

ARE WEALTHIER ELDERLY HEALTHIER?

-A STATISTICAL ANALYSIS OF AHEAD DATA

by

JEE-HEE HAN

(Under the Direction of Anand Vidyashankar)

ABSTRACT

This thesis examines the relationship between health and wealth of the elderly who are aged 70 or more through an interaction with socio-economic status, wealth depletion, and out-of-pocket expenses for health services rendered. For the analysis, the data set of Wave 1 and Wave 2 of the AHEAD (Asset and Health Dynamics of the Oldest Old) funded by the National Institute of Aging were employed. The results showed strong evidence to support the existence of a positive relationship between current health status and the socio-economic status. Elderly with higher socio-economic status had better health status. On the other hand, those with poor health conditions had less wealth. Elderly with Medicaid spent less out-of-pocket expenses, however, elderly with Medicare or government insurance or other insurance spent the similar amount of out-of-pocket expenses compared to those without such coverage.

INDEX WORDS: Health, Wealth, Chronic Disease, Socio-Economic Status, Out-of-Pocket Expenses, AHEAD, Elderly

ARE WEALTHIER ELDERLY HEALTHIER?
- A STATISTICAL ANALYSIS OF AHEAD DATA

by

JEE-HEE HAN

B.A., Sogang University, Korea, 1997

M.A., Sogang University, Korea, 1999

M.M.C., University of Georgia, 2001

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial
Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2002

© 2002

Jee-Hee Han

All Rights Reserved

ARE WEALTHIER ELDERLY HEALTHIER?
- A STATISTICAL ANALYSIS OF AHEAD DATA

by

JEE-HEE HAN

Approved:

Major Professor: Anand Vidyashankar

Committee: Robert L. Taylor
Gauri Datta

Electronic Version Approved:

Gordhan L. Patel
Dean of the Graduate School
The University of Georgia
August 2002

ACKNOWLEDGEMENTS

I would like to especially thank Dr. Vidyashankar for his endless guidance on my writing and research skills. I would also like to thank Dr. Taylor and Dr. Datta for their warm guidance and interest on my thesis. Thank you.

I can never thank enough my companion, Kyoungrae Oh, for his never-ending support and love.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	viii
CHAPTER	
1 INTRODUCTION.....	1
2 LITERATURE REVIEW.....	4
2-1. Health and Wealth of Elders.....	4
2-2. Health Insurance Coverage, Out-of-Pocket Expenses, and Financial Burden.....	6
3 DATA.....	9
3-1. Introduction.....	9
3-2. Data Descriptions.....	10
4 DEFINITIONS.....	15
4-1. Variable Descriptions and Measurements.....	15
4-2. Research Questions and Statistical Models.....	17
4-3. Models.....	20
5 RESULTS AND CONCLUSIONS.....	26
5-1. Descriptive Analysis.....	26
5-2. Health and Socio-Economic Status.....	28
5-3. Health and Wealth.....	32

5-4. Out-of-Pocket Expenses, Insurance, and Health Conditions.....	34
5-5. Conclusions.....	38
5-6. Discussions.....	42
REFERENCES	43
APPENDICES	
1 Table of Out-of-Pocket Expenses by Coverage of Medicare	46
2 Table of Out-of-Pocket Expenses by Coverage of Medicaid.....	47
3 Table of Out-of-Pocket Expenses by Possession of Government Insurance...	48
4 Table of Out-of-Pocket Expenses by Possession of Other Insurance.....	49
5 Table of Change in Health Conditions by Out-of-Pocket Expenses.....	50

LIST OF TABLES

Table 1: Demographic Descriptions.....	27
Table 2: Relation of Health Status Respect to Socio-Economic Status.....	29
Table 3: Relation of The Change in Health Status Respect to Socio-Economic Status.....	29
Table 4: Change in Chronic Disease Conditions and Socio-Economic Status.....	31
Table 5: Effect of Health Status on Wealth of Elderly.....	33
Table 6: Effect of Health Status on Out-of-Pocket Expenses.....	35

CHAPTER 1

INTRODUCTION

America has experienced a dramatic increase in the health status of Americans over the past few years. The mortality rate has fallen and life expectancy has increased. It seems that more individuals have encountered improvement in health and wealth. However the question of whether general public has really encountered or felt such improvement is left unanswered. There is research that supports the fact that individuals with low socio-economic status are faced with higher mortality rate than those with higher status (Feinstein, 1993). Old Americans who are aged 70 and over experience such inequalities more than other young individuals. Such inequality in health outcomes is quite easy to notice nearby and has actually increased in recent years (Feinstein, 1993). Low socio-economic status implies low wealth or assets which sometimes hinder individuals in obtaining immediate medical care. This is the case with older Americans who are the ones in need of such care the most.

The association between wealth and health of the elderly has not been studied much despite the fact that over one fifth of the population over age 65 suffers from chronic disability which results in great financial hardships. In 2001, more than \$300 billion had been spent for the elderly on the chronic diseases. That amount is equivalent to one-third of total health care expenditures of the United States. According to the study done by the Center for Disease Control and Prevention (1999, 2001), the health care spending for

elders is expected to be increased by 25% within 30 years. This indirectly indicates that there could be more burden for the population over age 65 regarding out-of-pocket health care expenses even if they have Medicare. Although over 95% percent of the elders have Medicare, it was found that the current Medicare does not cover all expenses, leaving the elders with no choice but to pay for the health care services through their own out-of-pocket expenses (Hurd & McGarry, 1997). This leads to the financial burden not only to the elders but also to their families. Also, according to the data collected from the 1981-1982 Channeling Demonstration project, an average elderly person spent approximately 43% of their income for medical expenses (Crystal, Johnson, Harman, Sambamoorthi & Kumar, 2000).

According to the Consumer Expenditure Surveys administrated by the U.S. Department of Labor (see Paulin, 2000), there has been over 20% increase in the out-of-pocket healthcare expenditure for the elderly households from 1984 to 1997. Through the Medicare Current Beneficiary Survey, it was found that the out-of-pocket health care costs constitutes about 19% of the household income for full-year Medicare beneficiaries in 1995 (Coughlin, Liu, & McBride, 1992). It is projected that such share would reach up to 44% for the population over 65 with poor health conditions and with no additional health insurance (Maxwell, Moon & Segal, 2000). To make the matters worse, the recent proposal for restructuring Medicare's financing would increase the out-of-pocket healthcare expense burdens for the elderly (Patashnik & Zeilizer, 2001).

As the financial burden increases, sometimes it is hard for the elders with insufficient income or health insurance coverage to pay for all the expenses with available money. In this case, it becomes natural to find alternative ways like paying by selling

assets or paying through savings. This implies that the increase in the financial burden of the medical expenses could deplete elders' lifetime savings or wealth. Such depletion of lifetime savings and wealth as well as deterioration of health could create high levels of psychological distress which is clearly another burden for the elders to cope with (Ferraro & Su, 1999).

Even if such events are very likely to occur, there has only been very limited interest in the matter. There are only few studies dealing with the depletion of wealth due to the impact of health of the elders. As this topic has a multi-disciplinary structure, it would have not been easy to carry on the research. However, recently there are a few studies that examined the effect of health shocks on wealth depletion (Smith, 1999; Feinstein & Ho, 2000; Wu, 2001). These studies only examined the effects of either new health events (Smith, 1999; Wu, 2001) or the change of health conditions with aggregate measure of health status (Feinstein & Ho, 2000) on the depletion of life-time savings or wealth.

This thesis examines the impact of health on the financial security as in the depletion of life-time savings or wealth of the elderly. For the analysis, the panel data from the Asset and Health Dynamics of the Oldest Old (AHEAD) commissioned by the National Institute on Aging was used. The main object is to examine how the deterioration of existing health conditions of the elders would affect the depletion of life-time savings or wealth. Also, the relationship between health conditions and socio-economic status is examined.

CHAPTER 2

LITERATURE REVIEW

2-1. Health and Wealth of Elders

There has been research that examined the relationship between health and wealth status of elders using two approaches. One is examining the influence of economic status on health and the other is examining the influence of health on economic status. There is an increasing body of literature which studied such relationships by comparing the mortality and morbidity experiences within different socioeconomic groups or by contrasting health experiences and by exploring various explanations of different health outcomes, concluding that there may be an influence of economic status (SES) on health status of the elders (Feinstein, 1993). Even race, along with socioeconomic status, has a considerable influence on health status since certain ethnic groups have low levels of education and wealth resulting in poverty which hinders them to familiarize themselves with a health care provider; the group with low SES usually has poor health status compared to the group with high SES (Schoenbaum & Waidmann, 1997; Singer & Ryff, 2001).

