

Running head: PREDICTING COGNITIVE CHANGE WITH HEALTH BEHAVIORS

**DO HEALTH BEHAVIORS AFFECT COGNITIVE CHANGE  
SIMILARLY ACROSS ABILITIES?**

Faika A. K. Zanjani,  
K. Warner Schaie, & Sherry L. Willis  
Department of Human Development and Family Studies  
Gerontology Center  
Pennsylvania State University

Presented at the Bi-Annual Meeting of the Cognitive Aging Conference, Atlanta, GA., April 1-4, 2004.

### Abstract

Cognitive gain and decline, ability specific (e.g. Inductive Reasoning, Verbal Comprehension, Perceptual Speed, Spatial Orientation, Numeric Facility, Verbal Memory) and global (e.g. IQ (intelligence quotient), EQ (education quotient)), were predicted from eight health behavior domains: smoking abstinence, alcohol use, food consumption, food preparation, exercise, seat belt use, dental care, and medical check-ups. 970 Seattle Longitudinal Study participants who had 1991 and 1998 cognitive test data and 1993 health behavior data were included in the current investigation. Mean age for sample was 65.39 years (Range= 29-96; SD= 14.37) and mean education was 15.43 years (Range= 7-20; SD= 2.70). To examine age group differences the sample was divided into three age groups 1) 29-54 year olds (N=244); 2) 55-67 year olds (N=237); and 3) 68-96 year olds (N=489).

The statistical criterion for “gain” and “decline” was one standard error of measurement (SEM) above or below their 1991 cognitive score. Logistic regression was used to predict change in cognitive ability from the health behavior domains. After controlling for age, income, education, and simultaneously accounting for all other health behavior domains: results indicated that in the total sample, Exercise significantly predicted gain in IQ, Alcohol Consumption significantly predicted gain in EQ, Exercise significantly predicted gain in Inductive Reasoning, Food Preparation significantly predicted gain in Spatial Ability, Food Consumption, Seat Belt Use, Medical Check-ups significantly predicted decline in Spatial Ability; Medical Check-ups significantly predicted decline in Number Ability; and Food Preparation significantly predicted gain in Verbal Memory. Health behaviors did not predict gain or decline in either Verbal Ability or Perceptual Speed, gain in Number Ability, or decline in IQ and EQ. Although these results imply that health behaviors do not predict cognitive change similarly across all abilities, it was shown that 7-year cognitive change can be predicted from some health behaviors assessed five year prior to cognitive follow-up.

When examining age group differences, divergent patterns of health behavior predictors for cognitive change emerged, all eight health behaviors emerged as significant predictors for at least one of the age groups, implying the need to examine health behavior effects on cognitive change separately and by age groups.

## **DO HEALTH BEHAVIORS AFFECT COGNITIVE CHANGE SIMILARLY ACROSS ABILITIES?**

Health behaviors are a vital component in explaining individual differences in physical and psychological development into old age and have been recognized as one mechanism that can influence the compression of morbidity (Fries, 1983). Health behaviors have also been recognized as one possible path involved in improving societal health conditions (U.S. Department of Health, Education, and Welfare 1979). The empirical literatures on health behaviors have shown health behavior influences on cognitive performance, mortality, and disability outcomes (Blumenthal, et. al., 1991; Hawkins & Anderson, 1996; McGinnus & Foege, 1993).

The current study is focused on predicting cognitive change, using eight specific health behavior domains: smoking, alcohol, food preparation, food consumption, exercise, seat belt use, dental care, and medical check-ups. While there is research on cognitive ability and health behaviors, finding longitudinal studies examining health behavior effects on cognitive change is limited.

There is a limited amount of research on general health behaviors and cognitive ability. However, within the existing literature the focus is on specific health behaviors and their association with cognitive ability. Therefore, the associations between specific health behaviors and cognitive ability will be discussed.

It is important to note the directionality of the reviewed literature. Health behavior and cognitive ability research is generally represented in a uni-directional manner with the specified health behavior thought to affect cognitive performance using a cross-sectional design rather than longitudinal methods, leaving the claim of causality to be questionable (Schaie, 1996). Nevertheless, the literature reviewed below remains informative in identifying associations between specific health behaviors and cognitive ability.

### **Smoking and Cognitive Ability**

Studies that have compared groups of individuals on their smoking status have shown a negative association between smoking and cognitive performance throughout most of the lifespan (Carmelli, Swan, Reed, Schellenberg, & Christian, 1999; Elmwood, Gallacher, Hopkinson, Pickering, Rabbit, Stollery, Brayne, Huppert, Bayer, 1999; Foulds, Stapleton, Bell, McSorley, & Russell, 1996). Foulds, et al., (1996) found smokers to perform cognitively worse than nonsmokers in their population of 18 to 39 year olds. The Elmwood, et al., (1999) study of men aged 55-69 found that current smokers had the lowest scores on cognitive performance relative to men who have never smoked or who were ex-smokers. Carmelli et al., (1999) also found smoking to be associated with poor cognitive performance in white male veterans aged 59 to 69 years.

### **Alcohol and Cognitive Ability**

The literature on alcohol consumption and cognitive ability suggests that individuals that sustain from alcohol perform better cognitively. However, the literature also indicates that light alcohol intake may act as a protective factor for age-related change in cognitive performance. Higher levels of cognitive performance have been associated with lower levels of alcohol consumption across the adult lifespan (Christian, Reed, Caremelli, & Page, 1995; Span & Earlywine, 1999). However, there is also an apparent protective effect on cognitive performance found among middle to young-old adults, with light drinking modifying the age-related cognitive trajectory (Carmelli, et al., 1999). Alcohol has also been shown to have both long-term and short-term effects on cognitive performance. When comparing alcoholics vs. nonalcoholics, alcoholics show relatively more deficits in cognitive performance for individuals at all

adult ages (Arbuckle, Chaikelson, & Gold, 1994; Christian et al., 1995; Hendrie, Gao, Hall, & Hui, 1996; Parsons, 1998; Nixon, 1994; Williams & Skinner, 1990). In addition, an increased consumption of alcohol over time has been associated with a decline in specific cognitive performance for middle-aged and older women (Edelstein, Kritz-Silverstein, & Barrett-Connor, 1999).

### **Nutrition and Cognitive Ability**

The literature has shown that positive nutrition behaviors have a positive affect on both child and adult cognitive performance. Thatcher, McAlaster, Lester, and Cantor (1984) found a positive relationship between carbohydrate intake and reading achievement in young and adolescent children. In college-aged adults, an evening meal was found to improve performance on logical reasoning and caffeine was found to improve performance on cognitive tasks that require attention (Smith, Maben, & Brockman, 1994). Smith, Kendrick, Maben, and Salmon (1994) found that college students who ate breakfast had improved performance on free recall and memory recognition tasks but impaired accuracy on logical reasoning tasks. In the same study, caffeine intake was also found to have a positive effect on performance of semantic memory, logical reasoning, free recall, and recognition memory tasks. On the other hand, a significant reduction in food intake had a negative effect on cognitive performance in young and middle-aged adults (Green, Elliman, & Rogers, 1995; Green, Elliman, & Rogers, 1997; Rogers & Green, 1993).

### **Exercise and Cognitive Ability**

Physical exercise has been shown to have both a short-term and long-term positive effect on cognitive performance. Experimental studies have generally found that exercise has a beneficial short-term effect on cognitive performance for adults throughout the lifespan (Hawkins & Anderson, 1996; Kramer, Hahn, Cohen, Banich, McAuley, Harrison, Chason, Vakil, Bardell, Boileau, & Colcombe, 1999). In addition, exercise status has also been found to predict individual cognitive performance (Lochbaum, 1999) while intensive exercise has not been found to have a negative effect on cognitive performance (Zerfaz, 1991).

Exercise can intervene in the cognitive trajectory and function as a protective or modifying factor in age-related cognitive decline. Exercise has been found to positively modify age-related changes in reaction times (Emery, Huppert, & Schein, 1995). Older individuals that are fit often process cognitive information more efficiently than those that are not fit (Chodzko-Zajko, 1991).

### **Driving Behaviors and Cognitive Ability**

There have not been any direct investigations of the effect of cognitive performance on seat belt use. However, the literature does provide some insight on safe driving regarding the relationship between cognitive ability and driving behaviors. Safe driving behavior is a concern for both young, inexperienced drivers and older, experienced drivers, but for varying reasons. In the young, the reason for concern can be due to a lack of experience in driving. However in older drivers, there is a concern due to age-related changes in the senses and cognitive ability (Dobbs, Heller, & Schopflocher, 1998). One study found that drivers above the age of 65 that have been involved in motor vehicle accidents perform relatively less well on tests of visuoconstructive ability (spatial), visuospatial memory (spatial memory), and psychomotor speed (speed of processing) when compared to drivers that have not have their license suspended or have not been involved in car accidents (Lundberg, Hakamies-Blomqvist, Almkvist, & Johansson (1998). The same study also indicated that an analysis of an individual's visuoconstructive ability, visuospatial memory, and verbal episodic memory can be used to classify an individual's motor vehicle accident status; thus being useful in targeting unsafe drivers.

Because the current investigation is interested in examining seat belt use in individuals across the lifespan, it may be relevant to explore the literature associating cognition and general safety behaviors. Coppens (1986) used infants and children to examine their safety behavior. Coppens found that an

understanding of causal reasoning (inductive reasoning) and a reflective cognitive style (memory) can promote safety behavior. While it is understood that children do not drive, their environment is filled with qualitatively different risk. Thus, the cognition and safety association found in Coppens' (1986) study provides insight into how cognitive ability is associated with general safety behaviors in children. Thus, an extended conclusion from Coppens' study may be that an individual's level of inductive reasoning and memory of events may determine safe driving, which might extend to safety belt use.

