were not separated for these two years, the equivalency with the measure for previous years was only possible through “large” increase in heart rate (per day). A question asking how often a person did vigorous activities for at least 10 minutes that caused heavy sweating or large increases in breathing or heart rate and a question on time period (per day) were combined as a measure of exercise for the years of 2000 and 2005. The same “large/vigorous” increase in heart rate was matched with those eleven exercises/sports/physically active hobbies for the years of 1985, 1990, and 1995. Lack of exercise (with the assumed large increase in heart rate) is coded 1 and non-lack of exercise is coded 0.

As for the remaining health risk behaviors, smoking is coded 1 for those who are currently smoking and 0 for those who are not (“current” smoking status regardless of frequency). Similarly, alcohol is coded 1 for those who are currently consuming it (including those having “some” drinks) and 0 for those who are non-drinkers (total abstainers). This may appear a rather global measure of alcohol consumption, but it is challenging to find a single measure of alcohol that is reliable as an indicator of unhealthy alcohol consumption (e.g., frequency and type of alcohol consumed). We cannot always easily know if it is “bad” or “good” alcohol consumption, and recommendations would vary for those who are non-drinkers and those who are (Boden-Albala and Sacco 2000). Alcohol is perceived to have both beneficial (e.g., antioxidant polyphenolic compounds in wine or beer) and adverse effects on behavior and health (Bautzmann et al. 2008; Boden-Albala and Sacco 2000). Furthermore, the original theory is concerned with whether someone engages in these risk behaviors or not and
does not particularly look at the specific extent of that engagement. No alcohol consumption data were available for 1995.

Obesity and overweight measures are derived from the Body Mass Index (BMI), which incorporates height and weight into the following standard equation
\[ \frac{\text{weight}}{\text{height} \times \text{height}} \times 703. \] In general, the Department of Health and Human Services has identified the following four BMI categories: underweight (BMI<18.5), normal (BMI=18.5-24.9), overweight (BMI=25-29.9), and obese (BMI=30 or greater). When the overweight measure was formed, the first two BMI categories were collapsed into ‘not overweight’ category and the remaining two into overweight (obese is at the same time overweight, as well). The measure of obesity was additionally formed only from the obese category, considering all the other categories non-obese.

3.1.2. Independent Variables

Three main social status variables are: gender (1=male, 0=female), race (1=white, 0=non-white), and education as a measure of SES (11 or less years of education, an indication of low SES coded 1; and more than 11 years, an indication of high SES, coded 0), corresponding to Miech’s (2008) way of measuring it. Individual education information was available for all data periods, except 2005 where the measure was for the individual with highest level of education in the family (and not directly of each respondent surveyed).

An additional independent variable was selected, age, with 0=less than 45 years and 1=45 or older (mean age=45) as it is also important in the discussion of health-risk behaviors (such as in life course research in which Age-Period-Cohort analysis become
very suitable for descriptive trend analysis). In sum, education is used as a measure of SES (unlike income, for example) due to some notions of a more lucid understanding of the association between education and health than income and health (e.g., Miech 2008). Further, there is evidence for reverse causation between income and health, which adds methodological challenges (Williams and Collins 1995). Education, on the other hand, is a more forward (unidirectional) type of measure compared to income. Income is a more unstable measure of SES than either education or occupation; in fact, education is the most stable/robust and the least volatile measure of SES (Kitagawa and Hauser 1973; Williams and Collins 1995). Tables 3.1 and 3.2 provide percentage summaries for variables used in descriptive and convergence/divergence analyses respectively. Once again, 2005 dataset did not have a direct measure of education and that year was consequently excluded from convergence/divergence analyses (Table 2).

Table 3.1 Valid Percent for Variables Used in Descriptive Analyses (Pooled NHIS 1977-2005), N=178,695

<table>
<thead>
<tr>
<th>Variable</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smoker</td>
<td>26.1</td>
</tr>
<tr>
<td>Obese</td>
<td>16.5</td>
</tr>
<tr>
<td>Overweight</td>
<td>49.2</td>
</tr>
<tr>
<td>Current drinker</td>
<td>66.3</td>
</tr>
<tr>
<td>Lacks exercise</td>
<td>66.6</td>
</tr>
<tr>
<td>Low SES</td>
<td>24.2</td>
</tr>
<tr>
<td>45 or older</td>
<td>52.5</td>
</tr>
<tr>
<td>White</td>
<td>82.4</td>
</tr>
<tr>
<td>Male</td>
<td>43.2</td>
</tr>
</tbody>
</table>
Table 3.2 Valid Percent for Variables Used in Convergence/Divergence Model-Analyses (Pooled NHIS 1977-2000), N=147,267

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smoker</td>
<td>27.2</td>
</tr>
<tr>
<td>Obese</td>
<td>15.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>46.9</td>
</tr>
<tr>
<td>Current drinker</td>
<td>68.0</td>
</tr>
<tr>
<td>Lacks exercise</td>
<td>66.9</td>
</tr>
<tr>
<td>Low SES</td>
<td>24.2</td>
</tr>
<tr>
<td>45 or older</td>
<td>45.8</td>
</tr>
<tr>
<td>White</td>
<td>82.7</td>
</tr>
<tr>
<td>Male</td>
<td>43.1</td>
</tr>
</tbody>
</table>

3.1.3. Analytic Technique – Convergence/Divergence Models

Descriptive data are presented first to show the percent of respondents’ engaging in each health-risk behavior across the entire time period, regardless of SES, and then separately by race, gender, and SES. I am also looking at health-risk behavior engagement across time for six groups simultaneously characterized by a specific gender, race, and SES. There are eight groups: white high educated female (WHEF), white low educated female (WLEF), non-white high educated female (NWHEF), non-white low educated female (NWLEF), white high educated male (WHEM), white low educated male (WLEM), non-white high educated male (NWHEM), and non-white low educated male (NWLEM).