In contrast, the impact of health status on the economic status has not been examined much. This could be due to difficulties in modeling and monitoring health as well as in gathering the data regarding changes in health and wealth information of an individual over time (Smith, 1999). It was only recently that a few studies have examined

the influence of health on socio-economic status of the elders. According to the research by Smith (1997, 1999), it is more likely that health status influences economic status rather than the other way around for people over 50. This is due to the fact that changes in a household's economic status are less dramatic except when they are due to the serious illness or changes in health status, which is more likely to happen to elders especially when they do not have an adequate income source. Feinstein and Ho (2000) analyzed the models of asset management by the elderly with different health status and found that sudden changes in family structure or health increased the spending-down assets. Lillard and Weiss (1997) used a dynamic programming approach to model the impact of health and survival uncertainty on the savings of retirees. Falling into poor health, loss of a spouse and anticipation of such events had a major influence on the maintenance of the assets, as elders who experienced any of those events were more likely to experience a depletion of their savings. Similar research has been done by Wu (2001) who concluded that changes in health conditions affect income, wealth, and consumption behavior of married couples nearing retirement age. The serious health weakening of a spouse, more for a wife than for a husband, leads to a large depletion of assets as they would be paying the living expenses as well as medical bills from existing assets.

However, the papers that dealt with the relationship between the health and wealth of elders have limitations. First, these studies only examined the impact of new health conditions on the wealth depletion or the impact of existing health conditions on the wealth depletion. There were no studies that examined the impact of both health conditions. Since the new health events and existing health events could happen to elders as they normally have poor health status compared to young people, these should be dealt

with. Moreover, the type of new health conditions and existing health deterioration could have a substantial impact on the degree of wealth depletion, so it needs to be considered as well.

Not only the types of health conditions, but also the levels of income could have influence over the depletion of savings. As Feinstein and Ho (2000) pointed out in their paper, new health conditions and levels of income could interact with each other to have a considerable impact on the household assets and their utilization. Elders with high income usually find an alternative way to pay for the out-of-pocket expenses for health care expenses usually through re-allocation of the budget without having to resort to the depletion of their savings compared to those with low income. Elders with low income usually pay the health care expenses through their savings rather than from their income. Therefore, the degree of wealth depletion could be quite different across the levels of income. However, there has not been an empirical investigation that could support this finding. So, this thesis would investigate this issue in order to give a better understanding of the impact of health on wealth depletion.

2-2. Health Insurance Coverage, Out-of-Pocket Expenses, and Financial Burden

For years, health insurance has been the dominant form of covering the health care expenses. Among many health insurance companies, elders generally select Medicare, a public health insurance program, to cover for the hospital charges. It was found that about 97.7% of all elders have Medicare (Hurd & McGarry, 1997). However, as Medicare usually only covers about 45% of total medical expenses, elders need to find an alternative way to pay for the remaining medical charges which often lead to the depletion

of wealth and savings. It was found that 11% depend on Medicaid and if they are not qualified then elders (68%) usually find additional insurance to cover all the expenses (Hurd & McGarry, 1997). However, those private insurance companies usually do not cover various medical services that elders usually need, and even if covered, the coverage is sometimes too little. For example, for hospital visits, nursing home overnight, outpatient surgery, and doctor's fees, the non-coverage rate sometimes accounts for 30 to 40%. The non-coverage rate for some medications constitutes up to 64%, and for dental service it is up to 84% (Lee, 2001). These high non-coverage rates for various medical services leave elders with no choice but to pay the extra costs from their own pockets. This could result in financial burden to many elders, not only once, but endlessly.

The level of income, however, decreases as age increases. Therefore, it could be hard to pay all expenses within the income they earn as the level for elderly household were down below 68% compared to that of the age of 55 (Anderson & Hussey, 1999) leaving with the median annual income of only \$17,000. Due to low income and high non-coverage rate, the out-of-pocket expenses for services received account for 22% to 52% of elderly household income (Maxwell, Moon & Segal, 2000). Stum, Bauer, and Delaney (1998) examined the risk of financial burdens due to home care expenses for the disabled using data from 1989 National Long-Term Care Survey. They concluded that over 11% of home care users experience financial burdens to pay for the medial expenses that are not covered by any of the insurance they have. The research done by Hong and Kim (2000) looks at the similar issue using 1995 Consumer Expenditure Survey and concluded that, on average, households spent about \$1,872 to \$2,004 for health care. Hong and Kim (2000) also reported that over 24 to 52.4 percent of households were experiencing financial

burdens due to out-of-pocket health care expenditures depending on the type of households. The low coverage and low level of income causes elderly who are more likely to face health changes which require them to visit medical center to deal with a financial burden at same time. This could be psychologically stressful to elders.

This thesis examines the impact of health on the depletion of wealth or savings of older Americans through, 1) examination on interaction impact of health and the socio-economic status 2) the interaction between health and wealth of elderly, and 3) identification of elders' savings spending as out-of-pocket health care expenditure and its extent.

CHAPTER 3

DATA

3-1. Introduction

For the analysis, the data sets of Waves 1 and 2 of the AHEAD (Asset and Health Dynamics of the Oldest Old) funded by the National Institute of Aging (NIA) for the Health and Retirement Study (HRS) were employed. AHEAD is a national longitudinal study that looks at the economic, health, marital, family status, and private as well as public support system of the older Americans aged 70 and older. The AHEAD survey focused on questions to have a better understanding of the impact and relationships between changes and transitions for older people. It was done through interviews which were designed to be simple and concrete such that interviewees could understand and only be inconvenienced for 60 minutes or less. Probability sampling method was used to find an appropriate sample composed of individuals who were born in 1923 or earlier. Such method gave the total of over 11,965 individuals, but due to budget limitations and some individuals being identified as ineligible such as living in long-term care facilities and any other institutions (1,268 individuals), the data was collected from only 8,221 respondents of 6,047 households with a response rate over 80% of the eligible persons. The data was collected from 1992 to 1995.

The field interviewers conducted the interviews using Computer-Assisted Personal/Telephone Interviewing method, but the respondents who were aged 80 and over or who were uncomfortable with a phone interview were interviewed person-to-person in

their homes. Because some of respondents were non-native speakers, a Spanish version of questionnaire was also prepared. If there were more than one eligible individual living in a household, only one was selected randomly for the interview. If the selected individuals were married, then the interview was also sought with a spouse since there could be areas where a spouse would be more knowledgeable over certain things such as financial conditions, and that spouse would be categorized as “Financial Respondent”. Since this was a long range study, it required for the respondents to be re-interviewed every two years; but for those who were deceased or who could not provide useful information, proxy informants were used.

There were an over representative of African Americans, Mexican-American Hispanics, and residents of the state of Florida, so the compensatory weights were used to minimize such inequalities. Apart from this, the weighting factors were also used to adjust the geographic and race group differences among the data collected. In order to match the demographic distributions with 1990 Census data, post-stratification adjustment were applied at the levels of households and of individuals which gave household analysis weight and respondent analysis weight.

3-2. Data Descriptions

The AHEAD data gives in-depth information about economic status as well as health status of an individual. There are 11 sections in the interview to aid such gathering of information. They are,

1) Demographics: This section is intended to gather personal data such as year of births, education, education of parents, marital status and its history if any, and veteran status.

2) Health Conditions: Asks the respondents whether they have gone to see a doctor for any health problems such as assessment of vision and hearing, pain, smoking, depression, weight, height, drinking and so on.

3) Cognition: This is a recall test to see whether a respondent could remember 10 words, and there are questions to aid self-assessment of memory.

4) Family Structure: This section contains various questions to determine the family structure such as the list of other household members and to determine the detailed information such as age, education, employment status, marital status if any, income, their relationship to the respondent, home ownership, financial situation relative to respondent, and so on. There is also a question pertaining to whether the respondents have children who live elsewhere, their closeness and their financial relationship to the respondent. Also questions regarding their siblings were asked such as the number and marital status of siblings.