### **Medical Service Utilization and Cognitive Ability**

There is evidence that heart disease (Almeida & Flicker, 2001; Almeida & Tamai, 2001; Rabbitt, Watson, Donlan, McInnes, Horan, Pendleton, & Clauge, 2002; Seeman, McEwen, Rowe, & Singer, 2001), chronic obstructive pulmonary disease (Fioravanti, Nacca, Amati, Buckley, & Bisetti, 1995; Incalzi, Gemma, Marra, Muzzolon, Capparella, Carbonin, 1993), diabetes (Jackson-Guilford, Leander, & Nisenbaum, 2000; McCarthy, Lindgren, Mengeling, Tsalikian, & Engvall, 2002), and pneumonia (Iwamoto, Shimizu, Ami, Yoneda, Imamura, & Takasaki, 2000; Medina-Walpole & McCormick, 1998) can all negatively affect cognitive competence. With proper health care utilization, the diagnosis and management of these diseases can possibly deter negative cognitive changes.

In summary, there are two specific research questions addressed in this study. 1) Do health behaviors predict cognitive change? 2) If health behaviors do predict cognitive change, within separate age groups, does the pattern of health behavior predictors vary relative to the total sample?

## **Methods**

### **Participants/Procedure**

970 Seattle Longitudinal Study participants who had 1991 and 1998 cognitive test data and 1993 health behavior data were included in the current investigation. Mean age for sample was 65.39 years (Range= 29-96; SD= 14.37) and mean education was 15.43 years (Range= 7-20; SD= 2.70). To examine age group differences the sample was divided into three age groups 1) 29-54 year olds ( $N=244$ ); 2) 55-67 year olds ( $N=237$ ); and 3) 68-96 year olds ( $N=489$ ).

The subsample of participants were selected from the Seattle Longitudinal Study (SLS), which at that time extended over 37-years assessing multilevel and longitudinal data on individuals between the ages of 22 and 96. SLS participants who had taken part in the 1993 Health Behavior Questionnaire (HBQ) and had 1991 and 1998 cognitive data were used for the current investigation. Participants in the 1993 data collection were all recruited from their previous participation in the 1989 (family) or 1991 (longitudinal) SLS wave. Longitudinal participants were volunteers recruited by age and sex random draws from, a health maintenance organization in the Western, Washington state area.

All longitudinal and family study participants tested in 1989 or 1991 were mailed the HBQ in 1993. The return rate for the survey was 82.5%. Only health behavior information was obtained from the 1993 data collection, all other variables (i.e. age, income, education, cognitive ability) were obtained from previous participation in the 1991 and 1998 SLS waves.

### **Selectivity of the Sample**

Attrition analyses indicated that the selected sample, compared to the 1991 parent sample, were significantly younger, had higher levels of education, had higher levels of income, and had higher levels of cognitive abilities, across ability and globally.

### **Measures/Material**

All subjects in the Seattle Longitudinal Study are given an extensive battery consisting up to 29 tests. The tests are all pencil-paper that were administered as part of broader psychometric battery that extended from 2-5 hrs. All subjects were tested partly in small group session and partly as a homework package that is required to be mailed back when completed. From the larger 1991/1998 batteries, a limited number

of measures were used to assess cognitive ability and demographic characteristics. From the 1993 data, health behavior information was only collected.

### **Independent Variables**

#### Health Behavior Domains

Health behaviors were assessed using the 1993 Health Behavior Questionnaire (HBQ). Factor analysis was conducted using 26 items to create an eight-factor structure (Caskie, Schaie, & Willis, 2000) depicted in Table 2. These eight factors represent the following health behavior domains: Smoking, Alcohol, Food Consumption, Food Preparation, Exercise, Seat-Belt Use, Dental Care, and Medical Check-ups. Depicted in Tables 1 and 2 is the specific coding and conceptualization for each health behavior item, with larger numbers representing more positive conceptualizations of that specific behavior.

#### Demographic Characteristics

Demographic variables were assessed using open-ended and multiple-choice responses obtained from the 1998 Life Complexity Inventory (LCI) (Gribbin, Schaie, & Parham, 1980). For this study, the specific demographic variables that were included in the analysis were age, education, and income.

### **Dependent Variable**

#### Cognitive Ability

Twenty cognitive tests were used to measure the six cognitive abilities structure. The six-ability factor structure was developed in previous research (Schaie, Dutta, & Willis, 1991), depicted in Table 3. These six cognitive abilities are Inductive Reasoning, Spatial Ability, Perceptual Speed, Numeric Ability, Verbal Ability, and Verbal Memory. In addition, two global measurements of cognitive ability were also assessed (e.g. IQ, QE) The statistical criterion for “gain” and “decline” in these abilities was one standard error of measurement (SEM) above or below their 1991 cognitive score, compared to 1998 cognitive score.

*Inductive Reasoning* is the ability to recognize and understand novel concepts or relationships; it involves the solution of logical problems, and the ability to foresee and plan. The ability was assessed by four tests: PMA Reasoning test (Thurstone & Thurstone, 1949), ADEPT Letter Series test (Blieszner, Willis, & Baltes, 1981), Word Series test (Schaie, 1985), and Number Series test (Ekstrom, French, Harman, & Derman, 1976)

*Spatial Orientation* is the ability to visualize and mentally manipulate spatial configurations in two or three dimensions, to maintain orientation with respect to spatial objects, and to perceive relationships among objects in space. This ability was measured by four tests: PMA Space test (Thurstone, 1948), Object Rotation test (Schaie, 1985), Alphanumeric Rotation test (Willis & Schaie, 1983), and Cube Comparison test (Ekstrom et al., 1976)

*Perceptual Speed* is the ability to find figures, make comparisons, and carry out other simple tasks involving visual perception with speed and accuracy. This ability was assessed by three measures: Identical Pictures test (Ekstrom et al, 1976), Finding A’s test (Ekstrom et al., 1976), and Number Comparison test (Ekstrom et al., 1976)

*Numeric Facility* is the ability to understand numerical relationships, to work with figures, and to solve simple quantitative problems rapidly and accurately. The ability was assessed by three tests: PMA Number test (Thurstone 1948), Addition test (Ekstrom et al., 1976), and Subtraction and Multiplication test (Ekstrom et al., 1976).

*Verbal Comprehension* is the ability to understand ideas expressed in words. The ability was assessed by three tests: PMA Verbal Meaning test (Thurstone 1948), ETS Vocabulary V-2 (Ekstrom et al., 1976), and ETS Vocabulary V-4 (Ekstrom et al., 1976).

*Verbal Memory* is the ability that involves the memorization and recall of meaningful words. The ability was assessed by three tests: Immediate Recall test (Zelinski, Gilewski, & Schaie, 1993), Delayed Recall test (Zelinski, Gilewski, & Schaie, 1993), and PMA Word Fluency test (Thurstone & Thurstone, 1949).

*Educational Aptitude* (EQ) is a composite score suggested by T.G. Thurstone (1958). This composite combines measures from PMA Verbal Meaning and Reasoning Abilities (e.g.  $EQ = 2(\text{Verbal}) + \text{Reasoning}$ ).

*Intellectual Quotient* (IQ) is a composite score suggested by the Thurstones (1949). This composite combines measures from PMA Verbal Meaning, Spatial, Reasoning Abilities, Number, and Word Fluency (e.g.  $IQ = \text{Verbal Meaning} + \text{Space} + 2(\text{Reasoning}) + 2(\text{Number}) + \text{Word Fluency}$ ).

### Results

There were two specific questions addressed in this study. 1) Do health behaviors predict cognitive change? 2) If health behaviors do predict cognitive change, within separate age groups, does the pattern of health behavior predictors vary relative to the total sample? Logistic regression analyses were performed for the total sample and for age groups.

#### **Significant Predictors for cognitive change in the Total Sample and in Age Groups**

Tables 4 depict logistic regression results for the probability for gain and decline across cognitive abilities for the total sample, controlling for age, education, and income. There were no significant health behaviors that predicted change in, Verbal Comprehension, and Perceptual Speed. The significant health behaviors for IQ are Exercise ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that lower levels of exercise predicted gain in IQ. The significant health behaviors for EQ are Alcohol Consumption ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that better alcohol consumption predicted gain in EQ. The significant health behaviors for Inductive Reasoning are Exercise ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that positive levels of exercise predicted gain in Inductive Reasoning. The significant health behaviors for Spatial Orientation are Food Preparation ( $p < .05$ ) for gain and Food Consumption ( $p < .05$ ), Seat Belt Use ( $p < .05$ ), and Medical Check-ups ( $p < .01$ ) for decline. The effects indicated that poorer levels of food preparation predicted gain in Spatial Orientation; and poorer levels of food consumption and positive levels of seat belt use and medical check-up predicted decline in Spatial Orientation. The significant health behaviors for Numeric Facility are Medical Check-ups ( $p < .05$ ) for decline and no significant health behaviors for gain. The effects indicated that positive levels of medical check-ups predicted gain in Numeric Facility. The significant health behaviors for Verbal Memory are Food Preparation ( $p < .05$ ) for gain and no significant health behaviors for decline. The effects indicated that positive levels of food preparation predicted gain in Verbal Comprehension.

#### **Significant Predictors for cognitive change in Age Groups**

##### Age Group #1: Young Adults

Tables 5 depict logistic regression results for the probability for gain and decline across cognitive abilities for young adults, controlling for age, education, and income. There were no significant health behaviors that predicted change in QE, Spatial Orientation, Perceptual Speed, and Verbal Memory. The significant health behaviors for IQ are Food Consumption ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that lower levels of food consumption predicted gain in IQ. The significant health behaviors for Inductive Reasoning are Seat Belt Use ( $p < .05$ ) for gain and Alcohol Consumption for decline. The effects indicated that poorer levels of seat belt use predicted gain in Inductive Reasoning and better alcohol consumption predicted decline in Inductive Reasoning. The significant health behaviors for Verbal Compression are Smoking ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that poorer levels of smoking predicted gain

in Verbal Comprehension. The significant health behaviors for Numeric Facility are Food Consumption ( $p < .05$ ) for gain and no significant health behaviors for decline. The effects indicated that poorer levels of food consumption predicted gain in Numeric Facility.