Unlike the years of 1977-2000 with triple-status simultaneity, the SES measure was not available for the 2005 data period, so only gender and race were captured simultaneously for this particular year (double simultaneity): white female (WF), non-
white female (NWF), white male (WM), and non-white male (NWM). Frequencies were run to obtain percentages for all groups in each health-risk behavior. Percentages were plotted using KaleidaGraph.

Next, I use logistic regression models for SES-health-risk behavior trend estimations. More precisely, I use convergence/divergence models as they are applicable to repeated cross-sectional data which allows one to test hypotheses about the reduction or widening of social divisions/gaps (Firebaugh 2008). “A single model with interaction terms is more convenient… since [it] provides a ready-made test for whether differences in the group trends are statistically significant” (Firebaugh 2008:185). The following is the model formulation:

\[
\logit \ (Y_{it}) = \alpha + \beta T + \delta G_2 + \phi (T \times G_2)
\]

Time (T) is the x-axis, which gives a model a very particular feature, where “the regression line for each group reflects the group’s linear time trend” (Firebaugh 2008:185). The initial year is coded 0 with 1977=0 (1985=8; 1990=13; 1995=18, 2000=23) where the numbers 8, 13, 18, and 23 represent the number of years following the zero point of 1977. Alpha (\(\alpha\)) is the predicted value of \(Y\) for the baseline group in the initial year. Time (T) and group (\(G_2\)) are independent variables. The coefficient (\(\beta\)) for time indicates the trend for the SES baseline group (high SES). The coefficient for the second (i.e., low SES) group (\(\delta_2\)) indicates the difference in y-intercepts between the second group (coded 1) and the baseline or reference group (coded 0). Essentially, \(\delta\)s demonstrate “initial group differences on \(Y\) (fitted by linear regression)” (Firebaugh 2008:186).
As for the time-SES interaction term, its coefficient ($\varphi_2$) represents the difference in slopes (linear time trends) for the second group and the baseline group. This coefficient is the most important (Liu and Umberson 2008) for the reason that it represents trends in health-risk behavior differences by SES. In order to conclude whether trends are converging or diverging over time, it is necessary to look at the signs of $\delta$s and $\varphi$s. If they have the same sign (+, + or -, -), Y is diverging between groups; if, however, they do not have the same sign, Y is converging between a particular group and the baseline group (or the trends may have crossed).

There can be more than two groups in a model, as well as more than one interaction term accordingly. Predicted probabilities on a dependent variable of interest can be obtained and then plotted to visualize trends for different groups, as Liu and Umberson (2008) did when they studied marital status and self-rated health relationship between 1972 and 2003 and also used the NHIS data.
CHAPTER IV

RESULTS

4.1. Descriptive Analysis Results – Aggregate Level

Descriptive results (depicted in Figure 4.1) show that, on aggregate, smoking decreased between 1977 and 2005 (from 32.1 percent to 20.8 percent), while obesity and overweight increased (9.4 percent to 23.9 percent and 39.4 percent to 60.5 percent respectively). Alcohol consumption increased between 1977 and 1990 (mid-60th to lower 70th percentile) but then decreased in 2000 and 2005 (to 60.0 percent and 59.3 percent respectively). Finally, lack of exercise first increased in 1990 (69.4 percent) by 2.1 percent from the 1985 level, then decreased in 1995 and 2000 to finally increase again in 2005, although not at the level of 1990 (65.3 percent).
### 4.2. Race and Gender Differences

Figures 4.2 and 4.3 depict percentage of whites and non-whites engaging in five health-risk behaviors over the 28-year period (1977-2005). Smoking decreased among both whites and non-whites but remained higher for non-whites for the most part (except in 2000 and 2005). Percent-change between the years examined was relatively similar, except between 1985 and 1990 when smoking decreased noticeably faster for non-whites
than whites (6.6 percent versus 3.9 percent). Obesity increased in general for both whites and non-whites, although it decreased in only one year (2000) for each group. Obesity percentages were higher for non-whites than whites between 1977 and 2005. Overweight also increased in general for both groups during the same period. Interestingly, it decreased in 2000 for both groups, just as it was the case for obesity. Alcohol consumption first increased for both groups (1977-1990) and then decreased for both groups (2000-2005). Alcohol data were not captured in the 1995 survey. Alcohol consumption was actually higher among whites in the first years mentioned (about 65 to 74 percent) than among non-whites (mostly around 50 percent). Even when this risk-behavior dropped in the 2000 to 2005 period, alcohol consumption was still higher among whites (62 to 60 percent) than non-whites (48 to 45 percent) in the respective years. Finally, the lack of exercise picture is somewhat mixed. Lack of exercise was increasing among the whites up to 1990, and then it started decreasing until 2000 to then rise again in 2005. The same could be said for non-whites. The only difference is that lack of exercise percentages stayed above 60 for whites, while they crossed the 70 mark for non-whites (earlier in and right at the end of the 28-year period).
Figure 4.2 Percentage of Whites Engaging in Health-Risk Behavior (1977-2005)
With regard to gender, Figures 4.4 and 4.5 depict percentages of men and women engaging in five health-risk behaviors from 1977 to 2005. Smoking decreased for both men and women between 1977 and 2005. Men smoked more in each year of interest. Smoking dropped from 34.4 percent to 24.2 percent for men from the beginning until the
end of the period, while it dropped from 30.2 percent to 18.0 percent for women. Obesity increased for men from 1977 to 2005 (7.1 percent to 21.2 percent). It did not drop in any year. Obesity also increased for women during the same period (9.5 percent to 21.4 percent) but it dropped slightly in 2000 (18.9 percent) from the 1995 level (20.9 percent). Women were more obese than men overall. Similar results were found for overweight. Overweight increased for men and women in general, with the exception of 2000 when it dropped. Contrary to overall obesity results, men were more overweight than women between 1977 and 2005. Overweight percentages ranged from 40.8 to 62.3 for men and from 29.9 to 47.6 for women.