5) Health Care Utilization and Costs: Asks about health care utilization for past twelve months such as hospitalizations, nursing home stays, doctor visits, outpatient surgery, dental care, and so on. It also asks whether such usage were covered by Medicare or not. If there are any out-of-pocket costs for any of health related conditions including nursing home stays, the respondents are asked to give the amount and whether any children or any other person has helped them paying such out-of-pocket expenses.

6) Housing: This sections contains questions concerning type of housing, and whether such choice was due to certain constraints such as income, age, entry fee or association payment, services offered to residents, number of stories, special feature available for impaired, part of a condominium or hosing project, ownership of a house, mortgage, and so on. The value of house or the rent amount, the amount paid for property taxes, home insurance, and utilities were also asked.

7) Job Status: The current employment status and any history of employment in the past 10 years were asked. The earnings and hours worked for the last calendar year, largest income ever earned in a year, and whether a respondent worked in last two years were included to get detailed information on job status. If a respondent were widowed or divorced, the similar questions were asked for former spouse.

8) Expectations: This section asks about the chances of giving or receiving major financial assistance to or from any of family members in next ten years. If there is any inheritance and if any, then the amount, any possibilities of depleting the savings in the next five years, of entering a nursing home or paying medical expenses, of living to a specified age, of moving to a different place and others were questioned. The respondents were asked on a 0 to 100 percent scale.

9) Income: The section asks questions about the income and its source. If the respondents have income from several sources such as social security, SSI, food stamps, pensions, annuities, interest income were asked, and if there were any, follow-up questions were asked to each source to gain more specific information. The total income of a respondent for the last calendar year and whether there is a will and provisions made for children were included in the interview.

10) Net Worth: The section includes the questions regarding assets. The questions were asked whether they own or have real estate other than home, automobiles or other means of transportations, family business, IRA or Keogh accounts, shares of stocks or mutual funds, checking or savings accounts, CDs, government saving bonds or any other possible assets. The questions on their values, beneficiaries, and other information were also included. If respondents have any other above assets, they were asked if any of those assets were used to pay the health related expenses in addition to savings for the past year. Apart from such expenses, they are asked if they received any lump sum payments such as insurance, pension or inheritance for the past year.

11) Insurance: The question about the current coverage by Medicaid, or by any other government insurance programs or other private health insurance was asked. Whether respondents received any coverage for long term care and any payments related to such coverage were also included. There were questions about life insurance such as its term, amount, and beneficiaries and so on.

Apart from these main questions, additional questions were asked to only randomly assigned sub-samples to cross walk or to experiment in a sense that the measure could have been not so well developed or clear to aging processes or policy issues. These questions were resiliency which asked about recent major life events and its impact, time use of unpaid but economically productive activities, quality of life as means of assessing the broad impact of medial treatments, any events which occurred in last 12 months they experienced due to lack of money like not paying bills, eating less expensive foods, skipping needed home repairs, seeing a doctor and many others.

All the interviews were gathered, and the data were carefully checked. Outliers and inconsistencies were eliminated, and the income and assets variables were edited. There were some missing data due to refusal of answering some questions on financial information or family information from a respondent. After this data verifications, the data were sorted under 'Wave 1.'

The Wave 2 data was collected after two years which was in 1994 and 1995. The Wave 2 data received supplemental support from the Social Security Administration. The sample was of those respondents from the initial interview in 1993. There were about 5% difference in sample from Wave 1 and Wave 2 since some were deceased, reallocated or did not participate in the interview. The questions including modules asked in Wave 2 were almost identical as those asked in Wave 1. The procedure for collecting data and interviewing respondents followed closely the one prepared in 1993.

As this paper tries to examine the impact of health on wealth depletion of the elderly, the data in both Wave 1 and Wave 2 would be used. The longitudinal nature of the data would be very useful in estimating the impact of changes in health status on the financial status of elders. As the sample of the study is non-institutionalized elders, the findings of this study would be generalized to such populations.

CHAPTER 4

DEFINITIONS

4.1. Variable Descriptions and Measurements

There are two main categories in dependent and independent variables in this study. They are wealth and health. For the wealth category, there are 'the total income', 'the total amount in the account', 'the total assets', and insurance related information. 'The total income' is the whole-year pre-tax income of Wave 1 and of Wave 2. The respondents were asked to give an approximate amount of their household income. The data has been recoded into seven levels: \$5,000 to \$20,000 to level 1; \$20,000 to \$30,000 to level 2; \$30,000 to \$50,000 to level 3; \$50,000 to \$75,000 to level 4; \$75,000 to \$100,000 to level 5; and over \$100,000 to level 6. 'The total amount in all bank accounts' is the total amount in all of savings, checking, or any kind of bank accounts that respondents owned. It has been recoded into four levels: \$2,000 to \$20,000 to level 1; \$20,000 to \$50,000 to level 2; \$50,000 to \$100,000 to level 3; and over \$100,000 to level 4. 'The total assets' is the sum of other investments such as real estate, CDs, stock and many others that respondents consider as a part of their assets. This has been recoded into three levels: \$5,000 to \$50,000 to level 1; \$50,000 to \$100,000 to level 2; and over \$100,000 to level 3. The values for these levels were determined by the AHEAD data format of both Wave 1 and Wave 2.

For insurance related information, the coverage of Medicare or Medicaid as well as the coverage of any government insurance or other insurance was asked. The amount of out-of-pocket expenses for health care services rendered was included in the data analysis. The possession of Medicare or Medicaid were asked by the 'Yes' or 'No' format. There were questions related to Medicare or Medicaid coverage which asked whether respondents have made visits to hospitals, doctors, dentists, nursing homes, and if all the visits were covered by insurance if they were insured. If not, then the respondents were asked to give an approximate amount on all out-of-pocket expenses. Those amounts were recoded into five levels to facilitate the statistical analysis: less than \$1,000 in level 1, more than \$1,000 but less than \$5,000 in level 2, more than \$5,000 but less than \$7,500 in level 3, and more than \$7,500 but less than \$10,000 in level 4, and over \$10,000 in level 5. The ranges of the levels were determined by the questionnaire of the AHEAD study.

In health category, there are variables regarding on 'current health conditions', 'changes in health condition compared to Wave 1', and, 'changes in chronic disease status compared to Wave 1'. 'Current health conditions' question requested respondents to rate their own health conditions as either 'excellent', 'very good', 'good', 'fair', or 'poor'. The change in health condition compared to Wave 1 had answer such as 'better', 'same', or 'worse'. Chronic diseases were placed in separate categories of 'lung disease', 'diabetes', 'cancer', 'heart condition', and 'arthritis'. Respondents were asked to self-rate their own chronic disease conditions as 'excellent', 'very good', 'good', 'fair', or 'poor'.

There are demographic variables such as 'age', 'education', 'ethnicity', 'job status', and 'marital status' in order to obtain more information on respondents. For 'age', the indirect question of what year a respondent was born was included. Then, the age of a

respondent was calculated using that data. The education was asked as 'no formal education', 'grade 1-12', 'college', 'post college', or 'other'. Ethnicity background was categorized as 'White/Caucasian', 'Black/African American', 'American Indian or Alaskan Native', 'Asian or Pacific Islander' or 'other'. The question on 'marital status' had options of 'married, spouse present', 'married, spouse absent', 'living with someone', 'divorced/separated', 'widowed', and 'never married'. For job status, respondents were asked whether they were 'working now' or 'unemployed, and looking for work or temporarily laid off, on sick or other leave', 'disabled', 'retired', 'homemaker/never worked', or 'other'. These values, combined with other variables on income and wealth are categorized under socio-economic status. All missing data or any refused answers were cleaned before analyzing the data. Only the data on one respondent per household was considered in the data.

4-2. Research Questions and Statistical Models

There are three major research questions related to health and wealth of older Americans who are aged mostly 70 or more. This thesis will examine the relationship between health of elderly and their socio economic status; the effect of health on the depletion of wealth of elderly; and the financial burden of out-of-pocket expenses for health services rendered by elderly Americans. To answer these questions, both new and chronic health conditions and its changes over a two-year period will be used.

