THE RELATIONSHIP BETWEEN PSYCHOLOGICAL ATTITUDES, HEALTH BEHAVIORS, AND HEALTH CARE UTILIZATION IN OLDER WOMEN

by

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ABSTRACT

Understanding the role of psychological attitudes in health behaviors and health care utilization has important implications for improving health and reducing health care costs. This is particularly important among the elderly, who require more and costlier health services. This dissertation explores the relationship between optimism (positive future expectation) and cynical hostility (mistrust of others) on smoking cessation, physical activity, and preventive service use in post-menopausal women. The public health relevance of this dissertation rests in identifying individuals at higher risk of developing illness burden due to health behaviors such as smoking and physical activity and potential under-use of preventive health services.

Chapter one assesses the relationship between optimism and cynical hostility on smoking cessation. Women with higher cynical hostility were less likely to quit smoking over time. Smoking cessation programs may consider incorporating attitudes measures to better target smokers who are less likely to quit on their own.

Chapter two focuses on understanding the role of optimism and cynical hostility in use of screening mammograms and lipid screenings and in particular how these attitudes mediate or moderate the established relationships with race/ethnicity, and socioeconomic status. Optimism predicts screening mammograms for some, but not all, racial/ethnic groups even when

adjusting for various demographic, social, and health factors. Incorporating psychological factors such as optimism scores into health risk modeling may prove useful especially among specific racial and ethnic minority groups.

Chapter three investigates the link between optimism and cynical hostility on strenuous physical activity. Women with higher optimism report higher levels of strenuous physical activity across the lifespan. Modeling reveals that much of this relationship is explained by other variables such as demographics and health status. Higher cynical hostility is associated with increased post-menopausal strenuous physical activity only in fully corrected models. This attitude may therefore play a particularly important role in activity levels depending on the presence or absence of barriers to physical activity.

Understanding how attitudes influence these behaviors may pave the way for physicians and health systems to employ novel approaches to improve health-related quality of life and ultimately reduce costs by reducing disease burden.

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This dissertation is dedicated to my family,
in the United States and in Serbia.

To my parents, who taught me to expect the best of myself,
and whose sacrifices have ensured my well-being and bright future.

And to my brother, who was my first friend in this world.

1.0 ARE PESSIMISM AND CYNICAL HOSTILITY ASSOCIATED WITH SMOKING CESSATION IN OLDER WOMEN?

1.1 INTRODUCTION

The smoking-attributable mortality of older adults is almost 20% higher than was previously thought.[1] In the United States, 8% of women over the age of 65 are smokers.[2] Smoking leads to poor health outcomes across the lifespan and has particularly strong associations with the development of CVD.[3] In old age, smoking is also associated with shorter life expectancy,[4] lower levels of physical functioning,[5] increased risk of stroke,[6] and increased odds of hospitalization and death.[7] While two-thirds of smokers report intentions to quit in the next 6 months[8], achieving long-term cessation is typically fraught with multiple relapses[9] to smoking, and fewer than 5% of those attempting to quit are still abstinent after one year.[10,11] Those who do succeed in quitting smoking often exhibit higher intention to quit smoking and planning for the quit attempt,[12] consume fewer cigarettes per day before quitting, and tend to more often be male and employed. [13] Elderly smokers see large health improvements within 1-2 years of smoking cessation, which include increased physical functioning and quality of life and reduced risk of cardiac death, coronary events, and other morbidities.[14] Sicker patients are more likely to receive smoking cessation advice from

physicians,[15] while elderly women normally present with major cardiovascular disease much later than men, making smoking cessation a key issue for older women.

The psychological attitudes optimism (positive future expectation[16]), pessimism (negative future expectation), and cynical hostility (mistrust of most people[17]) are associated with important health outcomes and behaviors, including smoking. [18-47] These attitudes independently predict incident coronary heart disease (CHD), cancer-related mortality, and CHD-related as well as all-cause mortality in the Women's Health Initiative (WHI).[48] This excess risk is only partially explained by baseline smoking prevalence, which is higher among women with higher pessimism and hostility.[48] Optimism, pessimism, and cynical attitudes influence health and health behaviors independently of depression[49] and other mental illnesses, and are themselves risk factors for poor mental health later in life. [20,35,50-54] These psychological attitudes tend to stabilize by young adulthood and are considered stable traits based on their high test-retest correlations (0.58-0.79 over 3 years,[55] and up to 0.71 over 10 years for optimism/pessimism).[19] Even for youths and young adults, hostility scores over 4 years were correlated rates of 0.56.[56]

Optimism, pessimism, and cynical hostility have been related to smoking initiation, maintenance, and cessation in other populations. Higher cynical hostility predicts increased smoking initiation in youths and college students [57,58] and across races and genders,[40] while higher optimism is associated with not smoking [59,60] and lower optimism is associated with greater escalation of smoking behavior among adolescents.[61] Among 6th graders, high hostility is associated with more frequent smoking and with continued smoking in high school. [57] Among college students, higher hostility is associated with 27% higher odds of continuing smoking after graduation.[58] However, how these traits may influence smoking behavior in the elderly is not well-known.

The link between attitudes and smoking may be partially explained by how these attitudes influence perceived stress and coping, as well as how they interact with social support.[48] Optimists are not only more hopeful about the future, but also cope with adversity in healthier ways[62] and tend to have stronger social bonds;[63] hostility in individuals can have the effect of reducing positive benefits of social support.[64] In these ways, less optimistic and more hostile women may not be as equipped to handle the stressors of quitting smoking, or to fully leverage their support structures during the quit attempt. If this were the case, then the relationship between pessimism, cynical hostility, and smoking cessation should be even more pronounced in smokers with greater nicotine dependence. Heavier smokers, who are typically more nicotine dependent, would likely struggle with more pronounced withdrawal symptoms. Nicotine is also shown to reduce anger among high (but not low) hostility smokers,[65] and higher hostility predicts greater withdrawal symptoms after quitting smoking. [66,67] We therefore expected cynical hostility may be more important in predicting quit rates for heavy (vs. light) smokers.

These analyses examine whether psychological attitudes are prospectively and independently associated with smoking behavior over time among post-menopausal women e in the Women's Health Initiative (WHI). Optimism (and its subscales; optimism and pessimism), and cynical hostility were assessed at baseline enrollment in the WHI, while smoking status was followed via self-report at years 1, 3, and 6 after baseline. We hypothesized that less optimistic (more pessimistic) and more cynically hostile women would be less likely to quit smoking over time, independent of depression. We further hypothesized that low optimism and high cynical hostility would be associated with lower rates of cessation in women who were heavier smokers.

1.2 METHODS

1.2.1 Study Population

The Women's Health Initiative recruited 161,809 postmenopausal women ages 50-79 from 24 states and the District of Columbia from diverse racial, ethnic, and socioeconomic backgrounds into one of two longitudinal study branches between 1994 and 1998: the clinical trial (CT; n=68,133) or the observational study (OS; n=93,676).[68] WHI exclusion criteria relevant to the current study included: any substance abuse (aside from smoking or alcohol), mental illness (clinical depression and dementia), life expectancy less than three years, participation in other randomized trails, and plans to move from current area within 3 years, as well as further restrictions for CT participants, which have been described elsewhere.[68] The current analysis is restricted to women who smoked at baseline from either the OS or CT and who had complete data for optimism, pessimism, and cynical hostility (n=10,242).

1.2.2 Optimism, Pessimism, and Cynical Hostility

The WHI's Behavioral Health Committee selected optimism and cynical hostility for inclusion in baseline psychological questionnaires because of their importance for women's health and their ease of capture using brief and reliable tests.[69]

Optimism is characterized by positive expectations for the future: "In uncertain times I usually expect the best". Pessimism, on the other hand, is characterized by negative future expectations: "I rarely count on good things happening to me."[55] Optimism and pessimism were measured by the Life Orientation Test–Revised (LOT-R), a widely-used and validated 6-item

scale, producing scores from 6 to 30, with higher scores signaling greater optimism and lower scores indicating greater pessimism. The LOT-R has two subscales of 3 questions that measure optimism and pessimism separately on a scale of 3-15). Higher optimism subscale scores indicate higher optimism, while lower scores reflect neutral expectations for positive events (i.e., having expectations for the future that are neither positive nor negative, but neutral). Similarly, higher scores on the pessimism subscale indicate higher pessimism, while lower scores reflect neutral expectations for future events. Full scale optimism (with optimism and pessimism at opposite ends of the same scale) and subscale optimism and pessimism scores were treated as both continuous and categorical measures. The continuous measure assesses the effects of a one-point difference on the scales, while the categorical measures by quartiles of score assess clinically-meaningful differences observed between real-world "optimists" and "pessimists" who score at opposite ends of the scale. For the full-scale optimism score, these quartiles were: low (6-20), mid-low (21-23), mid-high (24-25), and high ($\geq$ 26). Quartiles for the optimism subscale were: low (3-10), mid-low (11-12), mid-high (13), and high ($\geq$ 14). Quartiles for the pessimism subscale were: low (3-5), mid-low (6), mid-high (7-8), and high ($\geq$ 9).

Cynical hostility (deep mistrust of others) was measured with the cynicism subscale of the Cook-Medley Questionnaire[17,70] consisting of 13 true/false items such as "It is safer to trust nobody." Higher scores indicate greater cynical hostility. Scores were treated as continuous measures and as categorical measures by quartiles of score: low (0-1), mid-low (2-3), mid-high (4-5), and high (6 and above).

1.2.3 Measuring Smoking

Smoking was self-reported on baseline surveys (current, ever, or never smoker), along with cigarettes smoked per day, which was dichotomized for analysis into light (<15) and heavy smokers (≥15 cigarettes per day).[71] Baseline current smokers' (n=10,242) smoking status (y/n) was examined at years 1, 3, and 6 after baseline. Because heavier smoking is a sign of nicotine dependence[72] and more hostile women experience greater withdrawal symptoms, we conducted a secondary analysis in which we repeated models separately in heavy vs. light smokers. Self-reported smoking is considered a validated method for assessing smoking outside of clinical trials.[49]

1.2.4 Covariates and Potential Confounders

Individual characteristics known to be associated with smoking status or behaviors were measured by self-report at baseline and included as covariates, including age,[73] race and ethnicity,[73] cigarettes smoked per day (<15, ≥15),[74] education (<HS, ≥HS),[73] weekly exercise (METS/week),[73] and alcohol consumption (y/n).[73] Region of the United States[10] (Northeast, South, Midwest, or West) was included because it is associated with the distribution of trait attitudes[70] and of smoking. Other factors that may influence odds of quitting smoking were included, such as health insurance (y/n), social support (WHI construct, continuous score), having a regular source of medical care (y/n), and the presence or history (y/n) of seven health conditions at baseline: diabetes, high cholesterol, hypertension, CVD, cancer, depressive symptoms (short form CES-D; cut-offs of 0.06 indicating depressive symptoms which are separate from clinical depression), or obesity (BMI≥30). The physical baseline health conditions

were included to control for the fact that over 90% of individuals who attempt to quit smoking do so for health reasons,[75] and that a health condition which results in more frequent visits to the doctor increases the chances an individual is exposed to smoking cessation advice from a physician.[76]

1.2.5 Statistical Methods

1.2.5.1 Baseline Characteristics

Baseline characteristics were compared across quartiles of score for optimism and cynical hostility, including the covariates and potential confounders outlined above. Chi-squared tests (for categorical variables) and ANOVA tests (for continuous variables) were used to assess whether each variable was associated with quartiles of optimism and cynical hostility.