Alcohol consumption first increased for men (1977-1985), and then it started decreasing until 2005. For women, it first decreased from 1977 to 1985, increased in 1990, and then it started decreasing again. On average, men were more likely to drink than women (72 percent versus 59 percent). Interestingly, the percent of men consuming alcohol in 2005 (65.2 percent) was similar to that of the 1977 level (66.7 percent). For women, that difference was much larger (51.5 percent in 2005 versus 62.4 percent in 1977). Lack of exercise first increased for men (1985-1990), then, decreased in both 1995 and 2000, to finally increase again in 2005. The same can be said for women. The exception is that women, in general, lacked more exercise than men. From 1985 to 2005, lack of exercise decreased for men from 62.7 percent to 59.5 percent, while it decreased for women from 70.6 percent to 69.8 percent.
Figure 4.4 Percentage of Men Engaging in Health-Risk Behavior (1977-2005)
Figure 4.5 Percentage of Women Engaging in Health-Risk Behavior (1977-2005)

4.3. SES Differences

Most importantly, for the purpose of this thesis, results disaggregated by SES show that low SES individuals were more likely to smoke from 1977 to 2000 than high SES individuals, but both descriptive trends are decreasing almost in parallel form.
(Figure 4.6). The overall smoking percentages range from 34.1 percent to 26.1 percent for low SES and 31.5 percent to 22.2 percent for high SES.

![Graph showing smoking rates by SES from 1977 to 2000](image)

**Figure 4.6 Percent Smoker by SES (1977-2000)**

It is somewhat different for obesity and overweight (Figure 4.7 and 4.8), in which case low SES individuals are more obese/overweight over time, but descriptive trends seem to be coming closer together towards the last two time periods. In fact, they are staying almost flat for high SES between 1995 and 2000 (from 18.0 percent to 17.9 percent for obesity, and from 51.7 percent to 50.8 percent for overweight), while dropping faster for low SES between the same time period (from 24.0 percent to 21.6 percent).
percent for obesity, and from 59.5 percent to 55.3 percent for overweight), which is a very interesting finding.

Figure 4.7 Percent Obese by SES (1977-2000)
Alcohol consumption (Figure 4.9) was first increasing for high and low SES groups during the first half of the period examined, although it was much higher for the high SES group; however, this type of health-risk behavior began to decrease for both groups later in the second period. The finding is such that the decrease in alcohol consumption started earlier among low SES group individuals, that is, from 1985, as opposed to 1990 for high SES. Alcohol consumption actually grew between 1985 and 1990 for the high SES group (75.9 percent versus 76.3 percent) while it decreased for low SES group within the same period (57.8 percent versus 55.7 percent).
Finally, low SES individuals lack more exercise over time than high SES individuals as shown in Figure 4.10 (roughly 20 percent difference). From 1985 to 1990, lack of exercise increased more sharply for the high SES group (from 61.0 percent to 64.8 percent) than low SES group (85.2 percent to 86.1 percent), and then both descriptive trends took a decreasing turn; however, the drop in lack of exercise was much faster among high SES individuals (63.4 percent to 58.0 percent) from 1995 to 2000 than for low SES individuals (82.4 percent to 81.5 percent).
4.4. Social Status-Simultaneity Results

Simultaneity results (capturing race/class/gender) for the 1977 to 2000 period reveal that the percentage of those smoking (Figure 4.11) was generally lower for white high-educated females than white low-educated females, as was the case for non-white high-educated females versus non-white low-educated females. The only exception in these two cases is the percentage difference in 1977 when high-educated females smoked slightly more (30.3 percent) than low-educated females (29.7 percent). Mean percent-smoking was 24.6 for white high-educated females and 26.4 percent for white low-educated females. The mean percent for non-white high-educated females was 25.04 versus 27.78 for non-white low-educated females.
Smoking percentages were continuously lower for white and non-white high-educated males versus white and non-white low-educated males respectively during the 1977-2000 period. In fact, non-white low-educated males smoked most during the same period in contrast to all other groups, both men and women (mean percent=38.72).

Figure 4.11 Social-Status Simultaneity for Smoking (1977-2000)
With regard to obesity (Figure 4.12), non-white low-educated females were most obese across all the years (mean=29.22 percent versus the NWHEF mean=19.08 percent, versus WLEF mean=19.54 percent, and versus WHEF mean=12.56 percent). For men, white high-educated men were least obese (mean=12.34 percent versus NWHEM mean=12.94, and versus WLEM mean=14.96 percent), and non-white low-educated men were most obese (mean=16.48 percent). Regardless of race, low-educated individuals were more obese than high-educated ones.
Similar patterns are found for overweight (Figure 4.13). Non-white low-educated females were most overweight compared to both men and women (mean=59.84 percent), and white high-educated females were least overweight compared to both men and women (mean=33.52 percent) between 1977 and 2000.
Concerning alcohol consumption (Figure 4.14), white-high educated females and non-white high-educated females consumed more than their low-educated counterparts (WHEF mean=69.87 percent versus WLEF mean=43.3 percent, and NWHEF mean=55.27 percent versus NWLEF mean=42.2 percent). The same could be said for white and non-white high-educated males (WHEM mean=78.97 percent versus WLEM mean=70.5 percent).
mean=64.72 percent, and NWHEM mean=69.57 percent versus NWLEM mean=61.42 percent). Out of all groups, white high-educated females and white high-educated males consumed most alcohol when compared to other groups, though white high-educated males consumed the most.

Finally, for lack of exercise (Figure 4.15), low-educated individuals lacked more exercise than high-educated individuals, regardless of race. On average, white high-
educated males lacked the least (mean=56.5 percent) when compared to all other groups, while non-white low-educated females lacked the most (mean=80.37 percent) when compared to all other groups.