#### Age Group #2: Middle-Aged Adults

Tables 6 depict logistic regression results for the probability for gain and decline across cognitive abilities for middle-aged adults, controlling for age, education, and income. There were no significant health behaviors that predicted change in QE, Inductive Reasoning, Spatial Orientation, and Verbal Comprehension. The significant health behaviors for IQ are Food Preparation ( $p < .05$ ) and Medical Check-ups ( $p < .05$ ) for gain and no significant health behaviors for decline. The effects indicated that better levels of food preparation and poorer levels of medical check-ups predicted gain in IQ. The significant health behaviors for Numeric Facility are Food Preparation ( $p < .05$ ) and Seat Belt Use ( $p < .05$ ) for gain and no significant health behaviors for decline. The effects indicated that better levels of food consumption and poorer levels of seat belt use predicted gain in Numeric Facility. The significant health behaviors for Perceptual Speed are Food Preparation ( $p < .05$ ) for gain and there were no significant health behaviors for decline. The effects indicated that better levels of food preparation predicted gain in Perceptual Speed. The significant health behaviors for Verbal Memory are Medical Check-ups ( $p < .05$ ) for gain; and Dental Care for decline. The effects indicated that better levels of medical check-ups predicted gain in Verbal Memory; and better levels of dental care predicted decline in Verbal Memory.

#### Age Group #3: Old Adults

Tables 7 depict logistic regression results for the probability for gain and decline across cognitive abilities for older adults, controlling for age, education, and income. There were no significant health behaviors that predicted change in IQ, Inductive Reasoning, and Verbal Comprehension. The significant health behaviors for QE are Food Preparation ( $p < .05$ ) for gain and Exercise ( $p < .05$ ) for decline. The effects indicated that lower levels of food preparation predicted gain in QE; and lower levels of exercise predicted decline in QE. The significant health behaviors for Spatial Orientation are Food Consumption ( $p < .05$ ) and Medical Check-ups ( $p < .05$ ) for decline and no significant health behaviors for gain. The effects indicated that poorer levels of food consumption and better level of medical check-ups predicted decline in Spatial Orientation. The significant health behaviors for Numeric Ability are Medical Check-ups ( $p < .05$ ) for decline and there were no significant health behaviors for gain. The effect for medical check-ups indicated that better levels of medical check-ups predicted decline in Numeric Facility. The significant health behaviors for Perceptual Speed are Food Consumption ( $p < .05$ ) for decline and no significant health behaviors for gain. The effect for food consumption indicated that poorer levels of food consumption predicted decline in Perceptual Speed. The significant health behaviors for Verbal Memory are Smoking ( $p < .05$ ), Food Preparation ( $p < .05$ ), and Seat Belt Use ( $p < .05$ ) for gain and no significant health behaviors for decline. The effects indicated that poorer levels of smoking and seat belt use and better levels of food preparation predicted gain in Verbal Memory.

### **Discussion**

There were two specific questions addressed in this study. 1) Do health behaviors predict cognitive change? 2) If health behaviors do predict cognitive change, within separate age groups, does the pattern of health behavior predictors vary relative to the total sample? Logistic regression analyses were performed for the total sample and for age groups.

Our results did indeed indicate that health behaviors predict cognitive change for seven year period, both preventive and risk health behaviors, even after controlling for age, education, and income. In certain circumstances, health behaviors explained beyond demographic differences (i.e. Total Sample: Verbal Memory gain; Young Adults: IQ gain, Inductive Reasoning decline, Verbal Comprehension gain,

Numeric Facility gain; Middle-Aged adults: IQ gain and Verbal Memory gain and decline, and Perceptual Speed decline and Verbal Memory gain). In addition, the same health behavior was not found to predict gain and decline within the same cognitive indicator. In addition, the pattern of health behavior predictors varies when separate age groups are analyzed for the same cognitive predictors. We do not generally find cognitive ability change being predicted by the same health behavior across groups.

Additionally, our results were not always consistent with positive levels of health behaviors predicting gain in cognitive ability and negative levels predicting decline in cognitive ability. For example, in the total sample, poorer exercise behaviors gain in IQ; poorer levels of food preparation predict gain in Spatial Orientation; positive levels of seat belt use predict decline in Spatial Orientation; and positive levels of medical check-up predicted cognitive decline in Numeric Facility. In the youngest age group all the effects were counterintuitive, with poor health behavior predicting gain and positive health behavior predicting decline. However in the two older age groups, counterintuitive effects were not found as frequently.

#### LIMITATIONS OF RESEARCH

When interpreting the findings of this study, it is important to consider some limitations. First, the sample used in the current study was not a random sample. All the participants are involved in the Seattle Longitudinal Study (SLS), a longitudinal study that has been progressing since 1956. The subjects were recruited from a health maintenance organization (HMO) and resided in the greater Seattle, Washington area. This population is not only part of an HMO, implying regular health check-ups and health coverage, but also a population that is somewhat economically and educationally advantaged.

Second, the individual age groups did not have equivalent sample sizes. Variation in sample size can result in attenuation for the smaller sized groups. This finding may imply that if there were equal sample sizes across groups, our results would have been stronger for the groups that currently have relatively smaller sample sizes. This would also have been true if the ratio for individual that had gained declined were equal.

#### Acknowledgements

The research was supported by a grant from the National Institute on Aging (R37 AG08055) to K. Warner Schaie and a grant from the National Institute of Mental Health (5 T32 MH18904) awarded to Steve Zarit. We gratefully acknowledge the enthusiastic cooperation of members and staff of Group Health Cooperative of Puget Sound. Correspondence concerning this presentation should be addressed to Faika A. K. Zanjani at Pennsylvania State University, 10 Henderson South, University Park, PA 16802 email: [faz106@psu.edu](mailto:faz106@psu.edu).

## References

- Blieszner, R., Willis, S. L., & Baltes, P. B. (1981). Training research in aging on the fluid ability of inductive reasoning. Journal of Applied Developmental Psychology, *2*, 247-265.
- Ekstrom, R. B. French, J. W., Harman, H., & Derman, D. (1976). Kit of factor-referenced cognitive tests (rev. ed.). Princeton, NJ: Educational Testing Service.
- Gribbin, K., Schaie, K. W., & Parham, I. A. (1980). Complexity of lifestyle and maintenance of intellectual abilities. Journal of Social Issues, *36*, 47-61.
- Hultsch, D.F., Hammer, M., and Small, B.J. (1993). Age differences in cognitive performance in later life: relationships to self-reported health and activity life style. Journal of Gerontology, *48* (1), P1-P11.
- Maier, H. C. (1996). Health behaviors in adults: Interrelationships and correlates. Dissertation Abstracts International: Section B: the Sciences & Engineering, *57* (1-B), Jul 1996, 0271.
- Perlmutter, M., & Nyquist, L. (1990). Relationships between self-reported physical and mental intelligence performance across adulthood. Journal of Gerontology: Psychological Science, *45* (4), 145-155.
- Schaie, K. W. (1955). A test of behavioral rigidity. Journal of Abnormal and Social Psychology, *51*, 604-610.
- Schaie, K. W. (1960). Manual for Test of Behavioral Rigidity. Palo Alto, CA: Consulting Psychological Press.
- Schaie, K. W., & Parham, I. A. (1975). Manual for Test of Behavioral Rigidity. Palo Alto, CA: Consulting Psychological Press.
- Schaie, K. W. (1985). Manual for the Schaie-Thurstone Adult Mental Abilities Test (STAMAT). Palo Alto, CA: Consulting Psychological Press.
- Schaie, K. W. (1996). Intellectual development in adulthood: The Seattle Longitudinal Study. New York: Cambridge University Press.
- Schaie, K. W., Dutta, R., & Willis, S. L. (1991). The relationship between rigidity-flexibility and cognitive abilities in adulthood. Psychology and Aging, *6*, 371-386.
- Sobal, J., Revicki, D., & DeForge, B.R. (1992). Patterns of interrelationships among health-promotion behaviors. American Journal of Preventive Medicine, *8*, 351-359.
- Thurstone, L. L. (1948). Primary Mental Abilities. Chicago: University of Chicago Press.
- Thurstone, L. L. & Thurstone, L. L. (1949). Examiner manual for the SRA Primary Mental Abilities Test. Chicago: Science Research Associates.
- Willis, S. L. & Schaie, K. W. (1983). Alphanumeric space test. Unpublished manuscript, Pennsylvania State University, University Park.
- Zelinski, E. M., Gilewski, M. L., & Schaie, K. W. (1979). Age differences for fact vs. inferences. Paper presented at the 87<sup>th</sup> Annual Convention of the American Psychological Association, August 1979, New York.

Table 1.  
Health Behavior Domain Structure and Coding of Health Behavior Items

Health Behavior Items by Domain	Coding
<b>I. No Smoking</b>	
Amount smoked (per day)	1 = 2 or more packs of cigarettes, 5 or more cigars, or 5 or more pipes 2 = 1.5 packs of cigarettes, 4 cigars, or 4 pipes 3 = 1 pack of cigarettes, 3 cigars, or 3 pipes 4 = Half pack of cigarettes, 2 cigars, or 2 pipes 5 = Less than half pack of cigarettes, 1 cigar, or 1 pipe bowl 6 = Does not smoke
<b>II. Alcohol Consumption</b>	
Amount alcohol	The sum of the number of glasses of wine, bottles/cans of beer, and drinks containing hard liquor drank per week was coded as: 1 = More than 14 alcoholic drinks per week 2 = Less than 7 alcoholic drinks per week 3 = 7-14 alcoholic drinks per week
<b>III. Food Consumption</b>	
Amount caffeine	Sum of the amount of caffeinated coffee, amount of caffeinated tea, and caffeinated soda, where each item was on a 5-point scale ranging from “1 = 6 or more cups/day” to “5 = 0 to less than one cup/day.”
Beef consumption	These two items were each coded on a 3-point scale:
Egg yolks consumption	
Consumption of other meat	
	1 = 5-7 days per week 2 = 3-4 days per week 3 = 0-2 days per week Sum of three items assessing consumption of pork, veal, and lamb was coded on a 3-point scale: 1 = More than 4 total servings per week 2 = 3-4 total servings per week 3 = 0-2 total servings per week

(Table A1 continues)

(Table 1 continued)