1.2.5.2 Longitudinal Analysis

To analyze the contribution of groups of covariates on the relationship between trait attitudes and smoking status, hierarchical (sequential) multiple regression analysis in 11 modeling steps was performed using generalized linear mixed models (SAS 9.4 PROC GLIMMIX using random intercept). The main analysis (Models 1-7) examined attitudes as independent predictors of smoking status, with different groups of covariates included in each model. We then compared heavy vs. light smokers in Model 8, and Models 9-11 were used to confirm that missing data was not affecting the effects seen in prior modeling steps.

Each attitude variable (optimism and the optimism/pessimism subscales, cynical hostility) was modeled as an independent predictor of the binary outcome of smoking status. In the main analysis, covariates were added successively in 7 modeling steps (**Table 1-1**, Models 1-

7): age and time (Model 1); sociodemographic factors including race/ethnicity, education, income, region, and insurance status (Model 2); cigarettes per day (Model 3); health behaviors including physical activity and alcohol consumption (Model 4); presence of 7 health conditions including diabetes, high cholesterol, hypertension, baseline CVD, cancer, depressive symptoms, and obesity (Model 5); social support and regular source of medical care (Model 6); and finally the other attitude of interest (Model 7). Hierarchical modeling was used to better examine how covariates alter the relationship between attitudes and smoking status: by adding variables sequentially, we were able to see how effect sizes and significance changed with each added covariate. This methodology is useful to better understand the form of relationships between predictor and outcome variables[77] and is used across various research areas including smoking and attitudes research. [78-80] Models were checked for multicollinearity.

1.2.5.3 Examining Heavy vs. Light Smokers

First we tested for an interaction between heavy and light smoking (≥15 cigarettes per day n=4413, <15 per day n=5829) and the main attitude predictor variable in Model 8 (**Table 1-1**). Then in a parallel set of models we tested first heavy smokers only and then light smokers only, mirroring Models 1-7 (excluding the cigarettes/day variable in these models).

1.2.5.4 Examining Effects of Missing Data

Although 95% of women reported smoking status at least once during follow up period, missing data for smoking status at years 1 (28% missing), 3 (17% missing), and 6 (14% missing) presented an analytical challenge because these data were not missing at random. Women with missing smoking status were less optimistic (all years), more cynically hostile (years 3 and 6), experienced more depressive symptoms (years 3 and 6), smoked more cigarettes (years 3 and 6),

and had lower incomes (all years) as compared to their counterparts without missing smoking status at each year.

Pattern mixture modeling was used to address the effect of missing data in the main analysis (**Table 1-1**, Models 9-11). This required grouping women based on missing data patterns. The six groups were coded using dummy variables in Model 9. Next, Model 10 looked at the missing data patterns using one variable with six levels (pm), and also included two-way interactions for pattern mixture group, attitude, and time. Model 11 examines the 3-way interaction between attitude, pattern mixture group, and time.

Table 1-1. Hierarchical Modeling Steps for Main Analysis

Outcome = Smoking (Y/N)	**Category of Variables Added**	**Variables Added in addition to Main Attitude predictor variable**
Model 1	Basic Predictors	Age, Time
Model 2	Demographics	Race/Ethnicity, Education, Income, Region, Insurance
Model 3	Smoking Level	Cigarettes per day
Model 4	Health Behaviors	Physical activity, alcohol consumption
Model 5	Health Conditions	Diabetes, High cholesterol, hypertension, cardiovascular disease, cancer, depressive symptoms, obesity
Model 6	Other Characteristics	Social support, regular source of medical care
Model 7	Other Attitude	Other attitude (for example, if optimism is included as main attitude, other attitude here is cynical hostility)
Model 8	Cigarettes per day interaction with attitude	Cigsperday*Attitude
Model 9	Pattern Mixture Groups	Model 8 +Pattern Mixture Dummy Variables based on six different patterns of missing data (Pm1, Pm2, Pm3, Pm4, Pm5, Pm6)
Model 10	Pattern Mixture two-way interactions	Model 8 + Pattern Mixture group indicator variable (pm), pm*time, pm*attitude, attitude*time
Model 11	Pattern Mixture three-way interaction	Model 10 + Pm*attitude*time

1.3 RESULTS

1.3.1 Baseline Characteristics

Least (vs. most) optimistic female smokers were more likely to be from racial/ethnic minorities, to be uninsured, have less than a high school education, incomes under $35000, lower levels of physical inactivity, no regular care provider, lower levels of social support, to abstain from alcohol, and smoke ≥15 cigarettes per day (**Table 1-2** , all $p<0.05$, p-values not shown). Least (vs. most) optimistic women were also more likely to report diabetes, high cholesterol, hypertension, CVD, depressive symptoms, obesity, and smoking at least 15 cigarettes per day (all $p<0.05$). The most (vs. least) cynically hostile women closely resembled least optimistic women on baseline factors, but were also more likely to have cancer at baseline ($p=0.0082$).

Table 1-2: Baseline Characteristics of WHI Baseline Smokers. Quartile scores

	All	Optimism				Cynical Hostility			
Percent or Mean(SD)		Most (≥26)	Mid-High (24-25)	Mid-Low (21-23)	Least (6-20)	Most (≥6)	Mid-High (4-5)	Mid-Low (2-3)	Least (0-1)
	n=10,242	n=2223	n=2108	n=3323	n=2588	n=3013	n=2415	n=2644	n=2170
Age at screening	61.1(6.8)	61.1(6.7)	61.3(6.7)	61.1(6.8)	60.8(6.8)	60.9(6.8)	61.1(6.9)	61.2(6.8)	61.1(6.6)
U. S. Region									
Northeast	23.1	18.6	21.3	24.6	26.8	22.1	23.4	24.4	22.6
South	26.4	27.1	25.7	25.9	27	28.9	27.9	24.1	24.02
Midwest	22.9	22.8	24.8	23.7	20.3	22.4	21.6	22.7	25.2
West	27.6	31.6	28.3	25.9	25.9	26.6	27.1	28.8	28.2
Race/Ethnicity									
Black	13.3	12.8	12	14.4	13.2	20.2	14.6	9.3	7.2
White	79.7	81.6	82.8	78.3	77.2	70.6	79.6	84.4	86.4
Others	7.1	5.6	5.2	7.2	9.6	9.3	5.8	6.3	6.3
Less than HS education	6.8	2.7	4.8	6.9	12.2	11.6	6.3	4.4	4
Income < $35,000	47.7	37.9	43.8	49	58.2	56.7	47.9	44.4	39.3
No Insurance	10	8.4	8.4	9.4	13.5	13.5	9	8.9	7.6
Cigs/day ≥15	48.6	46.5	47.5	48.7	51.4	46.9	48.7	50.6	48.5
METs per wk >=25	63.3	69.1	65.5	63.1	56.6	57.4	63.5	65	69
Any Alcohol	76.3	81.2	78.1	76.1	70.7	70.7	77.5	78.1	80.4
Diabetes ever	5.8	4.6	4.7	6.2	7.3	7.8	5.8	4.5	4.7
High cholesterol	13.4	11.8	14	13	14.7	14.6	14.3	12.1	12.2
Hypertension	34.4	30.3	33.7	36.5	35.8	38.1	34.1	32.5	31.7
CVD	9.1	6.8	7.8	9.1	12	12.8	8.6	7.5	6.3
Cancer	9.8	9.5	10.6	9.5	9.7	10.8	10.2	9.8	7.8
Depressive Symptoms	17.6	7.2	9.8	16.4	35	27.9	17.4	13.1	9.5
Obesity (BMI≥30)	24.3	22.8	22.3	24.7	26.8	28.2	26.1	21.4	20.5
No Reg Care Provider	11.2	10.3	10.1	10.4	13.7	14	10.6	9.9	9.4
Social Support Construct	34.4 (8.4)	37.8 (7.1)	35.8 (7.4)	34.1 (8.0)	30.7 (9.1)	31.7(9.2)	34.2(8.0)	35.6(7.8)	37.0 (7.3)

Generalized Linear Mixed Models (SAS PROC GLIMMIX).

1.3.2 Longitudinal Analysis

In order to check for the stability of the scores of optimism and hostility scores over time, we assessed the correlations between baseline and close-out attitudes scores on the subset of women for whom these were available (n=3704). The Pearson correlation coefficient for total optimism score was 0.605 (n=3704, $p<0.0001$) and for cynical hostility was 0.619 (n=3583, $p<0.001$). These are within the 0.6 – 0.8 range reported in the literature for adults. [81-83] The Pearson correlation coefficient for depressive symptoms was lower, at 0.338 (n=3638, $p<0.001$). All psychological attitudes were moderately but statistically significantly correlated with each other, with the highest correlation found between the optimism and pessimism subscale scores (Pearson coefficient = -0.45, $p<0.0001$), and pessimism subscale and hostility score (Pearson coefficient = 0.37, $p<0.0001$).

1.3.2.1 Full Scale Optimism

Each 1-point increase in optimism (continuous) predicted a 3% increased odds in quitting smoking over time, after adjustment for age and time only (Model 1; OR=1.03, CI = 1.01-1.06, p=0.004), but this relationship was no longer significant after adding demographic covariates in Model 2 and beyond (not shown). Considering optimism in quartiles yielded similar results: most optimistic women were 40% more likely to quit smoking over time than least optimistic women (Model 1; OR=1.40, CI = 1.10-1.77, p=0.0061), but the difference was no longer significant after adjusting for demographics and further covariates (**Table 1-3**). Separate subscale analyses did not show differences in findings relative to the full scale.

1.3.2.2 Cynical Hostility

A 1-point increase in cynical hostility (continuous) was associated with 6% lower odds of quitting smoking over time adjusting for age and time only (Model 1; OR=0.94, CI = 0.92-0.97, p<0.0001), which was slightly attenuated after adjustment for all covariates (Model 7; OR=0.95, CI=0.92-0.98, p=0.0013). The most (vs. least) cynically hostile women were 40% less likely to quit smoking over time (Model 1; OR=0.60, CI=0.47-0.75, p<0.0001), which remained significant after adjustment for all covariates (Model 7; OR=0.60, CI = 0.46-0.77, p< 0.0001; **Table 1-3**).