Figure 4.15 Social-Status Simultaneity for Lack of Exercise (1985-2000)

Since there were no education data available (measure of SES) on each individual surveyed in 2005, only race and sex were considered simultaneously for this particular
year (Figure 4.16). Analyses reveal that white females smoked more than their non-white counterparts (18.4 percent versus 16.8 percent). White males smoked less than non-white males in 2005 (23.8 percent versus 26.0 percent). White females were less obese than non-white females (20.0 percent versus 27.2 percent), less overweight than non-white females (46.0 percent versus 54.2 percent) and lacked less exercise than non-white females (68.5 percent versus 74.9 percent), but they consumed more alcohol than non-white females (54.8 percent versus 38.4 percent). Contrary to white females, white males were more obese than non-white males (21.3 percent versus 20.5 percent), more overweight than non-white males (63.4 percent versus 57.4 percent), and they also consumed more alcohol than non-white males (67.2 percent versus 56.2 percent). Non-white males lacked more exercise, however, in 2005 than white males (64.5 percent versus 58.4 percent).
4.5. Convergence/Divergence Model Results

Table 4.1 presents the results for estimated trends in health-risk behaviors by SES for the 1977-2000 period, with the exception of lack of exercise reflecting the 1985-2000 period, net of the effects of age, gender, and race. Odds ratios can be obtained by exponentiation of the logit coefficients [Exp(B)].

Figure 4.16 Social-Status Simultaneity (2005)
4.5.1. Smoking Results

The initial year coefficient ($\delta_2$) is an indicator of the initial smoking difference (in 1977) between the low SES group and the baseline (high SES) group. For example, the logit coefficient of -0.368 (Table 4.1) means that the odds of low SES persons smoking in the initial year were 30.8 percent less than the odds of high SES persons smoking ($1 - \exp(-0.368)$ x 100), and this difference was significant ($p<.001$). The interaction term (low SES – high SES trend) indicates the difference in smoking trends between the two groups, that is, the (average) estimated annual difference during the entire time period examined ($\varphi_2$). As the logit is zero, the odds are even for both groups, and unlike the significant initial year difference, there is no particular significant trend difference over time (neither convergence nor divergence), after taking socio-demographic variables into consideration. Figure 4.17 shows decreasing predicted probabilities for smoking by SES and facilitates understanding of these results. Over two decades, the probability of smoking declined for both high and low SES groups in a rather stable manner (especially for the high SES group), with predicted probabilities remaining uniformly higher for the low SES group than the high SES group.
Table 4.1. Trends in Health-Risk Behaviors by SES, 1977-2000

<table>
<thead>
<tr>
<th></th>
<th>Smoking (logit)</th>
<th>Obesity (logit)</th>
<th>Overweight (logit)</th>
<th>Alcohol Consumption (logit)</th>
<th>Lack of Exercise (logit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Convergence coefficients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low SES – high SES, initial year (( \hat{\delta}_2 ))</td>
<td>-0.368*** (.025)</td>
<td>-0.622*** (.035)</td>
<td>-0.445*** (.025)</td>
<td>+0.653*** (.025)</td>
<td>-0.846*** (.051)</td>
</tr>
<tr>
<td>Low SES – high SES, trends (( \hat{\psi}_2 ))</td>
<td>0.000 (.002)</td>
<td>-0.018*** (.002)</td>
<td>-0.011*** (.002)</td>
<td>-0.007*** (.002)</td>
<td>-0.005* (.003)</td>
</tr>
<tr>
<td><strong>Baseline group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept for high SES (( \hat{\alpha} ))</td>
<td>-0.608*** (.022)</td>
<td>-1.923*** (.029)</td>
<td>+0.329*** (.022)</td>
<td>+0.644*** (.022)</td>
<td>+2.105*** (.048)</td>
</tr>
<tr>
<td>Trend for high SES (( \hat{\beta} ))</td>
<td>-0.020*** (.001)</td>
<td>-0.048*** (.001)</td>
<td>+0.039*** (.001)</td>
<td>-0.013*** (.001)</td>
<td>-0.020*** (.001)</td>
</tr>
<tr>
<td><strong>Demographic variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>+0.483*** (.013)</td>
<td>-0.259*** (.016)</td>
<td>-0.506*** (.011)</td>
<td>+0.594*** (.013)</td>
<td>-1.165*** (.014)</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.240*** (.012)</td>
<td>+0.186*** (.015)</td>
<td>-0.639*** (.011)</td>
<td>-0.653*** (.013)</td>
<td>+0.423*** (.013)</td>
</tr>
<tr>
<td>Race</td>
<td>+0.025 (.016)</td>
<td>+0.404*** (.018)</td>
<td>+0.342*** (.015)</td>
<td>-0.519*** (.016)</td>
<td>-0.219*** (.017)</td>
</tr>
<tr>
<td>Nagelkerke’s R²</td>
<td>0.030</td>
<td>0.041</td>
<td>0.082</td>
<td>0.110</td>
<td>0.154</td>
</tr>
<tr>
<td>N</td>
<td>145,035</td>
<td>140,879</td>
<td>140,879</td>
<td>127,688</td>
<td>123,955</td>
</tr>
</tbody>
</table>

Standard errors are presented in parentheses.
The subscript 2 stands for group 2 (low SES); high SES is the baseline group. Trends are described as average change per year.
* Lack of exercise results reflect the 1985-2000 period.
***p<.001; **p<.01; *p<.05.
4.5.2. Obesity Results

For obesity, controlling for age, gender, and race, the y-intercept for the low SES group is 0.622 logits below the y-intercept for the high SES group. This finding indicates that the odds of low SES persons being obese in 1977 were 46.3 percent less than the odds of high SES persons being obese \((1 - [\text{Exp}(-0.622)] \times 100)\), or alternatively, only slightly more than half of the odds of high SES persons being obese \((e^{-0.622} \approx 0.54)\). Over time, there is a significant divergence in trends between low and high SES groups \((\phi_2 = -0.018, p<.001)\), net of age, gender, race. This signifies that the odds of being obese decreased just 1.8 percent more for those of low SES than those of high SES annually \((1 - [\text{Exp} (-0.018) \times 100])\). As for the high SES group trend, more specifically, the odds of being obese increased 4.9 percent each year \(([\text{Exp}(0.048) - 1] \times 100)\) for them.