Health Behavior Item	Coding
	<b>IV. Food Preparation</b>
	Each of these seven items was coded on a 5-point scale:
Eat without butter	1 = never
Read sodium labels	2 = seldom
Buy low sodium	3 = sometimes
Cook low sodium	4 = often
Read fat labels	5 = almost always
Buy low fat	
Cook without butter	
	<b>V. Exercise</b>
Exercise: hours per week	Open-ended responses were coded on a 3-point scale: 1 = Less than 2 hours per week 2 = More than 7 hours per week 3 = 2-7 hours per week
Exercise: times per week	Open-ended responses were coded on a 3-point scale: 1 = Less than 3 times per week 2 = More than 7 times per week 3 = 3-7 times per week
	<b>VI. Seat-Belt Use</b>
Seat Belt: highway	Both items were coded on a 5-point scale:
Seat Belt: town	1 = never 2 = rarely 3 = sometimes 4 = often 5 = always
	<b>VII. Dental Care</b>
Teeth brushing (in past 7 days)	1 = never 2 = once or twice 3 = 3-6 times 4 = once per day 5 = twice per day 6 = 3 or more times per day
Teeth flossing (in past 7 days)	1 = never 2 = 1 or 2 days 3 = 3-6 days 4 = once per day 5 = 2 or more times per day
Dental Check-up	1 = No dental visit in past 12 months 2 = Dental visit for regular check-up, dental problems, or related to dentures

(Table A1 continues)

(Table 1 continued)

Health Behavior Item	Coding
<b>VII. Medical Check-Up</b>	
Vision Check-up	1 = No vision check-up in past 24 months 2 = Vision check-up in past 24 months
Hearing Check-up	1 = No hearing check-up in past 24 months 2 = Hearing check-up in past 24 months
Physical Check-up	1 = No medical check-up 2 = Regular check-up or check-up due to a problem
Cholesterol Check-up	1 = Not at all 2 = Once since 1984 3 = 2-3 times since 1984 4 = 4-6 times since 1984 5 = 7-8 times since 1984 6 = Yearly or more often since 1984
Colon/Rectal Check-up	1 = No colon/rectal check-up in past 12 months 2 = Colon/rectal check-up in past 12 months
Flu Shots	1 = None since 1984 2 = 1-2 shots since 1984 3 = 3-6 shots since 1984 4 = 7-9 shots since 1984 5 = Once a year since 1984

Caskie, G.I.L., Schaie, K.W., & Willis, S.L. (2000, November). Invariance of health behavior factors in adults over two occasions. Paper presented at the annual meeting of the Gerontological Society of America, Washington, DC.

Table 2.  
Health Behavior Domain Factor Solution

HBQ Factor/Item	Standardized Factor Weights			
	YA	MA	YO	OO
<u>Not Smoking</u>				
Amount Smoked	1.000	1.000	1.000	1.00
<u>Alcohol Use</u>				
Amount Alcohol	1.000	1.000	1.000	1.00
<u>Food Consumption</u>				
Amount Caffeine	.270	.325	.325	.120
Beef Consumption	.460	.435	.435	.470
Consumption of other Mean	.200	.320	.320	.490
Egg Yolk Consumption	.180	.310	.310	.560
<u>Food Preparation</u>				
Eat without Butter	.270	.290	.290	.290
Read Sodium Labels	.400	.570	.570	.570
Buy Low Sodium	.490	.650	.650	.650
Cook Low Sodium	.090	.220	.220	.220
Read Fat Labels	.800	.860	.860	.860
Buy Low Fat	.930	.900	.900	.900
Cook without Butter	.230	.320	.320	.320
<u>Exercise</u>				
Exercise: Hours per Week	.743	.743	.743	.743
Exercise: Times per Week	.688	.688	.688	.688
<u>Seat Belt Use</u>				
Seat-Belt: Highway	.888	.888	.888	.888
Seat-Belt: Town	.900	.900	.900	.900
<u>Dental Care</u>				
Teeth Brushing (past 7 days)	.380	.380	.380	.380
Teeth Flossing (past 7 days)	.520	.520	.520	.520
Dental Check-up	.480	.480	.480	.480
<u>Medical Check-Ups</u>				
Vision Check-up	.250	.260	.265	.265
Hearing Check-up	.290	.180	.320	.320
Physical Check-up	.600	.660	.530	.530
Cholesterol Check-up	.390	.510	.400	.400
Colon/Rectal Check-up	.400	.610	.460	.460
Flu Shots	.140	.230	.245	.245

**Caskie, G.I.L., Schaie, K.W., & Willis, S.L. (2000, November). Invariance of health behavior factors in adults over two occasions. Paper presented at the annual meeting of the Gerontological Society of America, Washington, DC.**

Table 3.  
Cognitive Abilities Factor Solution

Cognitive Ability	Factor Loadings					
	Inductive	Spatial	Verbal	Numeric	Perceptual	Memory
<u>Inductive Reasoning</u>						
PMA Reasoning	.934					
Adept Letter Series	.901					
Word Series	.913					
Number Series	.790					
<u>Spatial Ability</u>						
PMA Space		.847				
Object Rotation		.892				
Alphanumeric Rotation		.861				
Cube Comparison		.664				
<u>Verbal Ability</u>						
PMA Verbal			.411		.650	
ETS Vocabulary V-2			.908			
ETS Vocabulary V-4			.903			
<u>Numeric Ability</u>						
PMA Number				.854		
Addition				.944		
Subtraction & Multiplication				.893		
Number Comparison						
<u>Perceptual Speed</u>						
PMA Verbal						
Identical Pictures					.836	
Number Comparison				.243	.611	
Finding A's					.560	
Word Fluency					.360	
<u>Verbal Memory</u>						
Word Fluency			.302			.158
Immediate Recall						.950
Delayed Recall						.946

Schaie, K. W., Dutta, R., & Willis, S. L. (1991). The relationship between rigidity-flexibility and cognitive abilities in adulthood. Psychology and Aging, 6, 371-386.

Table 4  
Logistic Regression Predicting Cognitive Change Using 1993 Health Behavior Domains and Demographics (N=970)

	IQ					
	$\beta$	Gain (N=76)		$\beta$	Decline(N=276)	
		OR	CI		OR	CI
Smoking-1993	0.07	1.01	(0.984-1.052)	-0.00	0.99	(0.981-1.018)
Alcohol-1993	0.02	1.00	(0.981-1.029)	-0.01	0.99	(0.984-1.012)
Food Consumption-1993	-0.07	0.98	(0.962-1.009)	-0.05	0.99	(0.975-1.005)
Food Preparation-1993	0.05	1.01	(0.985-1.037)	-0.01	0.99	(0.983-1.013)
Exercise-1993	-0.15	0.97*	(0.948-0.995)	0.00	1.00	(0.985-1.016)
Seat Belt Use-1993	0.06	1.01	(0.979-1.050)	-0.01	0.99	(0.979-1.013)
Dental Care	-0.00	0.99	(0.973-1.024)	-0.05	0.99	(0.975-1.005)
Medical Check-ups-1993	-0.07	0.98	(0.960-1.013)	0.05	1.01	(0.994-1.029)
Age -1998	-0.25	0.96**	(0.949-0.989)	0.36	1.04***	(1.032-1.062)
Income-1998	-0.01	0.99	(0.935-1.057)	-0.01	0.99	(0.957-1.033)
Education-1998	0.01	1.00	(0.911-1.114)	0.11	1.08**	(1.021-1.146)

Table 4 (continued)

	QE					
	$\beta$	Gain(N=72)		$\beta$	Decline(N=221)	
		OR	CI		OR	CI
Smoking-1993	0.01	1.00	(0.974-1.035)	-0.04	0.98	(0.971-1.008)
Alcohol-1993	0.13	1.02*	(1.001-1.048)	-0.07	0.98	(0.972-1.003)
Food Consumption-1993	-0.07	0.98	(0.962-1.009)	-0.07	0.98	(0.971-1.003)
Food Preparation-1993	-0.09	0.98	(0.958-1.008)	-0.00	0.99	(0.983-1.016)
Exercise-1993	0.04	1.00	(0.983-1.035)	-0.02	0.99	(0.979-1.012)
Seat Belt Use-1993	0.05	1.01	(0.979-1.047)	0.01	1.00	(0.984-1.023)
Dental Care	0.07	1.01	(0.988-1.042)	-0.04	0.99	(0.975-1.007)
Medical Check-ups-1993	0.01	1.00	(0.975-1.031)	0.02	1.00	(0.986-1.023)
Age -1998	-0.16	0.97*	(0.958-1.000)	0.42	1.05***	(1.038-1.072)
Income-1998	-0.00	0.99	(0.938-1.063)	-0.05	0.98	(0.940-1.022)
Education-1998	-0.20	0.87**	(0.786-0.968)	0.10	1.07*	(1.006-1.138)

Table 4 (continued)

	Inductive Reasoning					
	$\beta$	Gain(N=61)		$\beta$	Decline(N=240)	
		OR	CI		OR	CI
Smoking-1993	-0.05	0.98	(0.959-1.016)	0.01	1.00	(0.983-1.022)
Alcohol-1993	-0.14	0.97	(0.948-1.002)	0.06	1.01	(0.997-1.027)
Food Consumption-1993	-0.01	0.99	(0.969-1.028)	-0.05	0.98	(0.974-1.005)
Food Preparation-1993	0.03	1.00	(0.977-1.035)	0.01	1.00	(0.987-1.020)
Exercise-1993	0.18	1.03*	(1.004-1.066)	-0.00	0.99	(0.983-1.015)
Seat Belt Use-1993	-0.07	0.98	(0.957-1.011)	0.02	1.00	(0.986-1.025)
Dental Care	-0.01	0.99	(0.967-1.026)	0.00	1.00	(0.985-1.016)
Medical Check-ups-1993	-0.04	0.99	(0.963-1.022)	-0.02	0.99	(0.977-1.012)
Age -1998	-0.40	0.95***	(0.929-0.972)	0.30	1.04***	(1.025-1.055)
Income-1998	0.02	1.01	(0.944-1.084)	-0.05	0.97	(0.941-1.018)
Education-1998	-0.10	0.93	(0.829-1.043)	0.04	1.02	(0.968-1.091)

Table 4 (continued)