Table 1-3: Attitudes and Odds of Quitting Smoking Over 6 Years Among WHI Baseline Smokers (n=10,242) by Quartiles of Attitude

	Covariates Included in modeling	Optimism Full Scale (Most vs. Least)		Cynical Hostility (Most vs. Least)	
		OR (95% CI)	p-value	OR (95% CI)	p-value
Model 1	Basic Predictors	1.40 (1.10 - 1.77)	0.0061*	0.60 (0.47 - 0.75)	<0.0001*
Model 2	Demographics	1.20 (0.94 - 1.52)	0.1462	0.60 (0.47 - 0.76)	<0.0001*
Model 3	Smoking (heavy vs. light)	1.15 (0.90 - 1.46)	0.2625	0.56 (0.44 - 0.71)	<0.0001*
Model 4	Health Behaviors	1.09 (0.85 - 1.40)	0.4925	0.60 (0.47 - 0.76)	<0.0001*
Model 5	Health Conditions	1.07 (0.83 - 1.39)	0.5888	0.61 (0.48 - 0.78)	<0.0001*
Model 6	Other social factors	1.15 (0.88 - 1.50)	0.2953	0.59 (0.46 - 0.76)	<0.0001*
Model 7	Other attitude (optimism and hostility together)	1.01 (0.77 - 1.32)	0.9387	0.60 (0.46 - 0.77)	<0.0001*

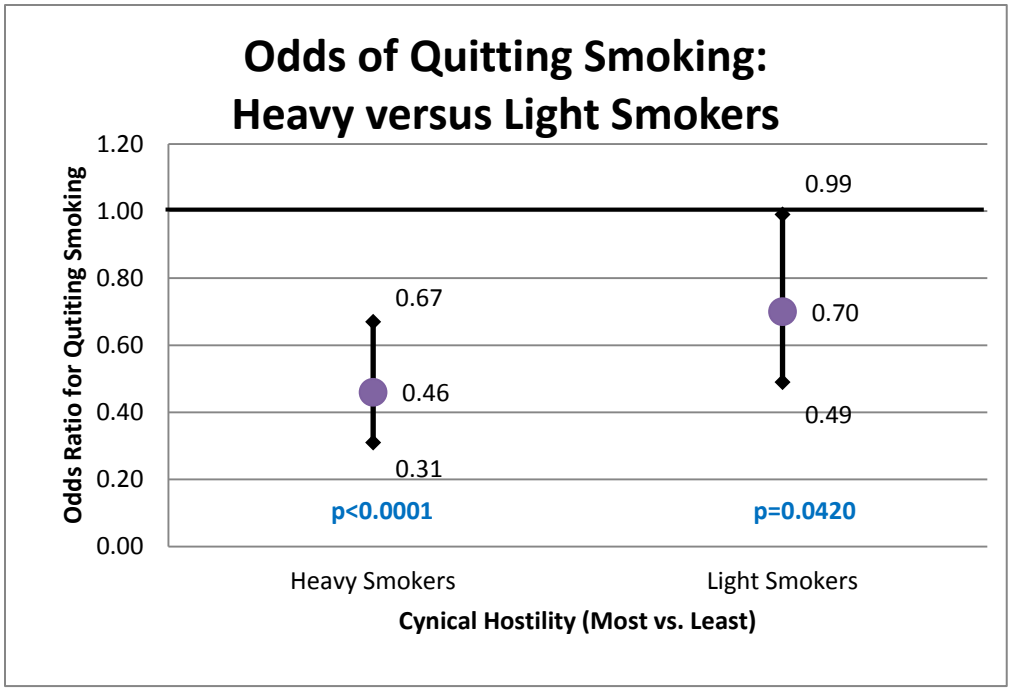
1.3.2.3 Interactions and Pattern Mixture Models

In Model 8, only the interaction between cynical hostility (in quartiles) and cigarettes per day approached significance (Model 8, p=0.074), which prompted a secondary analysis stratifying women into separate cohorts based on heavy (≥15 cigarettes per day, n=4413) and light (<15, n=5829) smokers. Pattern mixture groups were not significant as individual predictors in Model 9. Two-way pattern mixture results (Model 10) showed significant interaction between optimism

and pattern group, which did not affect results because optimism was not significant after adjustment. Three way interactions (Model 11) were not significant.

1.3.2.4 Stratified Models for Cynical Hostility Among Heavy vs. Light Smokers

We repeated Models 1, 2, 4, 5, 6, and 7 for light and heavy smokers to examine the effect of cynical hostility more closely in these groups. Higher cynical hostility (measured continuously) significantly predicted lower odds of quitting smoking only among heavy (Model 7 OR: 0.92, CI = 0.88-0.97, p=0.0006), but not light smokers (Model 7 OR: 0.97, CI = 0.93-1.02, p=0.2094). When considered categorically, most (vs. least) cynical hostile women were consistently less likely to quit smoking in both the heavy and light smoking groups. Most (vs. least) cynical hostile heavy smokers had 54% lower odds of quitting smoking (Model 7 OR: 0.46, CI = 0.31-0.67, p<0.0001), while the most (vs. least) cynical hostile light smokers were 30% less likely to quit (Model 7 OR: 0.70, CI =0.49 -0.99, p=0.0420) as shown in **Figure 1-1**.



Stratified Model 7 using SAS PROC GLIMMIX, adjusting for all covariates.

Figure 1-1. Fully-adjusted odds ratios the effect of hostility (most vs. least) on the likelihood of quitting smoking, among heavy and light smokers over time

1.4 DISCUSSION

Among WHI women, cynical hostility consistently predicted lower odds of quitting smoking during a six-year follow up after adjustment for a number of important covariates. Consistent with what we expected, our initial set of models indicated an interaction of borderline significance between cynical hostility and smoking level (heavy vs. light). Stratified analysis of heavy vs. light smokers confirmed these hypotheses: though cynical hostility predicted lower odds of quitting in both heavy and light smokers, the effect size appeared to be more pronounced for most cynically hostile heavy smokers (54% less likely to quit compared to least cynically hostile heavy smokers), than most cynically hostile light smokers (30% less likely to quit).

In contrast to the findings for cynical hostility, hypotheses were not confirmed for optimism (or either the optimism or pessimism subscales). When demographic predictors (race/ethnicity, education, income, region, and insurance status) were included as covariates, the initial effect of increased optimism on increased quitting rates was no longer significant.

These findings are in line with prior literature identifying cynical hostility as a risk factor for smoking initiation and maintenance, and extend them to smoking maintenance and quitting behaviors among elderly women. Cynical hostility may influence smoking behavior in many ways, including greater depression and lower social support, both of which may undermine motivation, self-efficacy, and coping skills for smokers attempting to quit.[84] Yet our results persisted even after controlling for these factors. Cynical hostility may also influence smoking in other ways that this study could not control for, such as providing an additional barrier for women who initiate a quit attempt.

Though we expected significant effects for optimism as well as cynical hostility, it appeared the role of demographic predictors and socioeconomic status explained the association between optimism and smoking cessation. Stress induced by low SES or discrimination induced by minority status may increase the likelihood of developing negative attitudes in the first place, [85] but SES and psychological attitudes are likely mutually reinforcing,[86] and certain attitudes may exacerbate, while others may buffer, these stresses.[87] Our results are in line with this literature, and suggest that the effects of optimism on smoking cessation in elderly women are likely entirely explained by these socioeconomic and demographic factors.

1.5 LIMITATIONS

Intent to quit smoking, quit attempts, and use of quit aides were not measured in the WHI and limited our ability to determine the direct mechanism by which psychological attitudes may have influenced smoking cessation rates. Because smoking was measured by self-report in mailed surveys, there are some missing data for smoking status. However, pattern mixture modeling results confirmed missing data patterns were not likely to influence the observed results.

While the WHI draws from a large, diverse, and representative sample of women in the United States, the WHI sample may limit the generalizability of findings to all persons because the sample focused on postmenopausal women only (possibly limiting usefulness of the findings for other ages and genders), and because WHI women are typically healthier and more motivated toward healthy behavior than the general population of healthy women. Because the WHI excluded women with mental health conditions like depression, our sample likely only includes women who had late-life onset episodes (another difference from the general population).

1.6 CONCLUSIONS

Higher cynical hostility predicted lower odds of quitting smoking over six years of follow-up in post-menopausal Women's Health Initiative participants who were smoking at baseline. Individuals with high cynical hostility may represent a group for whom attempting to quit smoking or following through with a quit attempt is particularly challenging, and for whom additional cessation resources may be required. Smoking-attributable

mortality has been underestimated in past analyses,[1] particularly for individuals age 55 and over. Thus, it is imperative that we identify and target those at higher risk of not quitting. Our findings suggest that cynical hostility may be a marker for those potentially at higher risk of not quitting smoking over time, particularly in older adults. Additionally, though cynical hostility is relatively stable over time, some researchers have shown significant reductions in hostility using techniques like mindfulness-based stress reduction (with stronger effects among women than men).[88 89] Future studies should examine whether cynically hostile women may benefit from additional resources for smoking cessation, or whether targeting cynical hostility itself may be helpful in aiding smoking cessation for this subset of women at higher risk for continued smoking.

2.0 PSYCHOLOGICAL ATTITUDES MAY MODERATE DISPARITIES IN PREVENTIVE SERVICE USE IN MEDICARE

2.1 INTRODUCTION

Even in the elderly population in the United States, where Medicare ensures near-universal insurance coverage, there is large variation in the use of preventive services, and differences in preventive service use persist by race/ethnicity and other socioeconomic status (SES) measures such as income and education. [90] Individuals from minority racial and ethnic groups and those with lower SES typically underutilize preventive services, [91-99] which often leads to higher downstream morbidity and mortality.[100-102] SES is also associated with lower use of preventive and screening services. [91,92,103] Women at or below 125% of the federal poverty level are half as likely as high income women to receive pap smears, mammograms, and cholesterol and breast cancer screenings, and less than a third as likely to have blood pressure screenings.[91] Yet lower rates of preventive services are not adequately explained by race/ethnicity or SES. [104-107,108]

Psychological attitudes are associated with health outcomes and behaviors, [18-47] and may explain some of the variation in use of preventive healthcare service by race/ethnicity and SES. Lower SES individuals have lower average optimism scores, [109] and black women have higher cynical hostility scores than their white peers. [48] The Reserve Capacity Model theorized by

Matthews and others [85,110] posits that low SES likely marks a high stress environment which, may stabilize over time into more negative attitudes [109] that ultimately influence health behaviors including diet, physical activity, sleep, and substance abuse. [29,31,32,110-112] A range of attitudes including optimism (positive future expectation[16]) and cynical hostility (mistrust of others[17]) predict Alzheimer's disease, cardiovascular disease, and other chronic diseases. [20,35,50-53] In the Women's Health Initiative (WHI), both optimism and cynical hostility independently predict incident coronary heart disease (CHD), cancer-related mortality, and overall mortality.[48] These effects of attitudes on health are likely via *direct* processes (e.g., neuroendocrine responses to stress)[30-32,111-113] and *indirect* ones (health care utilization,[114-117] health behaviors, or adherence to medical advice). Studies linking other psychological factors with healthcare utilization have uncovered that lengths of stay are higher for surgery patients with a pessimistic outlook[115] and that low agreeableness and high extroversion are associated with higher emergency department (ED) use. [114]

Stress induced by low SES or discrimination induced by minority status may increase the likelihood of developing negative attitudes in the first place,[85] but SES and psychological attitudes are likely mutually reinforcing,[86] and certain attitudes may exacerbate, while others may buffer, these stresses.[87] Given that the role of race/ethnicity and SES factors in preventive service use is fairly well-established, this analysis focuses on extending our knowledge of whether psychological attitudes (optimism and cynical hostility) mediate or moderate this relationship. Our study examines the use of screening mammograms and lipid screenings measured via Medicare claims data linked with the WHI, the largest longitudinal study of post-menopausal women in the United States. Optimism, cynical hostility, race/ethnicity, income, and various health-related covariates were obtained from WHI data. We expected that more optimistic and

less cynically hostile women would exhibit more favorable screening profiles (more frequent screenings), and anticipated that both optimism and cynical hostility would play significant roles as mediators and moderators of the relationship between race/ethnicity, income, education, and use of screening mammograms and lipid screenings.