As some of the logistic regression interpretations may be counter-intuitive, it is useful to look at Figures 4.22 and 4.23 depicting the logit transformation following an S-curve and the natural log function. For example, negative logits correspond to probabilities below 0.5 and vice-versa. The inverse transformation of logits to
probabilities is called anitlogit. At the 0.5 probability, the odds are even (0.5:0.5, or 1), and the logit equals 0 (Figure 4.22). The natural log decreases as odds approaches 0 (odds <1) and curves up with odds>1 (Figure 4.23). Odds and probabilities are not the same. Rather, odds are a function of probability, and a logit is the natural logarithm of the odds [ln(odds)]. In logistic regression, it is assumed that the logit of the probability, and not the probability itself, follows a linear model (Rodríguez 1993-2000).

Turning to Figure 4.18, predicted probabilities for obesity are increasing for both groups over time. When examining this figure more attentively, the predicted probability for obesity for the low SES group in the initial year (1977) was approximately the same as the predicted probability for obesity for the high SES group in 1990. And the predicted probability for obesity for the low SES group in 1990 was roughly the same as the predicted probability for obesity for the high SES group in 2000. From about 1995 to 2000, a sharper diverging trend took course for the low SES group from the high SES group. Therefore, there is a more pronounced initial year predicted probability difference between the two groups, and then beginning in the 1990’s, there is a sharper increase in predicted probabilities for the high SES group on obesity (curving upward). The all-together higher predicted probabilities for the low SES group on obesity took a significantly more diverging course from the high SES group toward the end of the time period, net of age, gender, and race.
4.5.3. Overweight Results

Similar results are found for overweight trends, controlling for age, race, and gender, which are also diverging significantly ($\phi_2 = -0.011$, $p<.001$) between the two groups, with predicted probabilities being higher over time for the low SES group than the high SES group (Figure 4.19). Again, predicted probabilities for the low SES group on overweight are much higher initially than for the high SES group, net of age, gender, and race.

From a steady upward trend, predicted probabilities began to increase modestly for the high SES group beginning in the early 1990s, moving closer to those of the low SES group, but from around 1995 to 2000, predicted probabilities took on a more pronounced overall diverging trend for the low SES group from the high SES group, net of age, gender, and race.
4.5.4. Alcohol Consumption Results

For alcohol consumption, net of age, race, and gender, the initial difference was such that the odds of consuming alcohol were 92 percent higher for the low SES group than the high SES group ([Exp(0.653) – 1] x 100), but over time the odds of drinking decreased 0.7 percent more for the low SES group than the high SES group each year (1-[Exp(-0.007)] x 100). This trend difference is rather small as the odds show little change in the likelihood of consuming alcohol between the two groups (e^{-0.007}=.993), but it is significant. Predicted probabilities (Figure 4.20) were decreasing over time for both groups although they were higher for the high SES group. The gaps were significantly narrowing over time ($\phi_2=-0.007$, $p<.001$), an indication of trend-convergence. Based on the trend coefficient for the high SES group ($\beta=-0.013$), it could be said that, each year, the odds of drinking decreased by 1.3 percent for the high SES group (1- [Exp(-0.013)] x 100). Figure 4.20 also shows that the probability of consuming alcohol decreased steadily over the 1977-2000 period for the high SES group. On the contrary, the probability of alcohol consumption decreased faster for the low SES group between 1977
and 1985. The decrease then slowed for the remainder of the period, ultimately resulting in a significant narrowing of the gap (p<.001) between the two groups, net of age, gender, and race.

Figure 4.20 Predicted Probability for Alcohol Consumption by SES (1977-2000)

4.5.5. Lack of Exercise Results

Finally, for lack of exercise, net of age, gender, and race, the y-intercept for the low SES group was 0.846 logits below the y-intercept for the high SES group at baseline (1985). The odds that low SES persons lacked exercise were less than half the odds that high SES persons lacked the same ($e^{-0.846} = 0.43$). But the odds of lacking exercise increased overtime for the low SES group. More precisely, the odds of lacking exercise were 0.8 percent higher for the low SES group than the high SES group over the 1985-2000 period ($[\text{Exp}(0.008) - 1] \times 100$). Each year, the odds of lacking exercise decreased 2 percent for the high SES group ($1 - [\text{Exp}(-0.020)] \times 100$). Figure 4.21 illustrates predicted probabilities for lack of exercise for the two groups. The probability of lacking exercise remained higher throughout the period for the low SES group than the high SES group.
While the probability of lacking exercise decreased more slowly between 1985 and 1990 for the low SES group, it started decreasing somewhat faster from 1990 to 2000. The probability of lacking exercise decreased quite steadily for the high SES group during the entire period, although that decrease seems to have been slightly slower from 1995 to 2000. These shifts resulted in a significant convergence of trends ($\varphi^2 = +0.008, p<.05$) for the two groups, net of age, gender, and race.

![Graph showing predicted probability of lack of exercise by SES (1985-2000)](image)

Figure 4.21 Predicted Probability for Lack of Exercise by SES (1985-2000)

4.6. The Logit Transformation and The Natural Log Function

The following figures illustrate the logit transformation that follows an S-curve and the natural log function for the purpose of complementing the trend-analyses results.
Figure 4.22 The Logit Transformation (Source: Germán Rodríguez, WWS509 Generalized Linear Models, Princeton University, 1993-2000)

Figure 4.23 Natural Log Function (Source: http://luna.cas.usf.edu/~mbrannic/files/regression/Logistic.html)
CHAPTER V
DISCUSSION

5.1. Descriptive Findings (Aggregate and by Race, Gender, and SES)

The analyses revealed several important findings. The descriptive analyses show that, on aggregate, cigarette smoking decreased during the 1977-2005 period, and obesity and overweight increased. Alcohol consumption and lack of exercise were initially on the rise then started decreasing in the 1990’s. Lack of exercise also increased between 2000 and 2005. These findings generally agree with past literature on the directions of health-risk behavior trends. It is always encouraging to find support for decreasing health-risk behavior trends, such as smoking.