	Space					
	$\beta$	Gain(N=79)		$\beta$	Decline(N=203)	
		OR	CI		OR	CI
Smoking-1993	0.00	0.00	(0.973-1.028)	0.06	1.01	(0.991-1.040)
Alcohol-1993	0.04	0.04	(0.985-1.031)	-0.04	0.99	(0.977-1.009)
Food Consumption-1993	0.04	0.04	(0.983-1.036)	-0.10	0.98*	(0.965-0.997)
Food Preparation-1993	-0.13	-0.13*	(0.952-0.999)	-0.08	0.98	(0.968-1.001)
Exercise-1993	0.02	0.02	(0.981-1.030)	-0.07	0.98	(0.969-1.003)
Seat Belt Use-1993	0.06	0.06	(0.982-1.046)	0.13	1.02*	(1.004-1.054)
Dental Care	-0.03	-0.03	(0.969-1.017)	-0.00	1.00	(0.983-1.017)
Medical Check-ups-1993	-0.00	-0.00	(0.973-1.025)	0.17	1.03**	(1.013-1.053)
Age -1998	-0.25	-0.25**	(0.950-0.988)	0.29	1.03***	(1.021-1.054)
Income-1998	-0.15	-0.15	(0.888-1.002)	0.02	1.00	(0.967-1.053)
Education-1998	0.02	0.02	(0.925-1.121)	0.04	1.03	(0.968-1.099)

Table 4 (continued)

	Verbal					
	$\beta$	Gain(N=48)		$\beta$	Decline(N=92)	
		OR	CI		OR	CI
Smoking-1993	-0.09	0.98	(0.953-1.007)	-0.01	0.99	(0.968-1.027)
Alcohol-1993	0.00	1.00	(0.971-1.031)	-0.02	0.99	(0.974-1.018)
Food Consumption-1993	0.04	1.00	(0.976-1.042)	-0.00	0.99	(0.977-1.024)
Food Preparation-1993	-0.02	0.99	(0.964-1.026)	0.00	1.00	(0.978-1.025)
Exercise-1993	-0.07	0.98	(0.957-1.017)	0.07	1.01	(0.989-1.038)
Seat Belt Use-1993	-0.04	0.99	(0.961-1.023)	-0.07	0.98	(0.960-1.007)
Dental Care	0.01	1.00	(0.972-1.034)	0.08	1.01	(0.991-1.039)
Medical Check-ups-1993	0.15	1.02	(0.994-1.066)	0.07	1.01	(0.987-1.042)
Age -1998	-0.34	0.95***	(0.933-0.982)	0.45	1.05***	(1.033-1.085)
Income-1998	-0.01	0.99	(0.921-1.075)	-0.05	0.97	(0.922-1.038)
Education-1998	-0.24	0.84*	(0.743-0.961)	-0.07	0.95	(0.871-1.035)

Table 4 (continued)

	Number					
	$\beta$	Gain(N=41)		$\beta$	Decline(N=269)	
		OR	CI		OR	CI
Smoking-1993	-0.00	1.00	(0.966-1.035)	-0.04	0.99	(0.973-1.008)
Alcohol-1993	-0.02	0.99	(0.963-1.028)	0.01	1.00	(0.989-1.018)
Food Consumption-1993	-0.11	0.97	(0.948-1.008)	0.00	1.00	(0.986-1.017)
Food Preparation-1993	0.11	1.02	(0.985-1.057)	0.01	1.00	(0.987-1.018)
Exercise-1993	-0.09	0.98	(0.951-1.017)	0.00	1.00	(0.985-1.017)
Seat Belt Use-1993	-0.02	0.99	(0.960-1.030)	-0.05	0.98	(0.972-1.006)
Dental Care	-0.10	0.98	(0.949-1.012)	0.01	1.00	(0.988-1.019)
Medical Check-ups-1993	-0.00	0.99	(0.964-1.036)	0.09	1.01*	(1.000-1.036)
Age -1998	-0.33	0.95***	(0.933-0.985)	0.33	1.04***	(1.028-1.058)
Income-1998	-0.09	0.96	(0.891-1.047)	-0.05	0.98	(0.943-1.018)
Education-1998	0.03	1.02	(0.895-1.169)	0.05	1.04	(0.982-1.103)

Table 4 (continued)

	Speed					
	$\beta$	<u>Gain(N=39)</u>		$\beta$	<u>Decline(N=312)</u>	
		OR	CI		OR	CI
Smoking-1993	-0.06	0.98	(0.955-1.019)	-0.06	0.98	(0.968-1.001)
Alcohol-1993	-0.01	0.99	(0.967-1.030)	0.01	1.00	(0.990-1.017)
Food Consumption-1993	-0.00	0.99	(0.964-1.035)	-0.04	0.99	(0.976-1.005)
Food Preparation-1993	0.14	1.02	(0.990-1.064)	0.01	1.00	(0.989-1.018)
Exercise-1993	-0.13	0.97	(0.943-1.010)	0.00	1.00	(0.986-1.015)
Seat Belt Use-1993	-0.02	0.99	(0.957-1.033)	0.01	1.00	(0.986-1.020)
Dental Care	-0.04	0.99	(0.959-1.027)	-0.05	0.99	(0.976-1.005)
Medical Check-ups-1993	-0.18	0.96	(0.932-1.002)	0.05	1.01	(0.994-1.027)
Age -1998	-0.11	0.98	(0.958-1.013)	0.26	1.03***	(1.021-1.048)
Income-1998	0.07	1.02	(0.945-1.117)	-0.05	0.97	(0.943-1.014)
Education-1998	0.14	1.10	(0.964-1.267)	0.08	1.05	(1.000-1.118)

Table 4 (continued)

	Memory					
	$\beta$	<u>Gain(N=107)</u>		$\beta$	<u>Decline(N=261)</u>	
		OR	CI		OR	CI
Smoking-1993	-0.03	0.99	(0.970-1.016)	-0.07	0.98	(0.968-1.001)
Alcohol-1993	0.06	1.01	(0.992-1.031)	0.02	1.00	(0.991-1.019)
Food Consumption-1993	-0.04	0.99	(0.970-1.013)	-0.00	1.00	(0.984-1.015)
Food Preparation-1993	0.15	1.02*	(1.005-1.052)	-0.04	0.99	(0.977-1.007)
Exercise-1993	-0.02	0.99	(0.974-1.017)	-0.01	0.99	(0.983-1.013)
Seat Belt Use-1993	-0.09	0.98	(0.959-1.002)	0.02	1.00	(0.987-1.024)
Dental Care	0.04	1.00	(0.986-1.031)	0.07	1.01	(0.998-1.029)
Medical Check-ups-1993	0.03	1.00	(0.982-1.030)	-0.03	0.99	(0.976-1.010)
Age -1998	-0.07	0.99	(0.973-1.009)	0.21	1.02***	(1.014-1.041)
Income-1998	0.07	1.03	(0.978-1.086)	-0.06	0.97	(0.940-1.013)
Education-1998	0.00	1.00	(0.925-1.093)	0.06	1.04	(0.986-1.106)

Note. Underlined values are significant at  $p < .05$ .

OR= Odd Ratio

CI=95% Confidence Intervals

Table 5  
Logistic Regression Predicting Cognitive Change Using 1993 Health Behavior Domains and Demographics for individuals 54 and younger (N=244)

	IQ					
	$\beta$	Gain (N=31)		$\beta$	Decline (N=32)	
		OR	CI		OR	CI
Smoking-1993	0.19	1.03	(0.982-1.094)	-0.00	0.99	(0.957-1.042)
Alcohol-1993	-0.12	0.97	(0.934-1.022)	0.17	1.03	(0.995-1.073)
Food Consumption-1993	-0.25	0.95*	(0.918-0.992)	0.01	1.00	(0.961-1.046)
Food Preparation-1993	0.06	1.01	(0.969-1.057)	-0.20	0.96	(0.923-1.005)
Exercise-1993	-0.16	0.97	(0.931-1.011)	0.16	1.03	(0.987-1.076)
Seat Belt Use-1993	0.10	1.02	(0.968-1.080)	0.00	1.00	(0.955-1.052)
Dental Care	-0.12	0.97	(0.934-1.018)	0.02	1.00	(0.962-1.048)
Medical Check-ups-1993	0.05	1.01	(0.967-1.056)	0.01	1.00	(0.961-1.047)
Age -1998	0.05	1.01	(0.951-1.086)	0.13	1.03	(0.977-1.105)
Income-1998	-0.01	0.99	(0.885-1.119)	-0.18	0.91	(0.821-1.018)
Education-1998	-0.04	0.96	(0.801-1.168)	0.15	1.13	(0.944-1.372)

Table 5 (continued)

	QE					
	$\beta$	Gain (N=20)		$\beta$	Decline (N=18)	
		OR	CI		OR	CI
Smoking-1993	0.00	1.00	(0.951-1.053)	0.07	1.01	(0.952-1.080)
Alcohol-1993	0.10	1.02	(0.973-1.069)	0.05	1.01	(0.961-1.061)
Food Consumption-1993	-0.16	0.97	(0.926-1.016)	0.02	1.00	(0.947-1.064)
Food Preparation-1993	0.05	1.01	(0.959-1.065)	-0.20	0.96	(0.911-1.017)
Exercise-1993	0.02	1.00	(0.956-1.056)	0.28	1.05	(0.994-1.114)
Seat Belt Use-1993	0.07	1.01	(0.951-1.085)	-0.01	0.99	(0.938-1.060)
Dental Care	0.00	1.00	(0.950-1.056)	0.17	1.03	(0.976-1.098)
Medical Check-ups-1993	0.07	1.01	(0.964-1.068)	-0.24	0.95	(0.899-1.011)
Age -1998	-0.03	0.99	(0.920-1.066)	0.48	1.14***	(1.033-1.266)
Income-1998	0.02	1.01	(0.883-1.163)	-0.19	0.90	(0.792-1.039)
Education-1998	-0.10	0.91	(0.735-1.146)	-0.08	0.93	(1.736-1.179)

Table 5 (continued)