Research Question 1: **Is there a relationship between health conditions and the socio-economic status for people who are aged 70 or more?**

In this research question, the main object is to examine whether the elderly people of higher socio economic status (SES) have better health status compared with those of low socio-economic status. Here, socio economic status is a combination of five individual variables of the level of income, level of education, marital status, ethnicity, and job status. Higher socio-economic status would mainly correspond to a higher level of income and of education. Marital status, race, and job status have been added to provide a better explanation of people who could be categorized as either 'higher' or 'lower' status. These variables may not be the major ones which can be categorized in relation to socio-economic status, but these may provide better insights of SES of the elderly and its relation to health. The model will be built with the health condition as a dependent variable and other socio-economic status variables as independent variables. The existence of any interaction terms between independent variables will also be examined to find the best fitted model which explains the relationship between health and SES. Significant independent variables will be reanalyzed to examine the trend.

Secondly, the change in overall health conditions and its relation to socio-economic status will be analyzed. This is to determine whether the elderly with higher SES have better health conditions and whether they can maintain better health conditions compared with those with lower SES. To determine if there are any other contributing factors in the model apart from five variables of SES, interaction terms with significant contribution will be included in the model.

Thirdly, the effect of socio-economic status on changes in chronic diseases will be examined. This is to discover whether respondents with higher socio-economic status have fewer problems with chronic diseases. Chronic diseases are separated as cancer, arthritis, heart problem, lung disease, and diabetes. They will be fitted separately to determine each interaction with SES. The inclusion of interaction terms will be examined. Significant independent variables will be reanalyzed to examine the trend.

Research Question 2: Does the current health status as well as changes in overall health conditions affect the wealth of elderly? Do chronic diseases also affect the wealth of elderly?

The main object of this research question is to determine whether the poor health status or decline in health conditions deplete the wealth of elderly. This is to examine the notion that people with poor health conditions spend more money on health care expenses. Spending more on health care expenses would eventually lead them to spend their savings since majority of them do not have any definite source of income. So, the effect of the current health conditions and of changes in health conditions will be separately examined. Here, wealth is divided into three variables and they are: the total amount in bank accounts; the total amount of assets; and the total household income. The inclusion of interaction terms in the model will also be analyzed. The significant variables will be additionally analyzed to study the trend.

Research Question 3: Does more insurance coverage help ease the financial burden resulting from out-of-pocket expenses for health care services rendered?

The main object in this question is to determine whether an increase in insurance would decrease out-of-pocket expenses. Also the effect of the current health status and changes in health status on out-of-pocket expenses will also be analyzed to determine whether respondents with better health conditions spend less on out-of-pocket health care expenses. Other insurance coverage such as government insurance, other insurance, Medicare, and Medicaid will be separately analyzed to determine an individual impact on the amount of out-of-pocket expenses.

These research questions will be analyzed using SAS version 8.02 for Windows. The major statistical procedure to be used is 'proc genmod' for logistic regression analyses and 'proc freq' for the chi-square tests in order to determine the presence of a significant difference among variables. The next section will discuss the procedures.

4-3. Models

Logistic regression¹:

Logistic regression is a category of generalized linear models. It is a mathematical modeling approach which allows predicting dichotomous (discrete) outcomes from a set of several variables which may be a mixture of dichotomous, discrete, and any other. The dependent variable can only take the value 1 with a probability of success P and the value 0 with a probability of 1-P. The model with a dependent variable z, which is an index that combines the independent variables, is a linear sum $\hat{\alpha}$ plus $\hat{\alpha}_1$ times X_1 and plus $\hat{\alpha}_2$ times

¹ This chapter is a summary of Kleinbaum, D., (1994), Logistic Regression: A Self-Learning Text. Springer-Verlag New York, Inc., <http://online.sfsu.edu/~efc/classes/bio1710/logistic/logisticreg.htm>, and

X_2 and so on to \hat{a}_k times X_k , where X 's are independent variables and \hat{a} and \hat{a} being the constant terms representing unknown parameters.

$$z = \mathbf{a} + \mathbf{b}_1 \mathbf{c}_1 + \mathbf{b}_2 \mathbf{c}_2 + \dots + \mathbf{b}_k \mathbf{c}_k$$

or, $z = \mathbf{a} + \sum \mathbf{b}_i \mathbf{c}_i$ where $i=1, \dots, k$

The independent variables, X 's, are free of any assumptions regarding the distribution such as being normal distribution and having equal variances. The relationship between dependent and independent variables is not a linear function. Rather, it is a logistic function or logit transformation of P .

$$P = P(X) = \frac{e^{(\mathbf{a} + \mathbf{b}_1 \mathbf{c}_1 + \dots + \mathbf{b}_k \mathbf{c}_k)}}{1 + e^{(\mathbf{a} + \mathbf{b}_1 \mathbf{c}_1 + \dots + \mathbf{b}_k \mathbf{c}_k)}} = \frac{1}{1 + e^{(\mathbf{a} + \sum \mathbf{b}_i \mathbf{c}_i)}}$$

Logistic regression is preferred over the ordinary linear regression in psychological or epidemiological data analysis where the data is either, 0 ("without") and 1 ("with"). This is due to the fact that the logistic function, $f(z)$, ranges between 0 and 1 regardless of how big the value of X might be. However in linear regression, the values will be greater than 1 or less than 0 depending on the value of X . Logistic regression also provides information on relationships and strengths among the variables.

Maximum likelihood method is used to estimate unknown parameters, \hat{a} 's, since there is no mathematical solution that could find least squares estimates of parameters in logistic function. Therefore, the utility function, a measure of fit between mathematical data and observed data, is 'maximum likelihood'. The ML method chooses an estimator which would maximize the likelihood function $L(\hat{\theta})$. It is advisable to have a large sample size in order to get a good fitted model.

The logic regression calculates the probability of success over the probability of failure, the results are in an odds ratio. The odds ratio is a measure of association directly estimated from a logistic model, usually, for case-control and cross-sectional studies. To get the odds ratio, first the logic transformation, logit P(X), is calculated.

$$\text{logit } P(X) = \ln_e \left[\frac{P(X)}{1-P(X)} \right]$$

$$\text{where, } P(X) = \frac{1}{1 + e^{(a + \sum b_i c_i)}}$$

The logit of P(X) simplifies to the linear sum found in the denominator of the formula for P(X). The odds is the ratio of the probability that some event will occur over the probability that the same event will not occur.

The preferred method for analysis of which variables will be eliminated or not, is backward stepwise regression. Variables are eliminated in an iterative process. Then, the fit of the model is tested after each elimination to check whether the model adequately fits the data. When there are no more variables to be eliminated, the analysis is complete. There are several techniques for the inclusion or elimination of variables: Wald test; the likelihood-ratio test; and Hosmer-Lemshow goodness-of-fit test. A Wald test tests the statistical significance of coefficients in the model. It is based on the Z statistics,

$$Z = \frac{\hat{b}}{Se}$$

Then, the square form of Z value follows a chi-square distribution. However, Wald Statistics could give inflated standard error for large logit coefficients, and leads to Type II errors. So, Wald Statistics is advised to be used with a caution.

The commonly used test is the likelihood-ratio test. It utilizes the ratio of the maximized value of the likelihood function of the full model (L_1) over the maximized value

of likelihood function for the reduced model (L_0). The test is,

$$-2 \log\left(\frac{L_0}{L_1}\right) = -2[\log(L_0) - \log(L_1)] = -2(L_0 - L_1)$$

The log transformation of the value also follows a chi-square distribution. The likelihood-ratio test is most recommended in backward stepwise elimination. A Hosmer-Lemshow Goodness of Fit test creates 10 ordered groups and compares it with an actual number of observed values with predicted ones. These values also follow a chi-square distribution. It is desired to find the model with non-significance which indicates that the model built by predicted values is not significantly differ from the one built by observed values. The model is then assessed for interaction and confounding effects of interaction terms. However, the confounding assessment is often quite difficult to perform when there are any significant interaction terms in the model since it becomes much more subjective.

Multinomial regression:

The multinomial regression is similar to logistic regression except that the dependent value is not dichotomous. It involves nominal dependent variables which have more than two levels or categories. So, it is a multi-equation model. The probability P_j can be modeled using,

$$P_j = \frac{\exp(\mathbf{b}_j X)}{\sum \exp(\mathbf{b}_j X)} \quad \text{for } j = 1, \dots, k+1$$

A dependent variable with k levels will produce k-1 equations with k-1 logits even though the model tests all possible combinations among all k groups. Each of the k-1 equations is a binary logistic regression which is compared with the reference group.