When trends are disaggregated by race, analyses reveal that three trends are quite similar for both whites and non-whites: smoking (decreasing), obesity (increasing), and overweight (increasing). A very noticeable difference is found for alcohol consumption and lack of exercise as the latter appears to be ranking the first risky behavior for non-whites and the former for whites (in terms of percent engaging in these behaviors). Non-whites were more obese and more overweight than whites though both of these health-risk behaviors dropped in the 1995-2000 period.
With regard to gender, men and women display more similar trends in smoking (decreasing), obesity (increasing), and overweight (increasing), than in alcohol consumption and lack of exercise. Men smoked more each year than women; women were more obese than men in general, although their obesity rates became quite similar between 2000 and 2005; and men were more overweight than women. Men consumed more alcohol than women. Lack of exercise remained rather flat for women with slight decreases over time, while it took a sharper decreasing turn for men between 1995 and 2000. These findings provide further evidence for race and gender health-risk behavior differences and extend previously reviewed literature.

Most importantly, results disaggregated by SES reveal that smoking decreased for both high and low SES during the 1977 to 2000 period, but the percentage of those smoking was always higher for the low SES group. The fact that this behavior decreased overtime speaks, to a considerable extent, of a large public anti-smoking push. There have been increases in legislation as to where smoking is or is not allowed and taxes have been imposed. This type of public awareness that dates back several decades has not been the case for obesity and overweight which are relatively new national issues that have become part of the public health agenda earlier in this decade (around the year 2000). Those of low SES were more obese and overweight between 1977 and 2000 than those of high SES, but descriptive trends show them coming closer together at the end of the period examined (in 2000). Alcohol consumption was much higher for the high SES than the low SES group throughout the period. This health-risk behavior trend first took increasing then decreasing turns for both groups, although it actually started decreasing earlier for the low SES group (in 1985), while it rose for the high SES group between
1985 to 1990, and then it started decreasing. Finally, the low SES group lacked more exercise than the high SES group over time. The trend for lack of exercise for the low SES group was generally one of decreasing values, which is encouraging, as well as for the high SES group. The exception is that this health-risk behavior trend had a sharper increase initially for high SES than low SES group, but the overall trend remained below that of the low SES group throughout the time period. Physical exercise promotions have also been on the rise (though they are relatively newer than smoking).

These results suggest that low the SES group engaged more in all preventable health-risk behaviors from 1977 to 2000, with the exception of alcohol consumption, where the high SES group consumed more. Descriptively speaking, these findings generally go in line with the theory of fundamental causes on high and low SES group differences on all health-risk behaviors. The only exception may be alcohol consumption, in which case the theoretical expectation would be that those of high SES would be more effective over time in decreasing that behavior than those of low SES. Even though people of high SES may have more resources to alter or decrease their health-risk behavior, they appear to consume alcohol more than those of low SES over time. It is useful to know, though, that these health-risk behavior trends decreased for both groups beginning in the 1990’s. As we are also aware, alcohol consumption has been a long-standing problem although there has not been a new public declaration of crisis in this regard, which probably contributes to explaining some of the observed results.
5.2. Descriptive Findings (Simultaneous Social Statuses)

Turning to social-status simultaneity results, major findings indicate that smoking generally decreased for all groups between 1977 and 2000; however, the smoking trend was higher among non-white low-educated males in comparison to all other groups, while it was the lowest for high-educated females, both white and non-white. White high-educated men smoked the least. The smoking trend for the first part of the period examined was the lowest for white high-educated females, but then in the second part it became the lowest for non-white high-educated females.

Obesity trends for the 1977-2000 period were increasing for all groups, except that they decreased between 1995 and 2000 for almost all groups, except three (white and non-white high-educated men and non-white low-educated men). The obesity trend was the highest for non-white low-educated females (being the only one markedly higher than all others) and the lowest for white high-educated men, in general. Overweight trends also increased during the 1977 to 2000 period. Contrary to obesity trends and one of the groups (NWLEF) being much higher than the rest, all overweight trends were closer together as they were increasing over time, with the exception of that for white high-educated females which was markedly lowest. Non-white high educated men and women and white low-educated females had lower overweight trends than, for example, white high- and low-educated men.

These results provide a more complete picture of racial and gender differences on health-risk behaviors in that they also simultaneously include SES. Previous discussions are extended beyond the general observation that women are more obese than men, as it happens to be that it is non-white low-educated females that are facing most obesity.
issues compared to other groups. They also had the highest overweight trend. As for men, it is true that they had higher increasing overweight trends than females in general, but it was mostly white low SES men and non-white low SES men who had the highest trends.

Alcohol consumption trend was the highest among white high-educated men, and this adds additional evidence to the literature. This type of health-risk behavior was the lowest among non-white low-educated women on average, during the 1977-2000 period. White low-educated females also drank considerably less than all other groups. Non-white high-educated females had the third lowest trend on alcohol consumption. Alcohol trends were quite similar for white and non-white low educated men.

Lack of exercise for 1985 to 2000 was the highest among non-white low-educated females followed by white low-educated females. Non-white high-educated men lacked least exercise for most of the time period compared to any other group. White high-educated men had the second lowest trend on this health-risk behavior, confirming previous analyses that men lacked less exercise in general than women, although this tells us which men groups in particular. On the contrary, lack of exercise trends were higher for white and non-white low-educated men than trends for white and non-white high-educated women.