	Inductive Reasoning					
	$\beta$	Gain (N=27)		$\beta$	Decline (N=28)	
		OR	CI		OR	CI
Smoking-1993	0.15	1.03	(0.964-1.101)	0.21	1.04	(0.978-1.109)
Alcohol-1993	0.00	1.00	(0.956-1.047)	0.25	1.04*	(1.008-1.091)
Food Consumption-1993	0.22	1.04	(0.988-1.101)	-0.14	0.97	(0.933-1.017)
Food Preparation-1993	-0.04	0.99	(0.948-1.037)	0.18	1.03	(0.986-1.084)
Exercise-1993	-0.02	0.99	(0.950-1.045)	-0.07	0.98	(0.944-1.032)
Seat Belt Use-1993	-0.24	0.94*	(0.908-0.992)	-0.01	0.99	(0.944-1.054)
Dental Care	-0.06	0.98	(0.941-1.037)	0.09	1.01	(0.973-1.067)
Medical Check-ups-1993	-0.16	0.96	(0.923-1.016)	-0.15	0.96	(0.926-1.014)
Age -1998	-0.29	0.92*	(0.866-0.982)	0.12	1.03	(0.967-1.107)
Income-1998	0.07	1.03	(0.918-1.175)	-0.09	0.95	(0.851-1.066)
Education-1998	-0.13	0.89	(0.731-1.101)	-0.02	0.97	(0.806-1.190)

Table 5 (continued)

	Space					
	$\beta$	Gain (N=30)		$\beta$	Decline (N=25)	
		OR	CI		OR	CI
Smoking-1993	0.00	1.00	(0.958-1.045)	0.25	1.04	(0.965-1.141)
Alcohol-1993	-0.09	0.98	(0.940-1.026)	0.03	1.00	(0.961-1.054)
Food Consumption-1993	-0.06	0.98	(0.948-1.029)	-0.13	0.97	(0.934-1.018)
Food Preparation-1993	-0.08	0.98	(0.944-1.027)	-0.02	0.99	(0.951-1.042)
Exercise-1993	0.07	1.01	(0.972-1.057)	-0.13	0.97	(0.933-1.019)
Seat Belt Use-1993	0.10	1.02	(0.969-1.077)	0.16	1.03	(0.952-1.124)
Dental Care	-0.01	0.99	(0.953-1.042)	-0.00	0.99	(0.952-1.049)
Medical Check-ups-1993	0.15	1.03	(0.986-1.076)	0.14	1.02	(0.980-1.081)
Age -1998	-0.08	0.97	(0.920-1.038)	-0.10	0.97	(0.910-1.039)
Income-1998	-0.15	0.92	(0.830-1.034)	-0.01	0.99	(0.873-1.128)
Education-1998	-0.14	0.88	(0.738-1.068)	0.05	1.04	(0.851-1.290)

Table 5 (continued)

	Verbal					
	$\beta$	Gain (N=19)		$\beta$	Decline (N=4)	
		OR	CI		OR	CI
Smoking-1993	-0.23	0.95*	(0.919-0.996)	1.72	1.38	(0.000-999.0)
Alcohol-1993	0.03	1.00	(0.955-1.062)	0.37	1.07	(0.954-1.206)
Food Consumption-1993	0.07	1.01	(0.960-1.071)	-0.11	0.97	(0.841-1.138)
Food Preparation-1993	0.01	1.00	(0.951-1.059)	-0.42	0.92	(0.821-1.045)
Exercise-1993	-0.08	0.98	(0.932-1.039)	0.23	1.04	(0.910-1.195)
Seat Belt Use-1993	0.01	1.00	(0.950-1.060)	2.18	1.58	(0.000-999.0)
Dental Care	-0.05	0.99	(0.936-1.048)	0.61	1.12	(0.953-1.334)
Medical Check-ups-1993	0.25	1.05	(0.995-1.113)	-0.33	0.93	(0.797-1.102)
Age -1998	-0.21	0.94	(0.874-1.013)	2.35	1.92	(0.822-4.483)
Income-1998	-0.09	0.95	(0.831-1.098)	0.32	1.17	(0.747-1.837)
Education-1998	-0.08	0.93	(0.741-1.176)	-0.34	0.75	(0.403-1.404)

Table 5 (continued)

	Number					
	$\beta$	Gain (N=17)		$\beta$	Decline (N=33)	
		OR	CI		OR	CI
Smoking-1993	0.14	1.02	(0.966-1.094)	-0.12	0.97	(0.937-1.017)
Alcohol-1993	-0.14	0.97	(0.913-1.036)	0.03	1.00	(0.969-1.045)
Food Consumption-1993	-0.30	0.94*	(0.899-0.993)	0.24	1.04	(0.994-1.099)
Food Preparation-1993	0.11	1.02	(0.963-1.084)	-0.08	0.98	(0.945-1.025)
Exercise-1993	-0.26	0.95	(0.901-1.008)	0.12	1.02	(0.980-1.068)
Seat Belt Use-1993	0.02	1.00	(0.947-1.068)	-0.01	0.99	(0.950-1.047)
Dental Care	-0.15	0.97	(0.915-1.028)	0.00	1.00	(0.959-1.047)
Medical Check-ups-1993	0.13	1.02	(0.967-1.089)	-0.03	0.99	(0.952-1.035)
Age -1998	-0.25	0.93	(0.856-1.013)	-0.03	0.99	(0.936-1.049)
Income-1998	-0.16	0.92	(0.797-1.064)	0.15	1.07	(0.957-1.217)
Education-1998	-0.10	0.92	(0.720-1.180)	0.00	1.00	(0.833-1.206)

Table 5 (continued)

	Speed					
	$\beta$	<u>Gain (N=18)</u>		$\beta$	<u>Decline (N=47)</u>	
		OR	CI		OR	CI
Smoking-1993	0.00	1.00	(0.955-1.050)	-0.08	0.98	(0.951-1.017)
Alcohol-1993	-0.08	0.98	(0.933-1.038)	-0.01	0.99	(0.964-1.033)
Food Consumption-1993	-0.01	0.99	(0.945-1.051)	0.15	1.02	(0.989-1.072)
Food Preparation-1993	0.07	1.01	(0.961-1.071)	-0.16	0.97	(0.937-1.006)
Exercise-1993	-0.14	0.97	(0.924-1.027)	0.09	1.01	(0.980-1.054)
Seat Belt Use-1993	-0.09	0.98	(0.933-1.029)	0.03	1.00	(0.964-1.053)
Dental Care	-0.02	0.99	(0.942-1.050)	0.09	1.01	(0.980-1.058)
Medical Check-ups-1993	-0.19	0.96	(0.911-1.018)	-0.01	0.99	(0.962-1.035)
Age -1998	0.10	1.03	(0.948-1.119)	0.20	1.05*	(1.001-1.118)
Income-1998	0.02	1.01	(0.881-1.168)	-0.14	0.93	(0.847-1.022)
Education-1998	-0.10	0.91	(0.727-1.156)	0.09	1.08	(0.924-1.269)

Table 5 (continued)

	Memory					
	$\beta$	<u>Gain (N=28)</u>		$\beta$	<u>Decline (N=51)</u>	
		OR	CI		OR	CI
Smoking-1993	0.10	1.02	(0.970-1.074)	-0.09	0.98	(0.952-1.014)
Alcohol-1993	0.17	1.03	(0.992-1.075)	-0.07	0.98	(0.954-1.021)
Food Consumption-1993	0.07	1.01	(0.967-1.061)	0.04	1.00	(0.973-1.046)
Food Preparation-1993	-0.04	0.99	(0.949-1.037)	-0.13	0.97	(0.943-1.010)
Exercise-1993	-0.10	0.98	(0.939-1.025)	0.00	1.00	(0.967-1.036)
Seat Belt Use-1993	-0.06	0.98	(0.940-1.036)	-0.02	0.99	(0.959-1.034)
Dental Care	0.03	1.00	(0.962-1.053)	0.11	1.02	(0.984-1.061)
Medical Check-ups-1993	-0.21	0.95	(0.915-1.004)	0.03	1.00	(0.972-1.043)
Age -1998	0.10	1.03	(0.965-1.101)	0.16	1.04	(0.993-1.106)
Income-1998	0.00	1.00	(0.892-1.125)	0.08	1.04	(0.946-1.153)
Education-1998	0.08	1.06	(0.878-1.302)	-0.10	0.91	(0.789-1.070)

Note. Underlined values are significant at  $p < .05$ .

OR= Odd Ratio

CI=95% Confidence Intervals

Table 6

Logistic Regression Predicting Cognitive Change Using 1993 Health Behavior Domains and Demographics for individuals 55–67 years old (N=237)

	IQ					
	$\beta$	Gain (N=23)		$\beta$	Decline (N=56)	
		OR	CI		OR	CI
Smoking-1993	0.01	1.00	(0.949-1.059)	0.00	1.00	(0.964-1.037)
Alcohol-1993	0.02	1.00	(0.955-1.056)	-0.02	0.99	(0.965-1.027)
Food Consumption-1993	0.19	1.04	(0.978-1.110)	-0.03	0.99	(0.958-1.030)
Food Preparation-1993	0.38	1.07*	(1.012-1.141)	-0.01	0.99	(0.964-1.030)
Exercise-1993	-0.13	0.97	(0.930-0.024)	-0.00	0.99	(0.966-1.032)
Seat Belt Use-1993	0.10	1.02	(0.930-1.125)	0.05	1.01	(0.973-1.055)
Dental Care	-0.13	0.97	(0.923-1.024)	-0.05	0.98	(0.954-1.024)
Medical Check-ups-1993	-0.35	0.93*	(0.891-0.986)	-0.02	0.99	(0.963-1.028)
Age -1998	-0.24	0.89	(0.778-0.019)	0.22	1.11*	(1.017-1.214)
Income-1998	-0.10	0.95	(0.849-1.076)	-0.04	0.98	(0.906-1.059)
Education-1998	0.07	1.05	(0.869-1.267)	0.01	1.00	(0.896-1.152)

Table 6 (continued)

	QE					
	$\beta$	Gain (N=23)		$\beta$	Decline (N=46)	
		OR	CI		OR	CI
Smoking-1993	0.02	1.00	(0.959-1.054)	-0.14	0.96	(0.936-1.003)
Alcohol-1993	0.16	1.03	(0.986-1.076)	-0.06	0.98	(0.954-1.023)
Food Consumption-1993	-0.15	0.96	(0.921-1.015)	-0.02	0.99	(0.956-1.033)
Food Preparation-1993	-0.03	0.99	(0.947-1.042)	-0.17	0.96	(0.933-1.002)
Exercise-1993	0.05	1.01	(0.964-1.060)	0.06	1.01	(0.975-1.050)
Seat Belt Use-1993	0.01	1.00	(0.944-1.064)	0.07	1.01	(0.973-1.063)
Dental Care	0.00	1.00	(0.949-1.054)	-0.15	0.96	(0.932-1.006)
Medical Check-ups-1993	-0.14	0.97	(0.928-1.022)	0.16	1.03	(0.993-1.069)
Age -1998	-0.10	0.95	(0.839-1.076)	0.17	1.09	(0.985-1.204)
Income-1998	-0.19	0.92	(0.824-1.030)	-0.07	0.97	(0.892-1.058)
Education-1998	-0.09	0.93	(0.765-1.128)	0.11	1.07	(0.934-1.236)