2.2 METHODS

2.2.1 Overview

We examined length of time that elapsed without women receiving screening mammograms or lipid testing, stratified by quartiles of optimism and cynical hostility score. Repeated events survival analysis was employed examine the extent to which psychological attitudes mediate or moderate the relationship between race/ethnicity, income, education, and screening events.

2.2.2 Study Population

The Women's Health Initiative recruited 161,809 postmenopausal women ages 50-79 from 24 states and the District of Columbia from diverse racial, ethnic, and socioeconomic backgrounds into one of two longitudinal study branches between 1994 and 1998: the clinical trial (CT; n=68,133) or the observational study (OS; n=93,676).[68] WHI exclusion criteria relevant to the current study include: any substance abuse (except smoking or alcohol), mental illness (severe depression, dementia), life expectancy under three years, participation in other randomized trials,

and plans to move within 3 years.[68] Our analysis is limited to WHI participants from either the CT or OS who were still enrolled in the WHI on January 1, 2005 (n=115,399) and who had linked CMS Medicare claims data (n=102,855). We created separate cohorts for each outcome of interest (screening mammograms and lipid screenings), further restricted to women who had complete data for optimism and cynical hostility. Mammogram screening cohort participants were continuously enrolled in fee-for-service (FFS) Medicare Parts A and B for at least 2 years during the window of 2005-2010, whereas lipid screening cohort participants were continuously enrolled in Medicare Parts A and B for at least 5 years. Each cohort restricted based on relevant health conditions: women the screening mammograms cohort were free from breast cancer prior to study start in 2005 (final n=48,291), while the lipid screenings cohort included women with no history of 13 cardiovascular and lipid diseases by 2005 (final n=24,857). (See **Figures 2-4 and 2-5 in Appendix** for details).

2.2.3 Outcome Variables: Screening Mammograms and Lipid Screenings

We selected screening mammograms and lipid testing because both services were recommended by the United States Preventive Services Task Force (USPSTF) during the study period and were covered as preventive services in Medicare. At the time of our study (2005 through 2010), women over 40 years old were advised to have a screening mammogram every 1-2 years.[118] Women aged 45 years and over were recommended to have "routine" lipid screening if they were at high risk for CVD.[119] Industry-specific guidelines from the National Cholesterol Education Program recommended that all adults aged 20 years and older receive a lipid screening every 5 years.[120] During our study period, screening mammograms were not subject to deductible requirements but were subject to co-insurance (20% in the absence of a supplemental

policy). Neither deductibles nor copays were applied to the cardiovascular screening benefit that covered lipid screenings.[121]

2.2.3.1 Measuring Screenings with Claims Data

We used HCPCS/CPT codes from Medicare Physician/Supplier Part B Carrier claims files (which includes outpatient physician services) to identify screening mammograms and lipid tests, and also applied a modified published algorithm to account for potential miscoding of screening vs. diagnostic mammograms (See **Figures 2-6 and 2-7 in Appendix** for procedure codes and algorithm for both outcomes).

2.2.3.2 Time-Without-Screening and Screening Event Survival Analysis

For both screening mammograms and lipid screenings, we constructed a "time-without-screening" variable for each cohort. Time-without-screening was constructed based on both the time elapsing between two definite screening events (screening mammogram or screening lipid test), as well as the time elapsing between specific events such as study start and screening, or screening and study end. Thus, for the mammograms cohort, any time period between the following events was used to construct time-without-screening durations: study start, mammogram screening, a diagnostic mammogram, study end, diagnosis of breast cancer, or death (**See Figure 2-8 in Appendix**). For the lipid testing cohort, time-without-screening duration was measured as time periods occurring between any of the following events: study start, lipid screening, diagnosis of CVD, death, or study end (**See Figure 2-9 in Appendix)**. These variables did not take into account whether the desired event (screening) happened at the end of this duration, only the time that elapsed during the duration. For survival analysis, these time durations were used, as well as indicators for whether or not the desired event (screening)

occurred at the end of each event period. This modeling strategy allowed us to use both left and right-censored time gaps, and therefore to use more information contained in our data than would a traditional time-to-event model with repeated measures (**See Figure 2-10 in Appendix** for illustration of time periods with complete information versus censoring).

2.2.4 Predictor variables: Attitudes, Race/Ethnicity, and SES

Optimism was assessed at WHI baseline by the Life Orientation Test-Revised (LOT-R) questionnaire.[16] This six-item scale (**See Figure 2-11 in Appendix)** results in scores from 6-30; higher scores indicate greater optimism and lower scores indicate greater pessimism. We classified women based on their quartile of score[48]: Least (<22), Mid-low (22 to < 24), Mid-high (24 to <26), Most (26+).

Cynical Hostility was assessed at WHI baseline using the 13-item cynicism subscale of the Cook Medley hostility questionnaire (Range: 0-13, higher scores indicate greater cynicism, **See Figure 2-12 in Appendix)**. [122] We classified women based on quartile of score:[48] Least (<1), Mid-low (1 to < 3), Mid-high (3 to < 5), Most (5+).

Race/Ethnicity, Income, and Education were all self-reported variables collected at WHI baseline. Race/ethnicity was reported in the following categories: White, Black, Hispanic/Latino, Asian or Pacific Islander, American Indian or Alaskan Native, and Other. Women self-reported gross total family annual income from which we created four categories: <$20,000, $20,000-$49,999, $50,000 to $74,999, and >=$75,000. Education levels were less than high school, high school or GED, some school past high school, college or some post-graduate or post-professional training, and graduate degree or higher.

2.2.5 Covariates and Potential Confounders

Models of both screening mammography and lipid screening were corrected for important covariates: some measured at baseline in WHI, and several updated through the study baseline in 2005. Baseline measures included WHI Control Trial vs. Observational Study enrollment, age on Jan 1, 2005, and Medicare eligibility (65+, disability, end-stage renal disease, disability and end-stage renal disease), whether women were uninsured, had a regular medical provider, or lived alone, depressive symptoms (y/n, CES-D algorithm [69,123,124]), social support construct (continuous[69,125]), and social strain construct[69,126] (continuous[77,79]). Baseline health behaviors included whether women drank alcohol, exercise METs/week (<2.5, 2.5 to <18.5, and 18.5 or greater). Additional health factors were included and were also updated through 2005 when available: smoking status (current, past, or never smoker), obesity measured as BMI≥30, hypertension ever, high cholesterol requiring pills ever, and diabetes ever.

For the screening mammograms cohort, we also included an additional two variables updated through the latest value by Jan 1, 2005 measuring the number of breast biopsies (0, 1, or ≥2), as well as family history of first-degree female relatives with breast cancer (none, or ≥1). We similarly included another two variables updated through Jan 1, 2005 for the lipid testing cohort. These included a family history of myocardial infarction (none or any relatives affected), and a measure of the number of CVD risk factors (0-8) based on tobacco use, obesity, diabetes, hypertension, cardiac catheterization ever, atrial fibrillation ever, aortic aneurism ever, and first-degree relative with myocardial infarction. This measure was meant to capture severity of CVD risk.

2.2.6 Statistical Methods

2.2.6.1 Baseline Characteristics

We described baseline characteristics according to race/ethnicity, income, education, mean optimism and cynical hostility scores, and all relevant covariates noted above for the screening mammograms (n=48,291) and lipid screenings cohorts (n=24,857).

2.2.6.2 Distribution of Race/Ethnicity, Income, and Education by Attitude

We described of how mean optimism and cynical hostility vary each in each sample based on race/ethnicity, education, and income levels. We evaluated whether there are statistical differences race/ethnicity, income and education by quartile of optimism and cynical hostility based on chi-square tests of association.

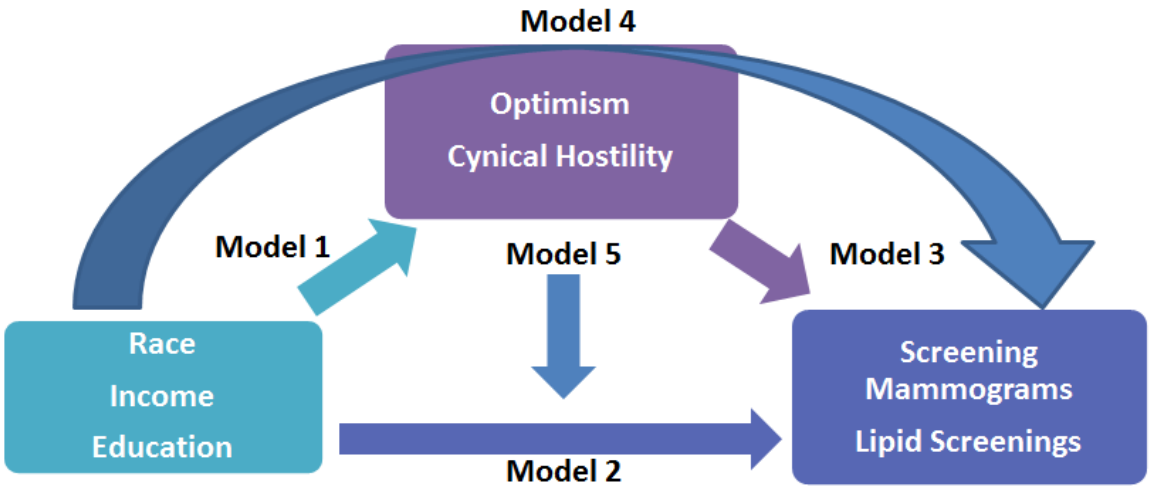
2.2.6.3 Distribution of Observed Time-Without-Screening by Attitudes

Differences in observed time-without-screening were evaluated by quartiles of optimism and cynical hostility score in each cohort, and tested for significance by chi-square tests of association.