Finally, for the year 2005, I was able to just look at two statuses simultaneously (race and gender). Analyses reveal that non-white males smoked the most in 2005 (followed by white males) and non-white females smoked the least; white males consumed most alcohol in 2005, and non-white females the least; non-white females were also the most obese while all other groups were similar on obesity in 2005; white
males were most overweight and white females the least in 2005; and non-white females lacked most exercise, and white males lacked the least. These findings indicate that, in 2005, white males were the highest on two health-risk behaviors (alcohol and overweight); non-white females on two health-risk behaviors (lack of exercise and obesity), and non-white males were the highest on one health-risk behavior (smoking).

5.3. Convergence/Divergence Findings

The remaining set of important findings focus on testing the hypotheses and ultimately fundamental cause theory. Convergence/divergence analyses give an indication of trend estimates for each health-risk behavior. Three of the hypotheses are supported. Fully supported hypotheses are on obesity and overweight, with significant diverging trends between high and low SES groups, with the probability of being obese or overweight staying generally higher for the low SES group than the high SES group. The third supported hypothesis is on alcohol consumption as significant convergence between the two groups over time was estimated by the model. Analyses revealed that the probability of consuming alcohol generally decreased over time for both groups, with higher probabilities for the high SES group compared to the low SES group. The remaining hypotheses regarding lack of exercise and smoking were not supported. The model estimation showed convergence for lack of exercise while divergence was predicted. The lack of exercise gap between low and high SES groups significantly narrowed over time. No significant trend difference in smoking was found.

It seems that fundamental cause theory correctly predicts certain health-risk behavior differentials, specifically in terms of widening gaps between high and low SES
groups (with low SES group being higher on those risky behaviors), such as obesity and overweight. To an extent, the theory could also be correct in viewing decreasing differentials on alcohol consumption, with the high SES group being able to effectively change its risky behavior and get closer to reducing the gap with the low SES group instead of getting increasingly higher or diverging from it; nonetheless, this is the only case in which the probability of the high SES group consuming alcohol was actually consistently higher over time than the probability of the low SES group. No support was found on two other health-risk behaviors examined. Taken together, the somewhat mixed results provided more support for fundamental cause theory than not.

Fundamental cause theory supports social causation as an explanation for health disparities. It considers social factors, such as SES, as a cause of illness. In light of the findings in this thesis, SES could be related to engagement in health-risk behaviors, but it could also be that illness (resulting from such behaviors or other types of causes) leads to downward mobility (Waldron et al. 1982). Similarly, differential exposure and differential vulnerability to stressors could be further (contrasting) explanations for some of my findings even though they are not mutually exclusive, that is, some people may experience both more stress and be more vulnerable to stress (George 2003). Differential exposure (a function of disadvantageous circumstances) could lead to negative coping health behaviors, such as smoking. And smoking could then increase vulnerability (bio-social function) to more serious and stressful health outcomes. Smoking as a coping mechanism may not be the best, but it may also not be completely negative under certain circumstances.
It is important to contextualize health-risk behaviors and understand the reasons for people’s engaging in them. Other health-risk behaviors sometime occur within the context of the social support/network (which could be positive or negative) and it would be useful to incorporate duration and/or frequency of engaging in those behaviors (e.g., alcohol consumption) and types of social support. It also depends on which physical environments people are more likely to display risky behaviors. The reason why some people may lack adequate exercise, for instance, could be their living in unsafe neighborhoods so that non-engaging in physical exercise could be out of self-protection. Perhaps more than one of these perspectives operates at the same time in explaining health-risk behavior differences, but studying these interactions is not within the scope of the current research.

Additionally, populations were faced with infectious diseases about a century ago and priorities were directed towards their management which increased life expectancies; now, however, we are faced with chronic diseases and rising health demands of the elderly (Yaukey, Anderton, and Hickes Lundquist 2007). This further puts countries like the U.S. in a situation to make choices between growing health costs and strained resources by the aging population, bifurcating public health policy focus of resource-allocation only to disadvantaged SES groups. Over the years and in large numbers, women have also entered occupations that were previously held by men and began displaying similar health-risk behaviors and lifestyles (Yaukey and colleagues 2007).

Lastly, SES mortality differentials will vary for specific causes examined (Marmot 1995), which can be health-risk behaviors apart from many other causes. So, in some instances the theory of fundamental causes may be more tenable than in others.
Referring to Yaukey and colleagues (2007), differences in maternal mortality between SES groups (and ethnic groups) still persist in the U.S., but they have declined over time. In my thesis, a similar result has been found for lack of exercise, with significant narrowing of the gap between high and low SES groups over time.
CHAPTER VI

CONCLUSIONS

The theory of fundamental causes focuses on social conditions in which people live and predicts that high SES individuals are better positioned (owing to their resources) than low SES to more effectively modify their health-risk behaviors over time. Generally, the results in this thesis support this theory. In view of the estimated divergence or convergence on certain health-risk behaviors between high and low SES groups when age, race, and gender are controlled, the trends are significantly diverging on obesity and overweight and significantly converging on alcohol consumption (all three as hypothesized). They are also significantly converging on lack of exercise (where divergence was hypothesized). No significant trend difference was found for the hypothesized divergence in smoking (the trends are parallel). Judging by narrowing or widening of health-risk behavior gaps, it seems that low SES and high SES groups have essentially become more similar over time on some behaviors and more different on others. In sum, the predictions made by fundamental cause theory, related to differences in advantageous social positioning and resources, have been more supported than not.

With respect to usefulness and implications of this research, convergence models can be applied to dealing with various issues “related to fissures in society” (Firebaugh
2008:186). Those issues can be related to race/ethnic divisions, gender gaps, or as in the case of this thesis, socioeconomic health disparities. The distinct attribute of this type of regression modeling with interaction terms lies in unique coefficients that capture time trends for each of the given groups (Firebaugh 2008). On a more policy-related level, it was evident that SES-based differences in health-risk behaviors generally persisted even after adjusting for the effects of age, race, and gender. It is, therefore, important to address SES as a fundamental cause of disease by making it a part of public health policy initiatives in an effort to diminish existing disparities. Focusing attention along the causal chain to, in addition to proximal, incorporate distal causes of disease could be a more effective way of improving public health.