Table 6 (continued)

	Inductive Reasoning					
	$\beta$	Gain (N=22)		$\beta$	Decline (N=48)	
		OR	CI		OR	CI
Smoking-1993	0.02	0.02	(0.950-1.063)	0.01	1.00	(0.964-1.045)
Alcohol-1993	-0.19	-0.19	(0.918-1.013)	-0.00	0.99	(0.967-1.033)
Food Consumption-1993	-0.23	-0.23	(0.899-1.003)	0.04	1.01	(0.971-1.053)
Food Preparation-1993	0.22	0.22	(0.987-1.102)	-0.05	0.98	(0.955-1.025)
Exercise-1993	0.14	0.14	(0.974-1.084)	-0.14	0.97	(0.940-1.007)
Seat Belt Use-1993	-0.12	-0.12	(0.926-1.022)	0.03	1.00	(0.965-1.054)
Dental Care	0.08	0.08	(0.962-1.079)	-0.00	1.00	(0.962-1.038)
Medical Check-ups-1993	-0.01	-0.01	(0.949-1.046)	-0.07	0.98	(0.954-1.021)
Age -1998	-0.17	-0.17	(0.807-1.051)	0.25	1.13*	(1.031-1.245)
Income-1998	0.06	0.06	(0.912-1.159)	0.15	1.06	(0.978-1.160)
Education-1998	-0.10	-0.10	(0.765-1.124)	-0.11	0.92	(0.814-1.062)

Table 6 (continued)

	Space					
	$\beta$	Gain (N=18)		$\beta$	Decline (N=38)	
		OR	CI		OR	CI
Smoking-1993	-0.03	0.99	(0.931-1.058)	0.00	1.00	(0.955-1.046)
Alcohol-1993	0.08	1.01	(0.966-1.068)	-0.10	0.98	(0.945-1.019)
Food Consumption-1993	0.00	1.00	(0.943-1.062)	0.01	1.00	(0.960-1.047)
Food Preparation-1993	-0.22	0.95	(0.910-1.011)	-0.10	0.98	(0.943-1.019)
Exercise-1993	-0.21	0.96	(0.912-1.015)	-0.02	0.99	(0.957-1.033)
Seat Belt Use-1993	0.22	1.05	(0.948-1.170)	0.17	1.04	(0.975-1.111)
Dental Care	-0.18	0.96	(0.907-1.021)	-0.14	0.97	(0.931-1.010)
Medical Check-ups-1993	0.01	1.00	(0.952-1.057)	0.17	1.03	(0.993-1.073)
Age -1998	-0.19	0.90	(0.780-1.057)	0.05	1.02	(0.923-1.135)
Income-1998	-0.18	0.92	(0.812-1.053)	0.00	1.00	(0.911-1.094)
Education-1998	0.36	1.28*	(1.025-1.613)	0.03	1.02	(0.900-1.207)

Table 6 (continued)

	Verbal					
	$\beta$	Gain (N=10)		$\beta$	Decline (N=14)	
		OR	CI		OR	CI
Smoking-1993	-0.07	0.98	(0.928-1.048)	0.00	1.00	(0.932-1.077)
Alcohol-1993	-0.22	0.96	(0.867-1.066)	-0.09	0.98	(0.925-1.046)
Food Consumption-1993	-0.11	0.97	(0.898-1.066)	0.37	1.08	(0.990-1.193)
Food Preparation-1993	0.10	1.02	(0.939-1.108)	-0.15	0.97	(0.911-1.032)
Exercise-1993	0.04	1.00	(0.933-1.087)	-0.05	0.99	(0.933-1.050)
Seat Belt Use-1993	3.62	2.27	(0.000-999.0)	-0.08	0.98	(0.924-1.044)
Dental Care	0.33	1.07	(0.968-1.181)	-0.02	0.99	(0.934-1.058)
Medical Check-ups-1993	-0.10	0.98	(0.914-1.055)	0.09	1.01	(0.960-1.082)
Age -1998	-0.28	0.87	(0.715-1.076)	0.13	1.06	(0.909-1.265)
Income-1998	0.09	1.03	(0.864-1.237)	0.10	1.04	(0.903-1.209)
Education-1998	-0.80	0.57**	(0.361-0.860)	-0.30	0.81	(0.618-1.014)

Table 6 (continued)

	Number					
	$\beta$	Gain (N=11)		$\beta$	Decline (N=48)	
		OR	CI		OR	CI
Smoking-1993	0.07	1.01	(0.927-1.115)	-0.05	0.98	(0.951-1.027)
Alcohol-1993	-0.14	0.97	(0.891-1.066)	0.07	1.01	(0.981-1.047)
Food Consumption-1993	0.16	1.03	(0.943-1.138)	0.05	1.01	(0.971-1.053)
Food Preparation-1993	0.63	1.12*	(1.019-1.243)	0.00	1.00	(0.967-1.037)
Exercise-1993	-0.16	0.97	(0.904-1.042)	-0.09	0.98	(0.949-1.017)
Seat Belt Use-1993	-0.29	0.93*	(0.876-0.999)	-0.14	0.96	(0.934-1.005)
Dental Care	-0.26	0.94	(0.880-1.016)	0.04	1.01	(0.971-1.050)
Medical Check-ups-1993	-0.14	0.97	(0.906-1.045)	0.08	1.01	(0.980-1.052)
Age -1998	-0.51	0.78*	(0.633-0.969)	0.23	1.11*	(1.016-1.230)
Income-1998	-0.36	0.85	(0.726-1.0116)	-0.06	0.97	(0.896-1.057)
Education-1998	0.18	1.13	(0.866-1.489)	0.09	1.07	(0.930-1.217)

Table 6 (continued)

	Speed					
	$\beta$	Gain (N=12)		$\beta$	Decline (N=57)	
		OR	CI		OR	CI
Smoking-1993	-0.22	0.95	(0.893-1.015)	-0.12	0.97	(0.942-1.007)
Alcohol-1993	0.14	1.02	(0.970-1.089)	-0.08	0.98	(0.953-1.016)
Food Consumption-1993	0.05	1.01	(0.933-1.097)	-0.03	0.99	(0.957-1.030)
Food Preparation-1993	0.58	1.11*	(1.017-1.218)	-0.01	0.99	(0.965-1.030)
Exercise-1993	-0.22	0.96	(0.901-1.025)	-0.07	0.98	(0.955-1.019)
Seat Belt Use-1993	0.07	1.01	(0.880-1.173)	-0.02	0.99	(0.957-1.032)
Dental Care	0.09	1.02	(0.945-1.099)	-0.08	0.98	(0.949-1.018)
Medical Check-ups-1993	0.03	1.00	(0.940-1.077)	0.15	1.02	(0.996-1.064)
Age -1998	0.06	1.03	(0.867-1.228)	0.09	1.04	(0.956-1.140)
Income-1998	0.27	1.12	(0.945-1.333)	-0.02	0.98	(0.914-1.067)
Education-1998	0.42	1.34*	(1.004-1.782)	0.00	1.00	(0.896-1.152)

Table 6 (continued)

	Memory					
	$\beta$	Gain (N=33)		$\beta$	Decline (N=51)	
		OR	CI		OR	CI
Smoking-1993	0.04	1.01	(0.959-1.063)	-0.12	0.97	(0.941-1.008)
Alcohol-1993	0.08	1.01	(0.977-1.055)	0.00	1.00	(0.969-1.034)
Food Consumption-1993	-0.16	0.96	(0.921-1.010)	-0.07	0.98	(0.947-1.023)
Food Preparation-1993	0.24	1.04	(0.998-1.098)	0.08	1.01	(0.980-1.052)
Exercise-1993	-0.14	0.97	(0.935-1.016)	-0.01	0.99	(0.964-1.033)
Seat Belt Use-1993	-0.07	0.98	(0.934-1.035)	-0.01	0.99	(0.956-1.039)
Dental Care	-0.00	0.99	(0.955-1.046)	0.24	1.05*	(1.009-1.100)
Medical Check-ups-1993	0.27	1.05*	(1.005-1.099)	-0.03	0.99	(0.960-1.028)
Age -1998	-0.11	0.94	(0.847-1.054)	0.12	1.06	(0.970-1.162)
Income-1998	0.09	1.03	(0.942-1.145)	-0.12	0.94	(0.875-1.029)
Education-1998	-0.05	0.96	(0.818-1.132)	0.06	1.04	(0.911-1.191)

Note. Underlined values are significant at  $p < .05$ .