If there are three levels in a dependent variable, then the probability for each level is calculated as below.

$$P(Y = 1) = \frac{e^{(b_1c)}}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

$$P(Y = 2) = \frac{e^{(b_2c)}}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

$$P(Y = 3) = \frac{e^{(b_3c)}}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

The above equations are not identifiable since there is more than one solution to the coefficients leading to same probability. One of probability is set to 0 yielding,

$$P(Y = 1) = \frac{1}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

$$P(Y = 2) = \frac{e^{(b_2c)}}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

$$P(Y = 3) = \frac{e^{(b_3c)}}{e^{(b_1c)} + e^{(b_2c)} + e^{(b_3c)}}$$

The first group will be the reference group. There is no loss of generality for the data. Then, the two coefficients representing the odds relative to the reference group can be calculated.

In the multinomial model, the coefficients are interpreted in RRR, the relative risk ratio for one unit change in X which is

$$\text{RRR} = \frac{P(Y=1 | X+1)/P(Y=\text{base category} | X+1)}{P(Y=1 | X)/P(Y=\text{base category} | X)} = e^{Xb_j}$$

Thus, the exponentiated value of the coefficient is the relative risk ratio and its risk is being measured as the risk of the category relative to the base category. The interpretation of the multinomial model is similar to that of the logistic regression.

CHAPTER 5
RESULTS AND CONCLUSIONS

5-1. Descriptive Analysis

For descriptive analysis, frequencies and percentages of every variable in Wave 1 and Wave 2 were calculated using 'proc freq' procedure. Among these variables, only demographic variables are shown in Table 1. As noted from the table, the ages of respondents were from 61 to 103 and most frequently occurring age group was 70 to 79 for both Wave 1 and Wave 2. Concerning education, about 2.62% of respondents did not have any formal education. About half of the respondents had some education of grade 1 through grade 12. The other half of the respondents had education consisting of college or beyond. For ethnicity, 83.22% of respondents were classified as White Americans or Caucasians and 14.55% were African Americans. About 40% of respondents were married with a spouse present and almost 47% were divorced or separated. In Wave 1, 465 respondents (9.09%) said that they were working, however the number of people working has reduced to 285 (5.81%) in Wave 2. Larger proportion of respondents did not have job in Wave 2 and about 75% of respondents (N=3644) answered that they had retired in Wave 2. The question regarding job status in Wave 1 had answer choices of either 'Yes' or 'No'.

Table 1: Demographic Descriptions

	Levels	Numbers	Percentage
Age - Wave 1			
	61-69	15	0.29
	70-79	3342	65.26
	80-89	1587	31.27
	90-103	177	3.48
Age- Wave 2			
	63-69	8	0.14
	70-79	3070	53.60
	80-89	2223	38.89
	90-105	427	7.37
Education			
	no formal education	134	2.62
	grade 1~ 12	2207	43.10
	some college	1423	27.79
	college grad	1055	20.60
	post college	302	5.90
Race			
	White/Caucasian	4261	83.22
	Black/African American	745	14.55
	American Indian/Alaskan Native	114	2.23
Job Status – Wave 1			
	working now	465	9.09
	looking for a job/temporarily laid off	.	.
	disabled	.	.
	retired/no current job	4648	90.91
	homemaker/never worked	.	.
Job Status – Wave 2			
	working now	285	5.81
	looking for a job/temporarily laid off	13	0.27
	disabled	185	3.77
	retired/no current job	3644	74.32
	homemaker/never worked	776	15.83
Marital Status			
	married, spouse present	2088	40.77
	married, spouse absent	76	1.48
	living with someone	26	0.51
	divorced/separated	332	6.48
	widowed	2414	47.14
	never married	185	3.61

5-2. Health and Socio-Economic Status

First, the relation between the health conditions of respondents in both Wave 1 and Wave 2 and socio economic status variables were analyzed using 'proc genmod'. It was found that all socio economic status variables were significant however, as shown in Table 2, interaction terms among variables did not have any effect so they were excluded. The variables of income ($p < 0.001$), education ($p < 0.001$), marital status ($p < 0.05$), race ($p < 0.01$), and job status ($p < 0.001$) were significant. The follow-up contrast estimates of significant variables were performed. All levels of income significantly contrasted with p-value with < 0.05 , and all levels of education were also significantly contrasted with p-value with < 0.05 . For marital status, only the group of respondents who were married with spouse present and the group of respondent who were divorced or separated were significantly different. This could be due to the fact that there was only a small set of respondents in other levels such as 'married but a spouse is absent', 'living with someone', or 'never been married'. The Caucasians have significantly different interaction with health conditions compared to the interaction of African Americans. The number of respondents in 'American Indian or Alaskan Native' category was maybe too small to give any significant contrast with other levels. All job levels were significantly contrasted with each level. All of these results show that there is a clear trend in health condition with socio-economic status.

Then, the change in health conditions since Wave 2 in relation to socio-economic status was analyzed. As shown in Table 3, the model included income, education, marital status, race, and job status as well as interaction terms of race and job status, of income and race, of income and marital status, of income and education, of education and race,

Table 2: Relation of Health Status Respect to Socio-Economic Status

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
income	5	30.16	<.0001
education	4	35.96	<.0001
marital status	5	12.68	0.0265
race	2	13.87	0.0010
job status	4	135.55	<.0001

Table 3: Relation of The Change in Health Status Respect to Socio-Economic Status

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
income	5	6.07	0.2990
education	4	8.52	0.0743
marital status	5	1.12	0.9524
race	2	1.73	0.4211
job status	4	20.18	0.0005
race*job status	6	1.65	0.9489
income*race	8	11.02	0.2005
income*marital status	18	12.09	0.8426
income*education	15	11.11	0.7448
education*race	8	13.19	0.1055
marital status*race	9	9.59	0.3846

and of marital status and race. The model was better fitted with the interaction terms than the one without them. Among those variables, job status ($p < 0.05$) was significant. The follow-up contrasts of estimates were performed. The group of respondents with a job was significantly different than those who were disabled ($p < 0.001$). The other groups were non-estimable.

Next, the change in chronic disease conditions in relation to socio-economic status was analyzed. Variables of chronic disease conditions were divided into five separate variables: diabetes, lung, arthritis, heart, and cancer, and they were calculated separately.

The results of these analyses are shown in Table 4. For diabetes, only race and job status variable were significant ($p < 0.05$) in the model with three interaction terms such as race and job status, income and race, and income and education. This model is better explained with these three interaction terms. There were not many contrasts within the levels of these two variables. This indicates that there might not be a trend in people having diabetes with socio-economic status. For lung disease, income and marital status were significant with p-value less than 0.05. The model was better fitted without interaction terms. There were contrasts among income levels, but not within marital status. Respondents with higher income (between \$50,000 to over \$100,000) were significant ($p < 0.07$), but respondents with lower income levels were not significant. This could indicate that there might not be a trend between income and its effect on condition of lung disease. For arthritis, only education, race, job status, and marital status were fitted in the model with only race being significant with p-value less than 0.05. Income level did not contribute in the model (algorithm did not converge with income variable or any of interaction terms). It was also found that all levels of race were significantly different indicating a clear trend among ethnicity and arthritis.

For heart condition, the model was better fitted with one interaction term of education and race with other socio-economic status variables. Among those, education and job status were significant along with the interaction term, education and race, all with p-value less than 0.05. After the contrast estimation analysis, only respondents with no formal education were significantly different from respondents with some formal education to high school. Respondents with jobs were significantly different with participants who were retired or without a job.

Table 4: Change in Chronic Disease Conditions and Socio-Economic Status

LR Statistics For Type 3 Analysis				
	Source	DF	Chi-Square	Pr > ChiSq
Diabetes				
	income	5	3.09	0.6867
	education	4	1.61	0.8071
	marital status	5	0.87	0.9724
	race	2	8.09	0.0175
	job status	4	9.76	0.0446
	race*job status	4	5.76	0.2176
	income*race	1	0.73	0.3921
	income*education	11	13.91	0.2382
Lung				
	income	5	19.69	0.0014
	education	4	1.06	0.9008
	marital status	5	11.10	0.0493
	race	2	0.61	0.7362
	job status	3	0.23	0.9733
Arthritis				
	education	4	2.71	0.6082
	race	2	9.01	0.0111
	job status	4	6.05	0.1952
	marital status	5	3.49	0.6255
Heart				
	income	5	7.07	0.2154
	education	4	11.49	0.0216
	marital status	5	2.19	0.8221
	race	2	5.16	0.0756
	job status	4	11.32	0.0232
	education*race	5	15.54	0.0083
Cancer				
	income	5	6.25	0.2827
	education	4	6.65	0.1553
	marital status	4	1.95	0.7446
	race	1	1.05	0.3055
	job status	3	8.05	0.0450

Concerning cancer, only job status was significant in the model without interaction terms. After contrasting the estimates, it was found that respondents with a job were significantly different than respondents who were retired or not employed. Conclusively there seems to be a clear trend in most changes in conditions of chronic diseases with respect to socio-economic status.