6.1. Study Limitations

Some limitations in this study are that measures are used globally for each health-risk behavior. Achieving such measure equivalency was a considerable task for some risky behaviors more than others, but other measures could be employed in different fashions such that they reflect more frequencies (and/or duration). The nature of this study was to test a particular theory, fitting the measures to it. Some changes that I have observed may reflect differences in measures overtime, particularly for lack of exercise, for which the measure equivalency was the most complex to achieve. To some extent, this is a rather standard problem in longitudinal and comparable research, leading to more conservative interpretations of change over time. While there may be these other possibilities, the findings in this thesis have been viewed as generally supportive of fundamental cause theory.
Limitations also occur due to the higher level of aggregation on health-risk behaviors as more specific measures (in each year of interest) may have not been available; for example, how much smoking mattered for a respondent, or if it mattered if his/her friends smoked. Measures of access to public health information would have also been desirable. Based on the theoretical expectations (presuming that information is a resource) and analytical results, overall, the thesis supports fundamental cause theory. This consistency has been used as an alternative (support), but the mechanism that is expected to operate behind it (how people process and make use of information) is not measured. There is also the possibility of associating changes in health-risk behaviors with people’s differential absorption of publically available health information.

In line with the foregoing comments, SES could be expressed in ways other than education, or in combined ways (e.g., by occupation, or income, or measures combining occupation, income, and education). In this study, the technique did not assume even SES group distributions, though the current measure could be re-operationalized with other SES categories. I was originally interested in contrasting only two SES groups on the high and low end, more in line with the theoretical background. Relevant covariates besides the ones used in this study could also be added. Finally, this study examines multiple groupings of cross-sectional data and is concerned with social change. Longitudinal or panel studies could be alternatives allowing for examining gross individual change (Firebaugh 2008). In this thesis, cross-sectional data were suitable for convergence/divergence model estimations congruent with the purpose of the study.
6.2. Future Implications

While it may be worthwhile to conduct similar analyses on other datasets, given the fact that this thesis has provided further support for fundamental cause theory, the following two practical implications are made:

I. To develop research surveys that would explicitly incorporate data on the way in which public health information in one’s social environment could change one’s health-risk behavior; this would allow us to better understand the scope of an important mechanism through which it is possible to change such behaviors.

II. To advance public health policy-making by including distal causes of disease as they can also influence health besides proximal or more immediate causes. Such policies would allow for better understanding and control of health outcomes. They would go further into unraveling more fundamental causes (conditions in which people live) and sociological processes linked to those outcomes to more successfully ameliorate national health status. A fundamental cause will continue to exert its effect on health if that fundamental cause itself is not addressed (Link and Phelan 1995).
BIBLIOGRAPHY


APPENDIX A

SMOKING RATES

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX B

SMOKING RATES BY EDUCATION (2005)

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX C

OVERWEIGHT AND OBESITY RATES (BMI)

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX D

OVERWEIGHT AND OBESITY (BMI) BY RACE (2005)

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX E

ALCOHOL CONSUMPTION RATES (PAST MONTH)

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX F

MODERATE PHYSICAL ACTIVITY RATES

Source: BRFSS – Prevalence and Trends Data (States and DC)
APPENDIX G

IRB REGISTRATION FORM (REVIEW EXCLUSION)

Registration Form

Please complete this form if you propose to conduct a project that involves interaction/intervention with or collection of information from individuals that meets one or more of the criteria below. IRB review is not required because:

☐ The project does not meet the Common Rule definition of research.
☐ The project does not collect information about the individuals with whom the researcher is interacting.
☐ Results will be shared only with the client or stakeholder(s) for private use for evaluation of an established program or for other non-research purposes.
☐ The project utilizes only data from secondary sources that are not individually identifiable.
☐ The project is an internal evaluation intended for quality control of ongoing program only.
☐ The project involves only oral history activities, such as open-ended interviews, that ONLY document a specific event, or the experiences of individuals without intent to draw conclusions, generalize findings, or influence policy or practice.

Project Title: Socioeconomic Disparities Linked to Health-Risk Behaviors: A Trend Analysis-Based Test of Fundamental Causality (1977-2005)

Principal Investigator (PI): Jelena Peharic

PI Department: Sociology

PI Phone & email: 330-963-8364 jph@uakron.edu

Co-investigators (list all co-investigators):

Faculty Advisor (if PI is a student): Dr. Mark Taussig

Provide below a brief description of the purpose of this study and the type and source of the information on individuals that you will use. (The space will expand as you type.)

The purpose of the project is to test a sociological theory (Fundamental Cause Theory by Link and Phelan 1995) on the basis of electronically available secondary data (National Health Interview Surveys-NHIS). Specifically, the purpose is to test whether a significant divergence or convergence in five health-risk behaviors (smoking, obesity, overweight, alcohol consumption, and lack of exercise) is occurring between two socioeconomic (SES) groups - high SES and low SES, in the period from 1977 to 2006. Finally, the purpose is to also examine descriptive health-risk behavior trends from 1977 to 2005. For this project, National Health Interview Survey (NHIS) data are used, precisely, six datasets (secondary data): 1977NHIS, 1989NHIS, 1990NHIS, 1993NHIS, 1999NHIS, and 2001NHIS. These data are publicly available through the Centers for Disease Control and Prevention website: http://www.cdc.gov/nchs/nhis/nhis_questionnaires.htm.

Investigator's Assurance

I certify that the information provided in this Registration Form is complete and accurate. I understand that as Principal Investigator, I have ultimate responsibility for the ethical conduct of this project.

Principal Investigator:

Date: 11-09

Faculty Advisor's Assurance

I certify that the student is knowledgeable about the regulations and policies governing the research and has sufficient training and experience to conduct this particular study.

Faculty Advisor:

Date: 11-09

Please submit this form to the IRB, c/o ORSS, 344 Pollak, 44025-2192

The University of Akron Institutional Review Board Form approved 2001