OR= Odd Ratio

CI=95% Confidence Intervals

Table 7

Logistic Regression Predicting Cognitive Change Using 1993 Health Behavior Domains and Demographics for individuals 68–96 years old (N=489)

	IQ					
	$\beta$	Gain (N=22)		$\beta$	Decline (N=188)	
		OR	CI		OR	CI
Smoking-1993	0.13	1.03	(0.952-1.123)	-0.00	1.00	(0.974-1.027)
Alcohol-1993	0.21	1.03	(0.996-1.078)	-0.05	0.99	(0.974-1.009)
Food Consumption-1993	0.00	1.00	(0.958-1.046)	-0.07	0.98	(0.969-1.006)
Food Preparation-1993	-0.12	0.97	(0.936-1.020)	0.00	1.00	(0.980-1.019)
Exercise-1993	-0.12	0.97	(0.933-1.024)	-0.04	0.99	(0.971-1.012)
Seat Belt Use-1993	0.05	1.01	(0.953-1.075)	-0.04	0.99	(0.969-1.013)
Dental Care	0.19	1.03	(0.988-1.082)	-0.08	0.98	(0.968-1.004)
Medical Check-ups-1993	0.03	1.00	(0.952-1.066)	0.10	1.02	(0.998-1.049)
Age -1998	-0.20	0.94	(0.868-1.021)	0.17	1.05*	(1.022-1.092)
Income-1998	-0.17	0.92	(0.819-1.048)	0.04	1.02	(0.974-1.075)
Education-1998	-0.02	0.98	(0.830-1.159)	0.16	1.11*	(1.042-1.203)

Table 7 (continued)

	QE					
	$\beta$	Gain (N=29)		$\beta$	Decline (N=158)	
		OR	CI		OR	CI
Smoking-1993	0.12	1.03	(0.946-1.124)	-0.03	0.99	(0.965-1.017)
Alcohol-1993	0.12	1.02	(0.987-1.059)	-0.08	0.98	(0.967-1.004)
Food Consumption-1993	0.06	1.01	(0.974-1.053)	-0.10	0.98	(0.962-1.000)
Food Preparation-1993	-0.23	0.95*	(0.923-0.995)	0.05	1.01	(0.990-1.032)
Exercise-1993	0.07	1.01	(0.972-1.057)	-0.11	0.97*	(0.959-1.000)
Seat Belt Use-1993	0.10	1.02	(0.969-1.079)	0.01	1.00	(0.979-1.027)
Dental Care	0.14	1.02	(0.986-1.068)	-0.05	0.99	(0.971-1.009)
Medical Check-ups-1993	0.14	1.03	(0.980-1.087)	0.00	1.00	(0.977-1.028)
Age -1998	-0.15	0.95	(0.890-1.026)	0.14	1.04*	(1.007-1.078)
Income-1998	0.09	1.04	(0.947-1.146)	-0.01	0.99	(0.941-1.044)
Education-1998	-0.36	0.79**	(0.673-0.929)	0.12	1.08*	(1.008-1.168)

Table 7 (continued)

	Inductive Reasoning					
	$\beta$	Gain (N=12)		$\beta$	Decline (N=164)	
		OR	CI		OR	CI
Smoking-1993	-0.17	0.95	(0.910-1.005)	-0.02	0.99	(0.969-1.021)
Alcohol-1993	-0.22	0.96	(0.908-1.021)	0.04	1.00	(0.989-1.026)
Food Consumption-1993	0.00	1.00	(0.943-1.062)	-0.08	0.98	(0.966-1.003)
Food Preparation-1993	-0.15	0.97	(0.914-1.036)	0.01	1.00	(0.982-1.022)
Exercise-1993	0.38	1.07	(0.993-1.163)	0.03	1.00	(0.986-1.027)
Seat Belt Use-1993	3.92	2.31	(0.000-999.0)	0.04	1.00	(0.984-1.034)
Dental Care	-0.10	0.98	(0.928-1.038)	-0.02	0.99	(0.977-1.014)
Medical Check-ups-1993	0.11	1.02	(0.949-1.109)	0.02	1.00	(0.979-1.028)
Age -1998	-0.20	0.94	(0.837-1.055)	0.07	1.02	(0.991-1.058)
Income-1998	-0.05	0.97	(0.837-1.141)	-0.08	0.96	(0.914-1.013)
Education-1998	-0.12	0.92	(0.731-1.162)	0.09	1.06	(0.988-1.141)

Table 7 (continued)

	Space					
	$\beta$	Gain (N=31)		$\beta$	Decline (N=140)	
		OR	CI		OR	CI
Smoking-1993	-0.02	0.82	(0.950-1.041)	0.04	1.01	(0.980-1.044)
Alcohol-1993	0.09	0.81	(0.982-1.052)	-0.03	0.99	(0.975-1.014)
Food Consumption-1993	0.22	0.34	(0.990-1.096)	-0.12	0.97*	(0.959-0.998)
Food Preparation-1993	-0.10	0.11	(0.945-1.020)	-0.10	0.98	(0.961-1.002)
Exercise-1993	0.17	0.35	(0.989-1.078)	-0.09	0.98	(0.961-1.004)
Seat Belt Use-1993	0.01	0.14	(0.957-1.050)	0.11	1.02	(0.996-1.056)
Dental Care	0.00	0.91	(0.967-1.037)	0.04	1.00	(0.987-1.028)
Medical Check-ups-1993	-0.15	0.94	(0.923-1.008)	0.15	1.03*	(1.005-1.062)
Age -1998	-0.20	0.10	(0.879-1.009)	0.17	1.05**	(1.018-1.093)
Income-1998	-0.14	0.08	(0.843-1.040)	0.05	1.02	(0.971-1.080)
Education-1998	-0.01	0.21	(0.861-1.141)	0.04	1.02	(0.954-1.113)

Table 7 (continued)

	Verbal					
	$\beta$	Gain (N=19)		$\beta$	Decline (N=74)	
		OR	CI		OR	CI
Smoking-1993	2.19	1.74	(0.000-999.0)	-0.02	0.99	(0.960-1.027)
Alcohol-1993	0.01	1.00	(0.959-1.048)	-0.03	0.99	(0.971-1.019)
Food Consumption-1993	0.11	1.02	(0.968-1.077)	-0.05	0.99	(0.967-1.014)
Food Preparation-1993	-0.14	0.97	(0.931-1.021)	0.06	1.01	(0.984-1.038)
Exercise-1993	-0.05	0.98	(0.941-1.039)	0.09	1.01	(0.989-1.046)
Seat Belt Use-1993	-0.09	0.98	(0.942-1.019)	-0.09	0.98	(0.954-1.008)
Dental Care	-0.05	0.99	(0.948-1.034)	0.07	1.01	(0.986-1.039)
Medical Check-ups-1993	0.14	1.03	(0.970-1.101)	0.06	1.01	(0.981-1.049)
Age -1998	-0.18	0.94	(0.867-1.033)	0.12	1.03	(0.996-1.085)
Income-1998	0.04	1.02	(0.907-1.150)	-0.10	0.95	(0.891-1.024)
Education-1998	-0.15	0.90	(0.751-1.086)	-0.03	0.97	(0.894-1.081)

Table 7 (continued)

	Number					
	$\beta$	Gain (N=13)		$\beta$	Decline (N=188)	
		OR	CI		OR	CI
Smoking-1993	-0.13	0.96	(0.919-1.018)	-0.04	0.98	(0.963-1.014)
Alcohol-1993	0.11	1.02	(0.975-1.068)	0.01	1.00	(0.985-1.020)
Food Consumption-1993	0.03	1.00	(0.945-1.073)	-0.04	0.99	(0.974-1.011)
Food Preparation-1993	-0.07	0.98	(0.931-1.045)	0.03	1.00	(0.987-1.027)
Exercise-1993	0.12	1.02	(0.959-1.090)	0.01	1.00	(0.982-1.022)
Seat Belt Use-1993	0.23	1.05	(0.925-1.195)	-0.04	0.99	(0.969-1.014)
Dental Care	-0.03	0.99	(0.941-1.049)	0.00	1.00	(0.983-1.020)
Medical Check-ups-1993	-0.07	0.98	(0.917-1.052)	0.14	1.03*	(1.006-1.057)
Age -1998	-0.10	0.96	(0.871-1.077)	0.20	1.06***	(1.029-1.100)
Income-1998	0.15	1.06	(0.930-1.230)	-0.05	0.97	(0.927-1.024)
Education-1998	-0.03	0.98	(0.789-1.218)	0.05	1.03	(0.972-1.120)

Table 7 (continued)

	Speed					
	$\beta$	Gain (N=9)		$\beta$	Decline (N=209)	
		OR	CI		OR	CI
Smoking-1993	1.57	1.49	(0.000-999.0)	-0.06	0.98	(0.959-1.010)
Alcohol-1993	0.05	1.00	(0.937-1.088)	0.07	1.01	(0.995-1.030)
Food Consumption-1993	0.03	1.00	(0.939-1.080)	-0.12	0.97*	(0.960-0.996)
Food Preparation-1993	-0.02	0.99	(0.927-1.066)	0.07	1.01	(0.995-1.034)
Exercise-1993	-0.00	1.00	(0.925-1.076)	-0.00	0.99	(0.980-1.019)
Seat Belt Use-1993	3.59	2.15	(0.000-999.0)	0.01	1.00	(0.981-1.026)
Dental Care	-0.11	0.98	(0.921-1.045)	-0.09	0.98	(0.966-1.002)
Medical Check-ups-1993	-0.13	0.97	(0.893-1.048)	0.01	1.00	(0.981-1.028)
Age -1998	0.27	1.08	(0.979-1.211)	0.05	1.01	(0.982-1.047)
Income-1998	-0.28	0.88	(0.716-1.103)	-0.02	0.98	(0.940-1.036)
Education-1998	0.35	1.25	(0.976-1.606)	0.10	1.06	(0.998-1.147)

Table 7 (continued)

	Memory					
	$\beta$	Gain (N=46)		$\beta$	Decline (N=159)	
		OR	CI		OR	CI
Smoking-1993	-0.12	0.96*	(0.937-1.000)	-0.02	0.99	(0.968-1.020)
Alcohol-1993	0.00	1.00	(0.974-1.029)	0.09	1.01	(0.997-1.035)
Food Consumption-1993	-0.06	0.98	(0.958-1.021)	0.00	1.00	(0.982-1.021)
Food Preparation-1993	0.23	1.04*	(1.006-1.082)	-0.04	0.99	(0.971-1.011)
Exercise-1993	0.06	1.01	(0.978-1.048)	-0.00	0.99	(0.978-1.020)
Seat Belt Use-1993	-0.15	0.96*	(0.940-0.998)	0.04	1.01	(0.984-1.036)
Dental Care	0.06	1.01	(0.979-1.045)	0.01	1.00	(0.985-1.023)
Medical Check-ups-1993	0.00	1.00	(0.961-1.044)	-0.05	0.98	(0.961-1.010)
Age -1998	-0.08	0.97	(0.920-1.032)	0.15	1.04**	(1.016-1.087)
Income-1998	0.05	1.02	(0.944-1.110)	-0.07	0.96	(0.921-1.022)
Education-1998	-0.01	0.98	(0.876-1.112)	0.12	1.08*	(1.009-1.169)

Note. Underlined values are significant at  $p < .05$ .

OR= Odd Ratio

CI=95% Confidence Intervals