5-3. Health and Wealth

First, effects of current health conditions on Wave 1 and on Wave 2 were examined separately using 'proc genmod' procedure. The results are shown in Table 5. For the wealth category, there are the total amount in all bank accounts, the total amount of assets, and the total household income variables. The effect of health conditions on these three variables were analyzed separately. The effect of current health status and Wave on the total amount in all bank accounts was significant with p-value <0.002. However, an interaction term of Wave and health was not significant in the model even though the model was better fitted with it. Within the levels of income and within the levels of Wave, the contribution significantly contrasted indicating a clear trend of health status and the total amount in bank accounts.

For the total amount in asset, the model was significant with current health status, Wave, and its interaction term between wave and current health status. There is a significant interaction in the model between current health status and Wave. All of the levels in health status and Wave were significant ($p < 0.05$) demonstrating the clear trend between wealth and health. For the total household income, the model was well fitted with current health status, Wave and its interaction term even though the interaction term

Table 5: Effect of Health Status on Wealth of Elderly

LR Statistics For Type 3 Analysis			
Effect of current health conditions in Wave 1 and Wave 2 separately on wealth			
Source	DF	Chi-Square	Pr > ChiSq
Accounts			
current health status	4	21.68	0.0002
wave	1	175.69	<.0001
wave*current health status	4	3.95	0.4131
Assets			
current health status	4	33.59	<.0001
wave	1	63.01	<.0001
wave*current health status	4	16.40	0.0025
Income			
current health status	4	15.62	0.0036
wave	1	19.19	<.0001
wave*current health status	4	4.77	0.3114
Effect of both change in health conditions and current health conditions on wealth			
Source	DF	Chi-Square	Pr > ChiSq
Accounts			
change in health status	2	10.16	0.0062
current health status	4	163.64	<.0001
Assets			
change in health status	2	3.41	0.1815
current health status	4	7.26	0.1226
Income			
change in health status	2	13.55	0.0011
current health status	4	106.12	<.0001

was not significant. There was also found a trend among health status and Wave, except low levels of health status, which were significantly contrasted. Conclusively current health status in both Wave 1 and Wave 2 had a significant effect on the wealth of elderly along with a significant trend of both variables.

Effect of both current health status and change in overall health conditions since Wave 1 on wealth of elderly were analyzed using 'proc genmod' procedure (see Table 5). First, the total amount in all bank accounts was significantly affected by the health

conditions and change in health conditions with p-value less than 0.005. It was found that an improvement in overall health conditions significantly contrasted with deterioration in overall health conditions since Wave 1. For the health status, the respondents with excellent health conditions significantly contrasted with those with very good, good or fair health conditions. However, for the assets variable, the model was not significant. This could be due to relatively small number of respondents having assets (N=220), one level having only 29 responds, or of people who declared to have assets. For the total household income, change in overall health conditions and current health status were both found to be highly significant ($p < 0.001$). According to contrast of estimates results, all levels of current and change in health conditions were significant. Conclusively, there seems to be a clear and significant trend between health conditions and wealth of the elderly.

5-4. Out-of-Pocket Expenses, Insurance, and Health Conditions

The relationship between out-of-pocket expenses and health conditions were examined by 'proc genmod' procedure and between out-of-pocket expenses and insurance were analyzed by 'proc freq'. The results on health conditions are shown in Table 6. First, effect of both current health status and change in health conditions were analyzed. Out-of-pocket expenses were significantly related to the current health status and the change in health conditions within the p-value of 0.002. Within the levels of health status and also within the change in health conditions, only respondents with excellent or very good health conditions were significantly contrasted with respondents with poor health conditions.

Table 6: Effect of Health Status on Out-Of-Pocket Expenses

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Effect of health status on out-of-pocket expenses			
change in health status	2	13.84	0.0010
current health status	4	17.87	0.0013
Effect of current health status of both Wave 1 and Wave 2 on out-of-pocket expenses			
current health status	4	16.07	0.0029
wave	1	1224.90	<.0001
wave*current health status	4	27.81	<.0001

This is not a strong indication yet, but, this does show a trend in the relationship between out-of-pocket expenses and respondents with excellent or very good health conditions, compared to the relationship of respondents with poor health conditions. The relationship between out-of-pocket expenses with current health conditions in Wave 1 and in Wave 2 shows that the model was significant with its interaction term of wave and health conditions. All variables have p-values less than 0.003 indicating significant contribution to the model. From the contrast of estimates results, the Wave 1 and Wave 2 were significantly different. The respondents with excellent and very good health conditions were significantly different from those with poor health conditions. This shows a trend of respondents with excellent or very good health conditions spending fewer out-of-pocket expenses compared to those with poor health conditions.

The relationship between the levels of out-of-pocket expenses and the coverage of insurance were examined using 'proc freq'. First, the relationship between out-of-pocket expenses with the coverage of Medicare of the elderly was analyzed (Appendix 1). About 95.5% of respondents were covered by Medicare and among these, 74.2% of respondents

have spent less than \$1,000 as out-of-pocket expenses in one year period. 23.3% of respondents have spent less than \$5,000 and there were about 2.5% of respondents who have spent more than \$5,000 even if they were covered by Medicare. Among respondents who were not covered by Medicare (4.4%), 85% of them have spent less than \$1,000, and 13% of those have spent less than \$5,000 as out-of-pocket expenses. There seems to be little difference in the proportion of respondents spending out-of-pocket expenses regardless of whether they were covered by Medicare or not. A chi-square statistics was calculated to see if out-of-pocket expenses' levels were significantly different among the respondents who were covered by Medicare and who were not, and it was found to be significantly different among those two groups with p-value of 0.0016.

The relationship between out-of-pocket expenses and the coverage of Medicaid was examined next (Appendix 2). 12.5% of respondents were covered by Medicaid and among those, 94.7% have spent about less than \$1,000 as out-of-pocket expenses in given one year period. Less than 5% of respondents have spent about less than \$5,000 and there were about less than 1% of them who have spent more than \$5,000. Among respondents who were not covered by Medicaid (87.5%), about 84.5% of them have spent less than \$1,000, and 13.4% have spent less than \$5,000 as out-of-pocket expenses. There seems to be a slight difference in the proportion of respondents spending out-of-pocket expenses depending on whether they were covered by Medicaid or not. There is a bigger proportion of respondents without the coverage who have spent more out-of-pocket expenses. Again, a chi-square statistics was calculated to see if out-of-pocket expenses' levels were significantly different. Among respondents with Medicaid and among

respondents with no Medicaid, there was a significant difference with the spending amount with p-value less than 0.0001.

The relationship between out-of-pocket expenses and the coverage of any other government insurance was analyzed using 'proc freq'. The result is shown in Appendix 3. There were about 96.1% of respondents who did not have any other government insurance. Among those, 85.7% of them have spent less than \$1,000 as out-of-pocket expenses in one year period. Similarly, 89.12% of respondents with other government insurance have also spent less than \$1,000. About 9.33% of respondents who have insurance and 12.4% of respondents who do not have insurance had spent less than \$5,000. And, there were about 1% of respondents who have spent more than \$5,000 regardless of having other government insurance or not. Conclusively, respondents with other government insurance have spent no less than respondents who do not have. According to the chi-square statistics, there is little difference among two categories, indicating no financial benefit to elderly who have other government insurance (p-value about 0.2812).