2.2.6.4 Modeling Attitudes for Role as Mediators and Moderators

Modeling analysis focuses on determining whether optimism and cynical hostility may act as mediators or moderators of the established influence of race/ethnicity and SES on screenings using five modeling steps (**Figure 2-1** below), each model adjusted for covariates (above). In **Model 1**, race/ethnicity, income, and education are regressed on optimism and cynical hostility (ordinal logistic regression on quartiles of score for each attitude separately, PROC GLM ,SAS

Version 9.2). Models 2-5 were each conducted using conditional risk set Repeated Events Survival Modeling using COX Models[127] to estimate the risk of screening mammograms and lipid screenings (PROC PHREG, SAS Version 9.3). These models assume that a woman is not at risk of a second screening until her first screening is complete. **Model 2** regresses race/ethnicity, income, and education on screening mammograms and lipid screenings (separately by cohort), **Model 3** examines optimism and cynical hostility as predictors for screenings). **Model 4** combines Model 1 and Model 3 predictors, and will allow us to determine whether effect sizes change or disappear when race and SES variables enter the model together with attitudes (mediator-type effect). Finally, **Model 5** extends Model 4 by adding interaction terms between each attitude and each race/ethnicity and SES variable. Significant interaction terms in Model 5 would indicate a moderator-type effect.



Model 4 = *Model 1 Predictors + Model 3 Predictors (Outcome = Screenings)*
Model 5 = *Model 4 Predictors + Interaction Terms (Outcome = Screenings)*

Figure 2-1: Modeling Steps to Examine the Role of Attitudes as Mediators or Moderators

2.3 RESULTS

2.3.1 Baseline Characteristics and Cross-Sectional Analysis

Our mammography cohort had an average age of 72.2 (SD 6.4), was primarily white (89.5%) and was relatively well-educated and high-income, with only 2.8% of women having not completed high school and 10.6% reporting household incomes of less than $20,000 annually. Our lipid screening cohort was similar on demographic characteristics: 72.5 years old (SD 5.7), 90.5% white, 2.4% completing less than a high school education, and 9.4% reporting incomes less than $20,000 annually. Due to application of exclusion criteria for cardiovascular and lipid disorders, the lipid screening cohort was markedly healthier and had lower prevalence of obesity, diabetes, and hypertension (**Table 2-1**).

Table 2-1. Baseline Characteristics

	Baseline Characteristics By Cohort		Mammogram Cohort (N=48,291)		Lipid Screening Cohort (N=24,857)	
			N	%	N	%
Basic Factors	Enrolled in OS		26079	54.0	14110	56.8
	Age on Jan 1, 2005 (Mean, SD)		72.2	6.4	72.5	5.7
	U.S. region:	Northeast	12354	25.6	6468	26.0
		South	14303	29.6	7150	28.8
		Midwest	11434	23.7	5937	23.9
		West	10200	21.1	5302	21.3
Race, Ethnicity, and SES factors	Race/ethnicity:	White	43241	89.5	22495	90.5
		Black	2746	5.7	1252	5.0
		Hispanic	862	1.8	396	1.6
		American Indian	128	0.3	55	0.2
		Asian/Pacific Islander	817	1.7	411	1.7
		Unknown	497	1.0	248	1.0
	Education:	0-8 years	249	0.5	99	0.4
		Some high school	1131	2.3	496	2.0
		High school diploma/GED	7840	16.2	3861	15.5
		School after high school	17689	36.6	8820	35.5
		College degree or some postgrad	11834	24.5	6423	25.8
		Graduate degree or higher	9324	19.3	5036	20.3
	Income	<$20,000	5138	10.6	2332	9.4
		$20,000 - $49,999	19881	41.2	10218	41.1
		$50,000 - $74,999	10152	21.0	5318	21.4
		$75,000 +	10443	21.6	5564	22.4
Health System Factors	Medicare eligibility: 65+		46947	97.2	24320	97.8
		Disability	1332	2.8	534	2.1
		End-stage renal disease	9	0.0	3	0.0
		Both DIB + ESRD	3	0.0	0	0.0
	Uninsured at baseline of WHI		1414	2.9	706	2.8
	No regular source of medical care at baseline		2498	5.2	1501	6.0
Psychosocial Factors	Optimism construct (Mean, SD)		23.6	3.4	23.7	3.3
	Hostility construct (Mean, SD)		3.4	2.7	3.3	2.6
	Lived alone at baseline		10906	22.6	5637	22.7
	Social support construct (Mean, SD)		36.6	7.4	36.9	7.2
	Social strain construct (Mean, SD)		6.4	2.4	6.2	2.3
Health Behaviors	Consumed alcohol at baseline		34193	70.8	18250	73.4
	Physical activity:	<2.5 METs/week	10780	22.3	5422	21.8
		2.5 - <18.25 METs/week	23238	48.1	12411	49.9
		≥18.25 METS/week	12022	24.9	6987	28.1
	Smoking:	Smoked at baseline of WHI	2674	5.5	1188	4.8
		Past smoker	20534	42.5	10527	42.4
		Never Smoked	24605	51.0	12919	52.0
Health Conditions	Obesity (BMI≥30 at Baseline)		13281	27.5	6090	24.5
	Hypertension ever at baseline		15634	32.4	6464	26.0
	High cholesterol requiring pills ever at baseline		6346	13.1	0	0.0
	Diabetes ever at baseline		2172	4.5	653	2.6
	Depressive symptoms (CES-D) at baseline		4213	8.7	1913	7.7

2.3.2 Distribution of Race/Ethnicity, Income, and Education by Attitude

In the mammograms cohort, mean levels of optimism (**Table 2-2**) were generally lower for minority women (with the exception of black women, whose mean rates in this cohort were

similar to whites). Mean scores for cynical hostility in the mammograms cohort were higher for minority groups as compared to whites, with the exception of Asian/Pacific islander women. These same patterns held for the lipid screening cohort. Mean rates of optimism increased along the gradient of increased education and increased income in both cohorts and the reverse trend was true for cynical hostility. These differences were statistically significant when attitudes were characterized by quartiles of score and assessed via chi-square tests for significance (all $p<0.0001$).

Table 2-2. Mean Attitudes Scores by Race/Ethnicity and SES variables

Mean Attitudes Scores by Race/ethnicity, Education, and Income	Mammograms Cohort n=48,291			Lipid Screening Cohort n=24,857		
	N	Optimism Mean (SD)	Cynical Hostility Mean (SD)	N	Optimism Mean (SD)	Cynical Hostility Mean (SD)
Race/ethnicity						
White	43241	23.6 (3.4)	3.3 (2.6)	22495	23.8 (3.3)	3.2 (2.6)
Black	2746	23.6 (3.4)	4.5 (3.0)	1252	23.6 (3.5)	4.5 (2.9)
Hispanic	862	22.8 (3.4)	4.1 (3.1)	396	22.9 (3.2)	3.9 (3.0)
American Indian	128	22.8 (3.8)	4.5 (3.2)	55	23.5 (3.6)	4.6 (3.0)
Asian/Pacific Islander	817	22.7 (3.0)	3.2 (2.9)	411	22.7 (3.0)	3.2 (2.9)
Unknown	497	23.1 (3.3)	4.0 (2.8)	248	23.5 (3.0)	3.7 (2.7)
Education						
0-8 yrs	249	21.5 (3.4)	5.4 (3.5)	99	21.4 (3.9)	5.1 (3.7)
Some high school	1131	22.0 (3.5)	4.6 (3.2)	496	22.2 (3.5)	4.3 (3.1)
High school diploma/GED	7840	22.7 (3.3)	3.7 (2.8)	3861	22.9 (3.3)	3.6 (2.7)
School after high school	17689	23.5 (3.3)	3.6 (2.7)	8820	23.6 (3.3)	3.5 (2.7)
College degree or some post-grad	11834	24.0 (3.3)	3.1 (2.6)	6423	24.1 (3.3)	3.1 (2.5)
Graduate degree or higher	9324	24.2 (3.3)	3.1 (2.5)	5036	24.2 (3.4)	3.0 (2.5)
Missing	224	23.3 (3.7)	3.9 (2.9)	122	23.3 (3.7)	3.7 (2.8)
Income						
< $20,000	5138	22.6 (8.6)	4.3 (3.0)	2332	22.7 (3.6)	4.1 (3.0)
$20,000 - $49,999	19881	23.4 (3.3)	3.5 (2.7)	10218	23.5 (3.3)	3.4 (2.6)
$50,000 - $74,999	10152	23.8 (3.3)	3.2 (2.6)	5318	23.9 (3.3)	3.1 (2.5)
$75,000 +	10443	24.3 (3.2)	3.0 (2.5)	5564	24.4(3.2)	3.0 (2.5)
Missing	2677	23.4 (3.4)	3.6 (2.8)	1425	23.6(3.3)	3.5 (2.7)

Note: Range of scores for optimism is 6-30 and for cynical hostility is 0-13.

2.3.3 Distribution of Observed Time-Without-Screening by Attitudes

2.3.3.1 Screening Mammograms

Consistent with our hypothesis, most optimistic women had an median observed time-without-screening of 13.5 months for mammograms while least optimistic women had a median observation of 14.4 months between screening mammograms ($p<0.0001$ across quartiles, **Figure 2-2**). Similarly, least cynically hostile women had a median of 12.8 months without screening mammograms, while their most hostile peers' median was 14.4 months ($p<0.0001$ across quartiles).