The relationship between out-of-pocket expenses and the coverage of any other insurance was examined. The result is shown in Appendix 4. 81.3% of respondents have other insurance apart from Medicare, Medicaid, and any government insurance. Among those, 83.37% of them have spent about less than \$1,000 as out-of-pocket expenses and 14.5% have spent less than \$5,000. 18.7% of respondents who do not have other insurance have showed similar out-of-pocket expenses as respondents who have insurance. 80.6% of those respondents who have other insurance have spent less than \$1,000 and 16.9% of them have spent less than \$5,000 in a one year period. There is not much difference in the proportion of respondents with other insurance and those with no

insurance regarding the amount of out-of-pocket expenses. A chi-square test gave a p-value of 0.085 which indicates that there is no difference among respondents whether they have other insurance or not. The effect of change in health conditions since Wave 1 on out-of-pocket expenses was evaluated using 'proc freq' procedure. As shown in Appendix 5, 8.56% of respondents declared that their health conditions got better, 59.14% being the same, and 32.3% declaring that their health conditions got worse since Wave 1. Among respondents declaring better health conditions, 98.82% of respondents have spent less than \$1,000 as out-of-pocket expenses. Also 99.11% of respondents with same health conditions and 96.20% of respondents with worse health conditions have spent less than \$1,000. The remaining respondents regardless of changes in health conditions have spent similar amount of out-of-pocket expenses. The chi-square test has been performed to see whether there exists a relationship between changes in health status and amount of out-of-pocket expenses. It was found that there is a significant relationship between two variables with p-value less than 0.0001.

5-5. Conclusions

Health and socio-economic status:

There is strong evidence to support the existence of a relationship between the current health status of the elderly and their socio-economic status. The level of income, marital status, education, race, and job status strongly influence the health status. As the level of income increased, the health status got better and as the level of education increased, the health status got better. Married couples with a spouse present had a positive relationship with the health status compared to separated couples. Elderly

people with a job had better health conditions compared to their counterparts who were retired or not employed. However, there is not strong evidence to support that the change in health conditions is related to the socio-economic status. Only the education level and job status had a positive relationship with the change in health conditions. There was not to be much of a trend in education levels or job status with respect to the changes in health conditions. Even though other SES variables were included in the model, they were not statistically significant (p-value <.9). Six interaction terms between income, race, job status, marital status, and education were included in the model. This indicates that the change in health conditions is not only affected by the socio-economic status alone, but also by other factors that might have some impact on the change. However, at this stage, it is not clear what the other influential factors might be.

Similarly, there is not a significant impact of the socio-economic status on the change in chronic disease conditions. For diabetes, race and the levels of education were significant determinants. There was found to be no trend in race or education in relation to the change in chronic disease conditions. The fact that there were three interaction terms contributing to the model indicates that there could be other factors affecting the condition of diabetes, not only race and education as found in this study.

Considering lung disease, only income and marital status affected the condition and people with higher income, who earned more than \$50,000, have experienced an improvement in lung disease alone. Even though this may not be the only factor related to the improvement of lung disease, but the income level were significantly effective.

Surprisingly, race was the only strong factor that had a relationship with arthritis. According to this analysis, Caucasians have the least problem with arthritis compared to other ethnic groups such as African Americans, and American Indians.

Heart condition is found to be influenced by education, race, job status, and an interaction term between education and race. However, there was not much of a trend among these factors except that people with a job had fewer problems with heart conditions compared to people who had retired or without a job. An interaction term present in the model indicates that not only the socio-economic status is the influential factor on the heart condition but also the interaction between education and race. Job status has an impact on the change in the condition of cancer. People with a job had fewer problems with cancer.

Conclusively, there is an impact of the socio-economic status and its interaction terms on health conditions or changes in health conditions. Even though there is not much of a strong impact of socio-economic status on the change in health conditions, SES is certainly one of the factors that has an influence on health of the elderly.

Health and wealth:

This study suggests a strong relationship between health and wealth of the elderly. The total amount in bank accounts, assets, and income were highly related to the current health status. The trend between people with different health status and their wealth was clearly found. People with more savings had better health conditions compared to people with less savings. An interaction term between Wave and health status indicates that there could be an impact on wealth in relation to Wave 1 and Wave 2 with its corresponding health status. In addition, people who reported of weakening health

conditions over the two year period had less wealth compared with people who did not report such. All these findings suggest that there is a clear interaction and trend between health status and wealth of the elderly.

Out-of-pocket expenses, insurance, and health conditions:

The finding suggests that the amount of out-of-pocket expenses were highly related to the health status and to the change in health conditions of the elderly. People with better health conditions spent less out-of-pocket expenses compared to people with worse health conditions. There was an interaction term between health conditions and Wave indicating that there could be a different impact on out-of-pocket expenses according to Wave and its corresponding health status.

The most interesting finding is that regardless of the number of health insurance that the elderly possessed, the levels of out-of-pocket expenses were not very much different. In other words, having more insurance did not cover more health care service fees. About 75% of elderly with Medicare coverage have spent less than \$1,000, but about 85% of elderly without Medicare coverage have spent a similar amount. Also, 23.3% of people with the coverage have spent less than \$5,000 where as only 13% of them without coverage have spent a similar amount. However, this does not clearly indicate that people with Medicare coverage spends more than those without Medicare coverage. Similarly, people with government insurance or other insurance have spent a similar amount of out-of-pocket expenses compared with those without insurance. Surprisingly, people with Medicaid coverage have spent clearly less than people without it. It was found that almost 80% or more elderly have spent less than \$1,000 in a year as out-of-pocket expenses for health care services rendered in 1992 and in 1994.

This thesis studied the relationship between the health and wealth of the elderly. The findings suggest that there is a positive relationship between the current health status of elderly and their socio-economic status particularly elderly with higher socio-economic status had better health status. However, this was not applicable in the case of the change in health status. Findings also showed elderly with more wealth had better health conditions compared with those with less wealth. Regarding out-of-pocket expenses, it was found that regardless of number of health insurance that elderly had, the amount of out-of-pocket expenses were not much different except for those with Medicaid coverage.

5-6. Discussions

This study examined the relationship of health and wealth of the elderly based on the AHEAD data set. There are quite interesting findings in relation to health, out-of-pocket expenses, and wealth depletion of elderly; however, these findings have limitations. The model on the impact of health conditions on wealth have ignored other factors such as other investments or donations that might have taken place within the two year period, the age of respondents which could have also explained the possibility of natural depletion of health conditions, and many other factors that could have influenced any changes in health as well as in wealth. For the examination of relationship between out-of-pocket expenses and insurance, the degree of health status and presence of any other diseases, which might have affected the decision of whether to have additional insurance or not, were not considered. Improvements of this study are needed in further studies with more variables. Even though there are such limitations, this thesis contributes to the field of health and wealth of the elderly as in a better explanation of their relationship.

REFERENCES

- Anderson, G.F. & Hussey, P.S. (1999). Health and Population Aging: A Multinational Comparison. The Commonwealth Fund Report No. 354.
- Center for Disease Control and Prevention (1999). Chronic Diseases and Their Risk Factors – The Nation’s Leading Causes Death, 7.
- Center for Disease Control and Prevention (2001). Health Aging-Preventing Disease and Improving Quality of Life Among Older Americans, 2.
- Coughlin, T.A., Liu, K. & McBride, T.D. (1992). Severely Disabled Elderly Persons with Financially Catastrophic Health Care Expenses: Sources and Determinants. *The Gerontologist*, 32, 391-403.
- Crystal, S., Johnson, R.W., Harman, J., Sambamoorthi, U. & Kumar, R. (2000). Out-of-Pocket Health Care Among Older Americans. *Journal of Gerontology: Social Sciences*, 55B, S51-S62.
- Feinstin, J.S. (1993). The Relationship Between Socioeconomics Status and Health: A Review of the Literature. *The Milbank Quarterly*, 71, 279-322.
- Feinstein, J.S. & Ho, C.C. (2000). Elderly Asset Management and Health: An Empirical Analysis. Yale School of Management Working Paper No. H-8.
- Ferraro. K.F. & Su, Y.P. (1999). Financial Strain, Social Relations and Psychological Distress Among Older People: A Cross-Cultural Analysis. *Journal of Gerontology: Social Sciences*, 54B, S3-S15.