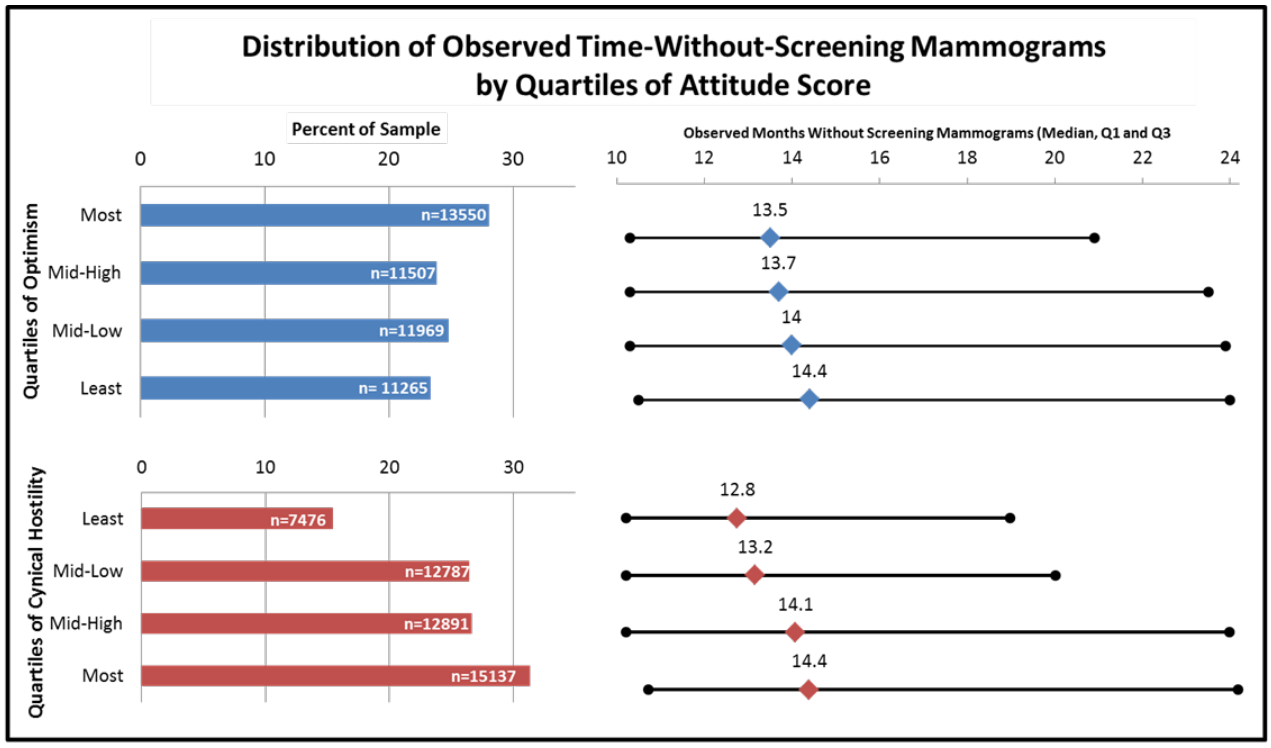


Figure 2-2. Distribution of Observed Time-Without-Screening Mammograms by Quartiles of Attitude

2.3.3.2 Lipid Screenings

Contrary to what we expected, most optimistic women had longer median observed time-without screening (18.0 months) than their least optimistic peers (17.7 months), significant at p=0.0006 across quartiles (**Figure 2-3**). We saw a similarly unexpected result for cynical hostility and time-without-lipid screening: least cynically hostile women had longer median observed time-without-screening (18.0 months) as compared to their most cynically hostile peers (16.3 months, p=0.0035 across quartiles).

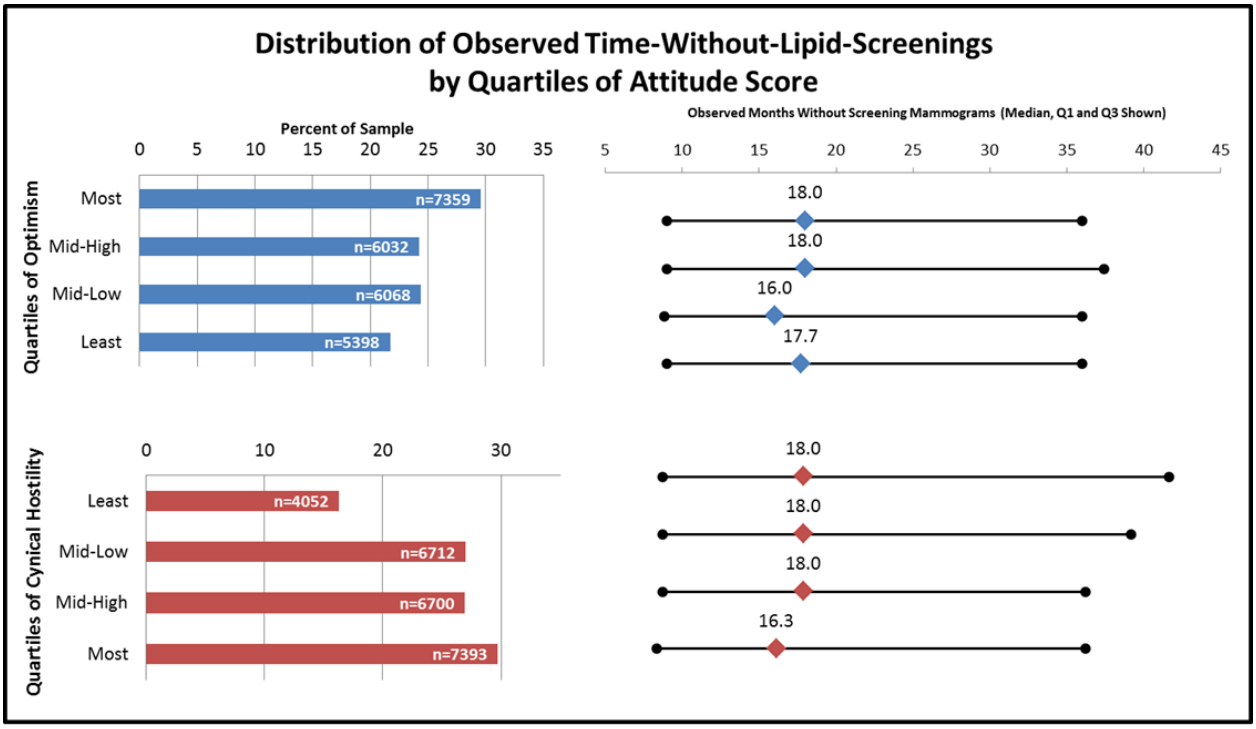


Figure 2-3. Distribution of Observed Time-Without-Lipid-Screenings by Quartiles of Attitude Score

2.3.4 Modeling Attitudes for Role as Mediators and Moderators

2.3.4.1 Overall (Type III) Effects

Race/ethnicity and education significantly predicted attitudes (optimism and cynical hostility) and screenings in **Models 1 and 2**, while income significantly predicted attitudes and screening mammograms but not lipid testing (**Table 2-3**). Optimism, but not cynical hostility, was significantly associated with screening mammograms and lipid screenings (**Model 3**). Results for **Model 4** were consistent with earlier models, suggesting that attitudes did not act as mediators, while **Model 5** showed significant interactions for optimism and race (in the case of screening mammograms) and cynical hostility and race (in the case of lipid testing); which suggests attitudes do act as mediators in the relationship between race/ethnicity, SES, and screenings.

Table 2-3. Type III (Overall) Significant Associations for Screening Mammograms and Lipid Screenings

Significant Type III (Overall) Effects	Screening Mammography Cohort n=48,291		Lipid Screening Cohort n=24,857	
Model 1	Optimism	Cynical Hostility	Optimism	Cynical Hostility
Race/Ethnicity	✓	✓	✓	✓
Income	✓	✓	✓	✓
Education	✓	✓	✓	✓
Model 2	Screening Mammograms		Lipid Screenings	
Race/Ethnicity	✓		✓	
Income	✓		-	
Education	✓		✓	
Model 3	Screening Mammograms		Lipid Screenings	
Optimism	✓		✓	
Cynical Hostility	-		-	
Model 4	Screening Mammograms		Lipid Screenings	
Race/Ethnicity	✓		✓	
Income	✓		-	
Education	✓		✓	
Optimism	✓		✓	
Cynical Hostility	-		-	
Model 5	Screening Mammograms		Lipid Screenings	
Race/Ethnicity	✓		✓	
Income	-		-	
Education	-		-	
Optimism	-		-	
Cynical Hostility	-		-	
Optimism * Race/Ethnicity	✓		-	
Optimism*Income	-		-	
Optimism*Education	-		-	
Cynical Hostility*Race/Ethnicity	-		✓	
Cynical Hostility*Income	-		-	
Cynical Hostility*Education	-		-	

Modeled using GLM ordinal regression (Model 1) and Repeated Events Survival Analysis (Models 2-5) and adjusting for covariates. Models 2-5 accounted for repeated measures by reporting estimates and p-values adjusted using sandwich variance estimator (robust variance estimator).

2.3.4.2 Examining Direction of Effects

In **Model 1,** Black vs. white women were more likely to be in higher quartiles of score for optimism and cynical hostility when adjusted for covariates in both screening cohorts (all

p<0.0001, **Table 2-4**). That black women were more likely to be optimistic after full adjustment was unexpected, but likely explains why no black vs. white differences are seen in any subsequent modeling steps: it is likely that these models have "adjusted away" the factors that typically account for any existing differences between black and white women through extensive covariate adjustment. What remains of the racial/ethnic differences appears in smaller subgroups. High vs. low income and high vs. low education predicted higher quartile of optimism score and lower quartile of cynical hostility score in both cohorts, which was in the expected direction.

In **Model 2**, higher-income and higher-educated women were more likely to obtain a screening mammogram (**Table 2-4).** Black vs. white women had no statistically significant difference, but as an example of subgroup differences, Asian/ Pacific Islander women were 10% more likely to have screening mammograms (p=0.0022) and 60% more likely to have lipid screenings (p<0.0001), while Hispanic women were 10% less likely to have screening mammograms only (p=0.0002, not shown). These sub-group differences likely account for the overall effect of race being significant for Model 2 (**Table 2-4**). Due to small sample size, we cannot account for significance of effects in smaller racial/ethnic categories.

In **Model 3** least vs. most optimistic women were 4% more likely to have screening mammograms (HR 1.04, 95% CI 1.02-1.07, p=<0.0001*), and 3% more likely to have lipid screenings (HR 1.03, 95% CI 1.00-1.07, p=0.0506*). Cynical hostility was not associated with obtaining either lipid screenings or screening mammograms (**Table 2-4**)

In **Model 4** for the mammograms cohort, effects were similar in size and direction to those seen in Models 2 and 3. The same was true of Model 4 in the lipids cohort, with the exception that optimism (which had been significant at p=0.0506) was no longer significant (p=0.057). Therefore overall the attitudes variables did not mediate the effect of income or

education on likelihood of receiving screening mammograms. Women with high vs. low incomes (HR 1.10, 95% CI 1.07-1.14, p<0.0001), high vs. low education levels (HR 1.07, 95% CI 1.02-1.13, p=0.0073), and least vs. most optimism scores (HR 1.05, 95% CI 1.03-1.07, p<0.0001) were more likely to obtain screening mammograms (**Table 2-4**).

In **Model 5**, as mentioned, overall effect of race/ethnicity was significant both for screening mammograms and lipid screenings, while an optimism-by-race interaction was significant only for mammograms, and a cynical hostility-by-race interaction was significant only for lipid screenings. Least (vs. most) optimistic American Indian women were 70% more likely to obtain screening mammograms (HR 1.70, 95% CI 1.12 -2.59, p=0.0148, not shown) and least (vs. most) optimistic women in the Other racial/ethnic category (which includes both multi-racial women and women who did not choose to report race) were 38% more likely to obtain screening mammograms (HR 1.38, 95% CI 1.10-1.74, p=0.0060, not shown). In the lipid screenings cohort, the difference in screenings for the most vs. least hostile women was not significant in any racial/ethnic group; the interaction was significant due to differences among the middle quartiles and least cynically hostile women in Hispanic, American Indian, and black women. Due to sample size limitations, we cannot directly address the significance of the observed effects within each group for Model 5 (**Table 2-4**).

Table 2-4. Results for Screening Mammograms and Lipid Screenings

Analysis Models - Fully adjusted for covariates	Screening Mammography Cohort n=46,895				Lipid Screening Cohort n=24,156			
Model 1	Optimism (increasing score by quartile)		Cynical Hostility (decreasing score by quartile)		Optimism (increasing score by quartile)		Cynical Hostility (decreasing score by quartile)	
	OR (95% CL)	p-value	OR (95% CL)	p-value	OR (95% CL)	p-value	OR (95% CL)	p-value
Race/Ethnicity (Black v. White)	1.22 (1.12- 1.32)	p<0.0001*	0.64 (0.59- 0.69)	p<0.0001 *	1.08 (0.97- 1.21)	p<0.0001 *	0.61 (0.54-0.68)	p<0.0001*
Income ($75K+ vs <20K)	1.45 (1.34- 1.56)	p<0.0001 *	1.25 (1.16- 1.34)	p<0.0001 *	1.41 (1.27- 1.56)	p<0.0001 *	1.22 (1.10- 1.35)	p=0.0002*
Education (Grad degree + v. <HS)	2.60 (2.32- 2.90)	p<0.0001 *	1.68 (1.50- 1.88)	p<0.0001 *	2.21 (1.87- 2.61)	p<0.0001 *	1.44 (1.22- 1.70)	p<0.0001 *
Model 2	Screening Mammograms				Lipid Screenings			
	HR (CI)		p-value		HR (CI)		p-value	
Race/Ethnicity (Black v. White)	0.97 (0.94-1.00)		p=0.0766		1.01 (0.96-1.06)		p=0.7444	
Income ($75K+ v <20K)	1.10 (1.06-1.14)		p<0.0001*		1.01 (0.96-1.06)		p=0.7984	
Education (Grad degree + v. <HS)	1.06 (1.01-1.12)		p=0.0221*		0.96 (0.89-1.05)		p=0.3890	
Model 3	Screening Mammograms				Lipid Screenings			
	HR (CI)		p-value		HR (CI)		p-value	
Optimism (Least v. Most)	1.04 (1.02-1.07)		p<0.0001*		1.03 (1.00-1.07)		p=0.0506*	
Cynical Hostility (Most v. Least)	1.01 (0.99-1.03)		p=0.4716		0.99 (0.95-1.02)		p=0.393	
Model 4	Screening Mammograms				Lipid Screenings			
	HR (CI)		p-value		HR (CI)		p-value	
Race/Ethnicity (Black v. White)	0.97 (0.93-1.00)		p=0.0835		0.88 (0.71-1.09)		p=0.2314	
Income ($75K+ v. <20K)	1.10 (1.07-1.14)		p<0.0001*		1.01 (0.96-1.06)		p=0.7342	
Education (Grad degree + v. <HS)	1.07 (1.02-1.13)		p=0.0073*		0.97 (0.89-1.05)		p=0.4078	
Optimism (Least v. Most)	1.05 (1.03-1.07)		p<0.0001*		1.01 (0.98-1.04)		p=0.5701	
Cynical Hostility (Most v. Least)	1.01 (0.99-1.04)		p=0.2454		0.99 (0.96-1.03)		p=0.6755	
Model 5	Screening Mammograms				Lipid Screenings			
	HR (CI)		p-values		HR (CI)		p-values	
Race/Ethnicity (Black v. White)†	0.90 (0.82-0.98)		p=0.0180*		1.01 (0.88-1.16)		p=0.8774	
Income ($75K+ v. <20K)†	1.09 (1.00-1.18)		p=0.0395*		1.15 (1.01-1.31)		p=0.0327	
Education (Grad degree+ v. <HS)†	1.01 (0.88-1.17)		p=0.8646		0.89 (0.74-1.06)		p=0.1945	
Optimism (Least v. Most)‡	1.04 (0.99-1.08)		p=0.0972		1.01 (0.95-1.08)		p=0.7080	
Cynical Hostility (Most v. Least)‡	1.02 (0.98-1.07)		p=0.3305		1.04 (0.96-1.12)		p=0.3374	
Interaction Terms:			Type III p-values				Type III p-values	
1. Optimism * Race/Ethnicity	-		p=0.0080*		-		p=0.9539	
2. Optimism*Income	-		p=0.2130		-		p=0.2148	
3.Optimism*Education	-		p=0.6651		-		p=0.2964	
4. Cynical Hostility* Race/Ethnicity	-		p=0.5878		-		p=0.0104*	
5. Cynical Hostility *Income	-		p=0.6036		-		p=0.4050	
6. Cynical Hostility *Education	-		p=0.9245		-		p=0.0636	

† Reported OR's for Optimism and Cynical Hostility fixed at mid-high
‡ Reported OR's for fixed levels of race/ethnicity (white), education (>HS), and income ($20-49K annually)
Modeled using GLM ordinal regression (Model 1) and Repeated Events Survival Analysis (Models 2-5) and adjusting for covariates. Models 2-5 accounted for repeated measures by reporting estimates and p-values adjusted using sandwich variance estimator (robust variance estimator).

2.4 DISCUSSION

Observed unadjusted time-without-screening mammogram decreased as quartile of optimism score increased, and as quartile of cynical hostility score decreased (both $p<0.0001$). Meanwhile, observed unadjusted time-without-screening for lipid testing increased as quartiles of optimism score increased ($p=0.0006$) and as quartiles of cynical hostility score decreased ($p=0.0035$). Only optimism predicted screening mammograms and lipid screenings, with least optimistic being 4% more likely to obtain screening mammograms and 3% more likely to obtain lipid screenings than their most optimistic peers. Psychological attitudes did not act as mediators of the relationship between race/ethnicity, income, and education on obtaining either type of screening. However, optimism acted as a moderator for the relationship between race/ethnicity and screening mammograms: only least vs. most optimistic American Indian women and women in the "Other" racial/ethnic category (which included multi-racial women and those choosing not to report race) were more likely to obtain screening mammograms. Cynical hostility acted as a moderator of the relationship between race/ethnicity and lipid screenings: mid-high vs. least cynically hostile black women were more likely to report lipid screenings, as were mid-low vs. low cynically hostile American Indian and Hispanic women.

Because women with high optimism are on average healthier, employ more proactive problem solving strategies, [35,55] and adhere to medical advice more readily than less-optimistic peers, [46,128] we anticipated more optimistic women would have more frequent screenings. Our

hypotheses stemmed from the expectation that because women with low optimism hold negative expectations of the future, they may view preventive services as ineffective or pointless, and therefore underutilize them. Our observed results before covariate adjustment were consistent with these hypotheses. In survival analysis with covariate adjustment and accounting for clustering of repeated events per woman, we found the opposite to be true (least optimistic women more likely to obtain screening mammograms) and the effect was more pronounced within specific racial/ethnic groups. These results may suggest an alternate explanation: that women with low optimism and therefore high negative expectations of the future may seek out additional screenings in anticipation of poor health outcomes.

Similarly, after adjustment for covariates and accounting for multiple events per woman, cynical hostility's effect within certain racial/ethnic groups on lipid screenings was in the opposite direction of our expectation: with higher cynical hostility associated with higher lipid screening specifically among American Indian, Black, and Hispanic women. Though we adjusted for health status and health behaviors and controlled for various cardiovascular and lipid-related conditions, it is possible that more cynically hostile women are still experiencing additional health problems compared to less cynically hostile peers, and therefore receiving lipid testing sooner – either as part of true screenings, or as part of disease management recommended by their physician for conditions which may have not been captured in our models.

2.5 LIMITATIONS

Our study has some potential limitations. First, women in the WHI may be more conscientious about their health, and our cohorts are also higher income, better educated, older, as well as healthier than the general population (due to health condition restrictions, especially the lipid screenings cohort). Though the WHI includes only women, optimism and pessimism are similarly distributed in men and women, implying that these results still may apply to men.[129] A second limitation is that psychological attitudes are measured at baseline in the WHI. While psychological attitudes are typically considered stable traits over the life course, they can sometimes change over time[86] or in the presence of targeted interventions. [88,89] Third, although we can measure several health-system factors, we do not observe screenings for women in Medicare Part C. For those in our sample who have Part A and B coverage, we could not measure supplemental coverage (Medigap plans). We also cannot observe providers' treatment recommendations or the content of patient-provider interactions, which could be a large influence on whether women pursue screenings in the first place. Fourth, clinical practice recommendations are constantly evolving, and actual practice patterns may differ from recommended guidelines in any given year. Fifth, our identification of women for screening tests based on the available diagnoses and demographic characteristics available in Medicare and WHI may under or overestimate eligibility. For example a woman's physician may determine that certain screenings are unnecessary using clinical information which we cannot access. We may underestimate eligibility if health conditions are under-coded or under-diagnosed. It is possible that, because the lipid screenings cohort excluded many women based on cardiovascular health conditions, women in our lipid screening sample represent an exceedingly healthy group of elderly women. This may be especially true for the selection of minority women, who

otherwise experience greater burden from conditions like CVD and breast cancer at younger ages: we may therefore have captured the "healthiest" women, especially from minority racial/ethnic groups

2.6 CONCLUSIONS

Understanding how psychological attitudes relate to use of recommended preventive healthcare services could clarify how these traits predict increased risk of conditions like CVD and overall mortality. To the extent that psychological traits form early in life and are associated with the development of CVD risk factors in younger populations, they may represent one of the "earliest" CVD risk factors. Regardless of their malleability, these traits are an important marker of vulnerable populations. If psychological attitudes have a greater effect on the use of preventive services among women from specific minority racial/ethnic groups then these women may be especially vulnerable to use services outside of recommended screening windows. The fact that specific differences in how optimism affects screening mammogram use exist among some but not all racial/ethnic minorities suggests that incorporating some consideration of these psychological factors for these groups only may be a way to begin to explore their utility in risk modeling.