- Hong, G.S. & Kim, S.Y.(2000). Out-of-Pocket Health Care Expenditure Patterns and Financial Burden across the Life Cycle Stages. *The Journal of Consumer Affairs*, 34, 291-313.
- Hurd, M.D. & McGarry, K. (1997). Medical Insurance and the Use of Health Care Services by the Elderly. *Journal of Health Economics*, 16, 129-154.
- Kleinbaum, D.G.(Eds.).(1994). Logistic Regression: A Self-Learning Text. Springer-Verlag New York, Inc.
- Lee, J. (2001). Assessing the Dynamics of Financial Security and Health Status of Ethnic Minority Elders with Chronic Health Conditions. A baseline report prepared for the 2000-2001 Georgia Gerontology Consortium Seed Grant Program.
- Lillard, L.A. & Weiss, Y. (1997). Uncertain Health and Survival: Effects on End-of-Life Consumption. *Journal of Business & Economic Statistics*, 15, 254-268.
- Maxwell, S., Moon, M. & Segal, M. (2000). Growth in Medicare and Out-of-Pocket Spending: Impact on Vulnerable Beneficiaries. The Commonwealth Fund Report No.430.
- Patashnik, E. & Zeilizer J. (2001). Paying for Medicare: Benefits, Budgets, and Wilbur Mill's Policy Legacy. *Journal of Health Politics, Policy and Law*, 26, 7-36.
- Paulin, G.D. (2000). Expenditure Patterns of Older Americans, 1984-1997. *Monthly Labor Review*, May, 3-28.
- Schoenbaum, M. & Waidmann, T. (1997). Race, Socioeconomic Status, and Health: Accounting for Race Differences in Health. *The Journal of Gerontology: Social Sciences*, 52B (Special Issue), 61-73.

- Singer, B.H. & Ryff, C.D.R. (Eds.). (2001) *The influence of inequality on Health Outcomes*. In
New Horizons in Health: An Integrative Approach (pp.100-117), Washington,
DC: National Academy Press.
- Smith, J.P. (1997). Wealth inequality among Older Americans. *The Journal of Gerontology:
Social Sciences*, 52B(Special Issue): 74-81.
- Smith, J.P. (1999). Healthy Bodies and Thick Wallets: The Dual Relation Between Health
and Economic Status. *Journal of Economic Perspectives*, 13, 145-166.
- Stum, M.S., Bauer, J.W. & Delaney, P.J. (1998). Disabled Elders' Out-of-Pocket Home
Care Expenses: Examining Financial Burden. *The Journal of Consumer Affairs*, 32,
82-105.
- Wu, S. (2001). The Effects of Health Events on the Economic Status of Married Couples.
Working Paper. Hamilton College.

<http://online.sfsu.edu/~efc/classes/bio1710/logistic/logisticreg.html>

<http://www.gseis.ucla.edu/courses/ed231c/notes3/mlogit1.html>

Appendix 1. Table of Out-Of-Pocket Expenses by Coverage of Medicare

out-of-pocket expenses	Coverage of Medicare		Total
	Yes	No	
Less than \$1,000	3759	200	3959
	70.95	3.78	74.73
	94.95	5.05	
	74.24	85.11	
\$1,000 to \$5,000	1177	30	1207
	22.22	0.57	22.78
	97.51	2.49	
	23.25	12.77	
\$5,000 to \$7,500	74	4	78
	1.4	0.08	1.47
	94.87	5.13	
	1.46	1.70	
\$7,500 to \$10,000	53	1	54
	1.00	0.02	1.02
	98.15	1.85	
	1.05	0.43	
Total	5063	235	5298
	95.56	4.44	100.00

Statistics for Table of out-of-pocket expenses by Medicare

Statistic	DF	Value	Probability
Chi-Square	3	15.3133	0.0016
Likelihood Ratio Chi-Square	3	17.3658	0.0006
Mantel-Haenszel Chi-Square	1	10.6917	0.0011
Phi Coefficient		0.0538	
Contingency Coefficient		0.0537	
Cramer's V		0.05	

Appendix 2. Table of Out-of-Pocket Expenses by Coverage of Medicaid

frequency percent row percent column percent out-of-pocket expenses	Coverage of Medicaid		Total
	Yes	No	
Less than \$1,000	1188	7373	8561
	11.90	73.88	85.78
	13.88	86.12	
	94.66	84.50	
\$1,000 to \$5,000	56	1166	1222
	0.56	11.68	12.24
	4.58	95.42	
	4.46	13.36	
\$5,000 to \$7,500	3	77	80
	0.03	0.77	0.80
	3.75	96.25	
	0.24	0.88	
\$7,500 to \$10,000	8	109	117
	0.08	1.09	1.17
	6.84	36.16	
	0.64	1.25	
Total	1255	8725	9980
	12.58	87.42	100.00

Statistics for Table of out-of-pocket expenses by Medicaid

Statistic	DF	Value	Probability
Chi-Square	3	93.3711	<.0001
Likelihood Ratio Chi-Square	3	115.4313	<.0001
Mantel-Haenszel Chi-Square	1	69.0036	<.0001
Phi Coefficient		0.0967	
Contingency Coefficient		0.0963	
Cramer's V		0.0967	

Appendix 3. Table of Out-of-Pocket Expenses by Possession of Government Insurance

Frequency percent row percent column percent out-of-pocket expenses	Possession of government insurance		Total
	Yes	No	
Less than \$1,000	344	8227	8571
	3.44	82.35	85.80
	4.01	95.66	
	89.12	85.66	
\$1,000 to \$5,000	36	1186	1222
	0.36	11.87	12.23
	2.95	97.05	
	9.33	12.35	
\$5,000 to \$7,500	3	77	80
	0.03	0.77	0.80
	3.75	96.25	
	0.78	0.80	
\$7,500 to \$10,000	3	114	117
	0.03	1.14	1.17
	2.56	97.44	
	0.78	1.19	
Total	386	9604	9990
	3.86	96.14	100.00

Statistics for Table of out-of-pocket expenses by possession of government insurance

Statistic	DF	Value	Probability
Chi-Square	3	3.8234	0.2812
Likelihood Ratio Chi-Square	3	4.1265	0.2481
Mantel-Haenszel Chi-Square	1	2.9888	0.0838
Phi Coefficient		0.0196	
Contingency Coefficient		0.0196	
Cramer's V		0.0196	

Appendix 4. Table of Out-of-Pocket Expenses by Possession of Other Insurance

frequency percent row percent column percent out-of-pocket expenses	Possession of other insurance		Total
	Yes	No	
Less than \$1,000	5496	1223	6719
	67.78	15.08	82.86
	81.80	18.20	
	83.37	80.62	
\$1,000 to \$5,000	954	257	1211
	11.76	3.17	14.93
	78.78	21.22	
	14.47	16.94	
\$5,000 to \$7,500	62	16	78
	0.76	0.20	0.96
	79.49	20.51	
	0.94	1.05	
\$7,500 to \$10,000	80	21	101
	0.99	0.26	1.25
	79.21	20.79	
	1.21	1.38	
Total	6592	1517	8109
	81.29	18.71	100.00

Statistics for Table of out-of-pocket expenses by possession of other insurance

Statistic	DF	Value	Probability
Chi-Square	3	6.6195	0.0851
Likelihood Ratio Chi-Square	3	6.4536	0.0915
Mantel-Haenszel Chi-Square	1	4.9334	0.0263
Phi Coefficient		0.0286	
Contingency Coefficient		0.0286	
Cramer's V		0.0286	

Appendix 5. Table of Change in Health Conditions by Out-of-Pocket Expenses

Frequency percent row percent column percent out-of-pocket expenses	Change in health conditions			Total
	Better	Same	Worse	
Less than \$1,000	417	2889	1533	4839
	8.46	58.61	31.10	98.17
	8.62	59.70	31.68	
	98.82	99.11	96.29	
\$1,000 to \$5,000	3	7	11	21
	0.06	0.14	0.22	0.43
	14.29	33.33	52.38	
	0.71	0.24	0.69	
\$5,000 to \$7,500	0	1	2	3
	0	0.02	0.04	0.06
	0	33.33	66.67	
	0	0.03	0.13	
\$7,500 to \$10,000	2	18	46	66
	0.04	0.37	0.93	1.34
	3.03	27.27	69.70	
	0.47	0.62	2.89	
Total	422	2915	1592	4929
	8.56	59.14	32.30	100.00

Statistics for Table of change in health conditions by out-of-pocket expenses

Statistic	DF	Value	Probability
Chi-Square	3	50.6041	<.0001
Likelihood Ratio Chi-Square	3	47.0282	<.0001
Mantel-Haenszel Chi-Square	1	37.7688	<.0001
Phi Coefficient		0.1013	
Contingency Coefficient		0.1008	
Cramer's V		0.0716	