2.7 SUPPLEMENTAL FIGURES AND TABLES

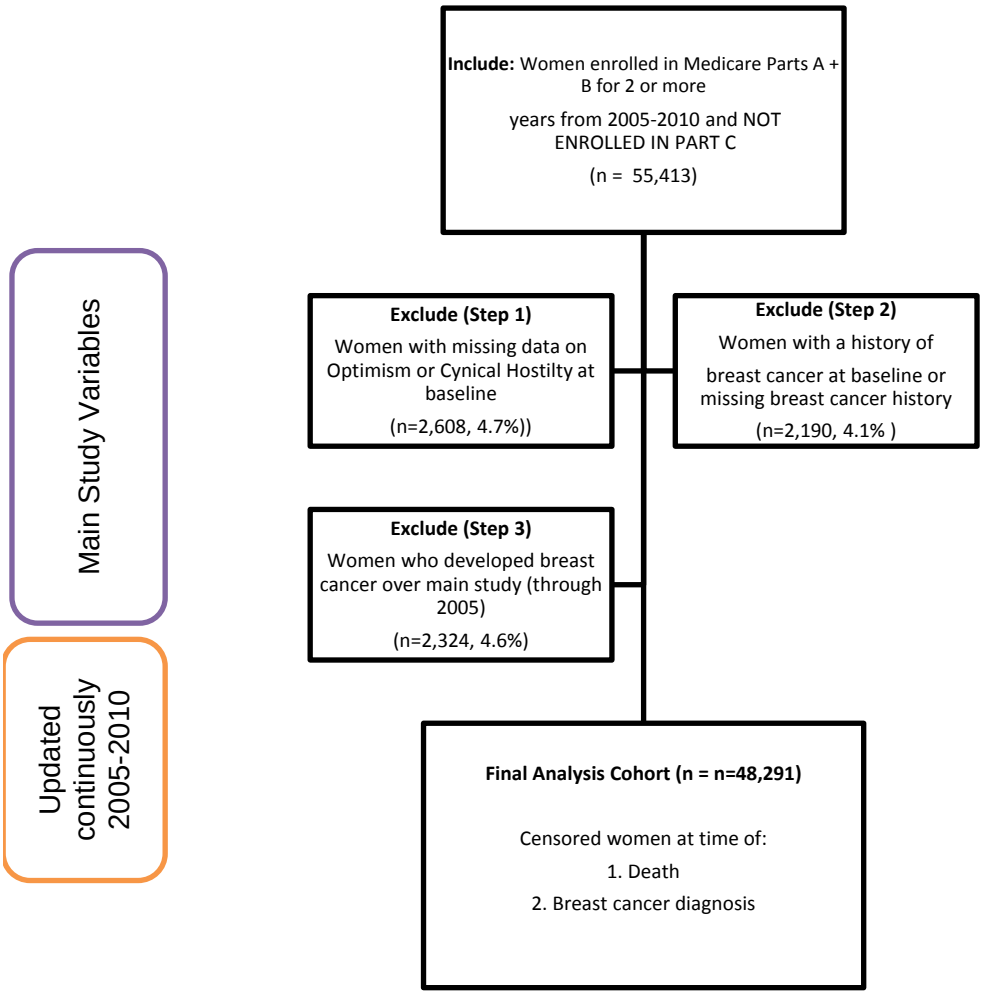
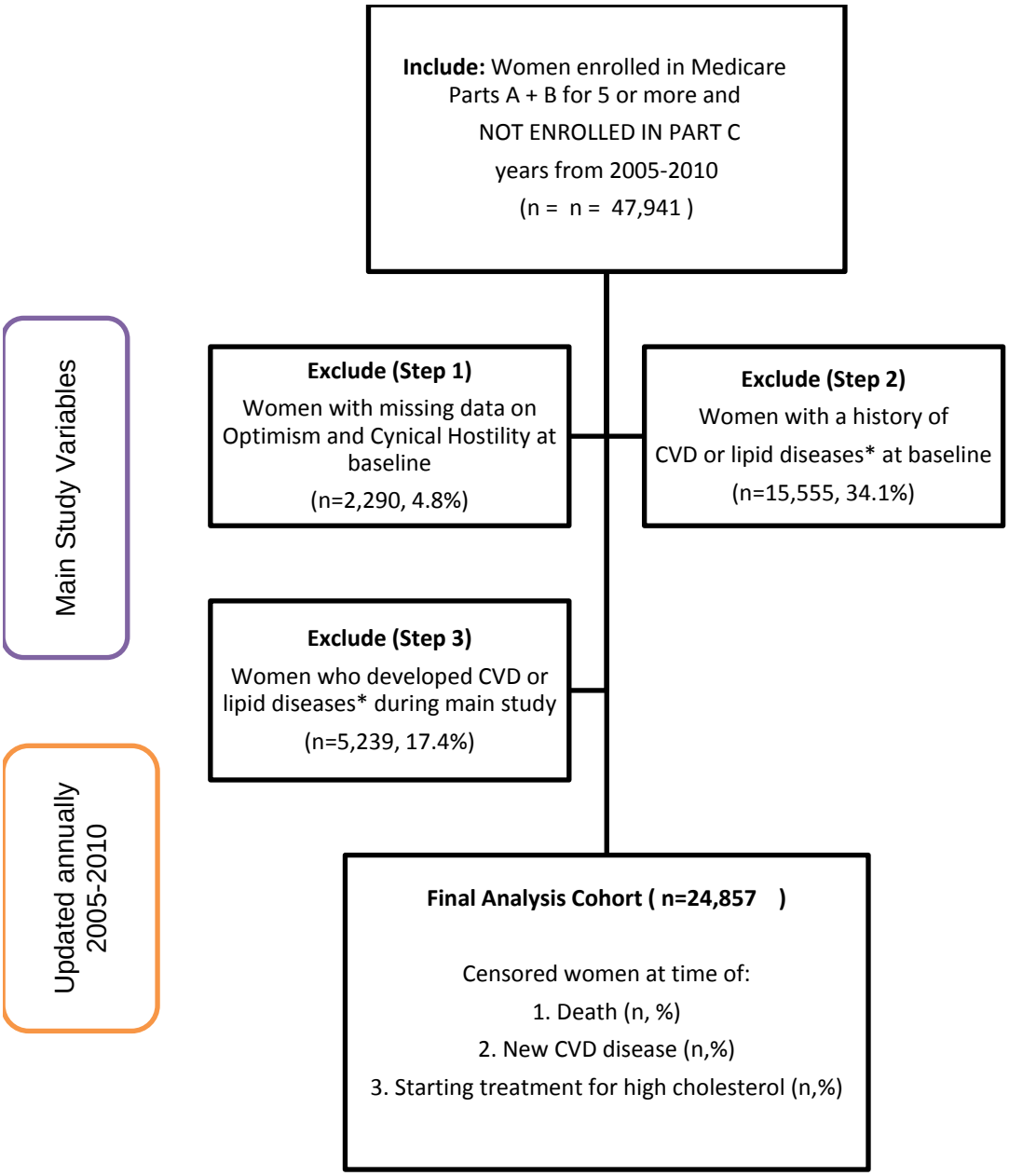
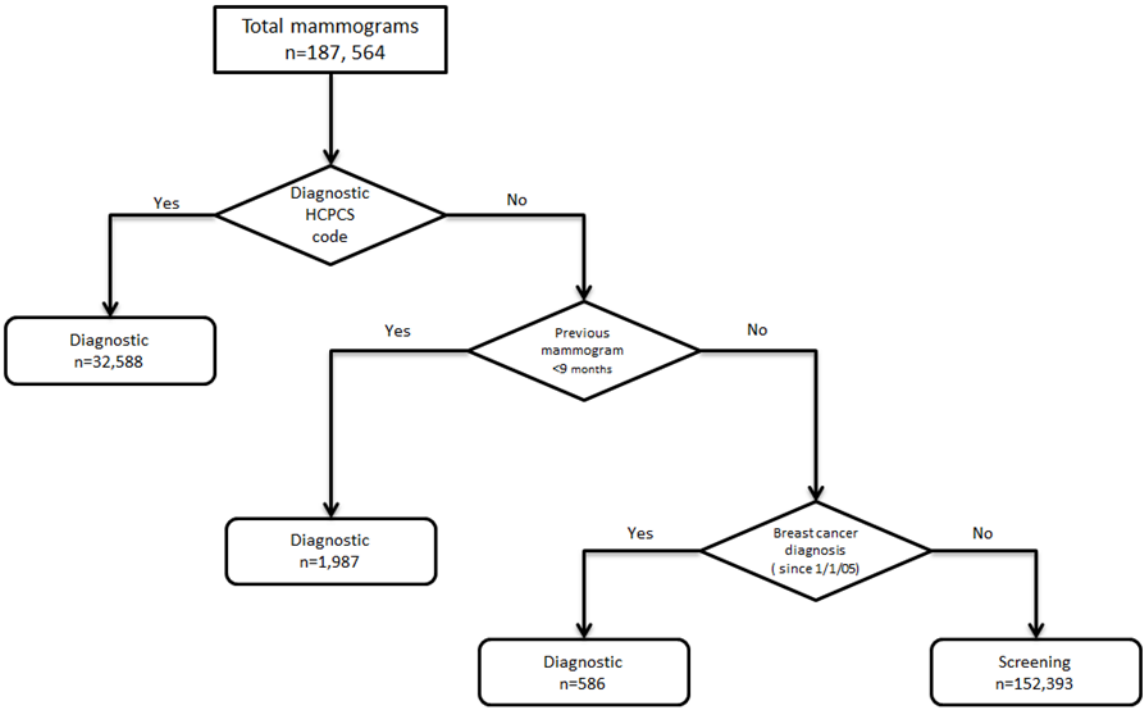


Figure 2-4. Mammography Cohort Selection Flowchart



*Cardiovascular and lipid disorder exclusion criteria exclusion conditions: stroke, myocardial infarction, cardiovascular disease, heart failure, congestive heart failure, cardiac arrest, peripheral arterial disease, coronary bypass surgery, angioplasty of coronary arteries, carotid endarterectomy or angioplasty, high cholesterol requiring pills, use of medication for angina, any statin use.

Figure 2-5. Lipids Screenings Cohort Selection Flowchart



Procedure Codes for Screening Mammograms (CPT/HCPC)	Procedure Codes for Diagnostic Mammograms (CPT/HCPC)	
76092	76090	G0204
77057	77055	G0206
G0202	76091	
	77056	

Algorithm Adopted from Fenton, et al. 2014

Figure 2-6. Screening vs. Diagnostic Mammograms by Codes and As Reported in Study Via Algorithm

Procedure Codes for Lipid Testing (CPT/HCPC)	
Full Panel	80061
Cholesterol	82465
Lipoprotein	83718
Triglycerides	84478

"Cardiovascular Screening Blood Test" in Medicare

Figure 2-7. Procedure Codes for Lipid Testing (CPT/HCPC)

Average **Time Without Screening Mammogram** (Months) – average time without screening. Include Time-to-Event and Time-to-event (censored).	
Time-Without-Screening Modeling	**Definition**
Time-to-event ("Screening Gap"- Definite)	A gap in between a "Hard" Start Point and "Hard" End Point (these would be the only events included in the **"Screening Gap")**
Time-to-event (censored) (Indefinite time-to-event)	A period between a "Hard" Start and "Censored" End Point (right censored) **OR** A period between a "Censored" Start Point and "Hard" End Point (left censored) **OR** A period between a "Censored" Start Point and "Censored" End Point (both sides censored)
Not Included in analysis	(1) any period following a **breast cancer diagnosis** or **death** (woman's follow-up time ends at this point) (2) any period of **less than 8 weeks** between screenings – ignore this screening period in modeling analysis

START POINTS		END POINTS	
"Hard" Start Points	**"Censored" Start Points**	**"Hard" End Points**	**"Censored" End Points**
Screening Mammogram	Study Start	Screening Mammogram (EVENT)	Study End
Diagnostic Mammogram			Diagnostic Mammogram
			Breast Cancer Diagnosis
			(Death)

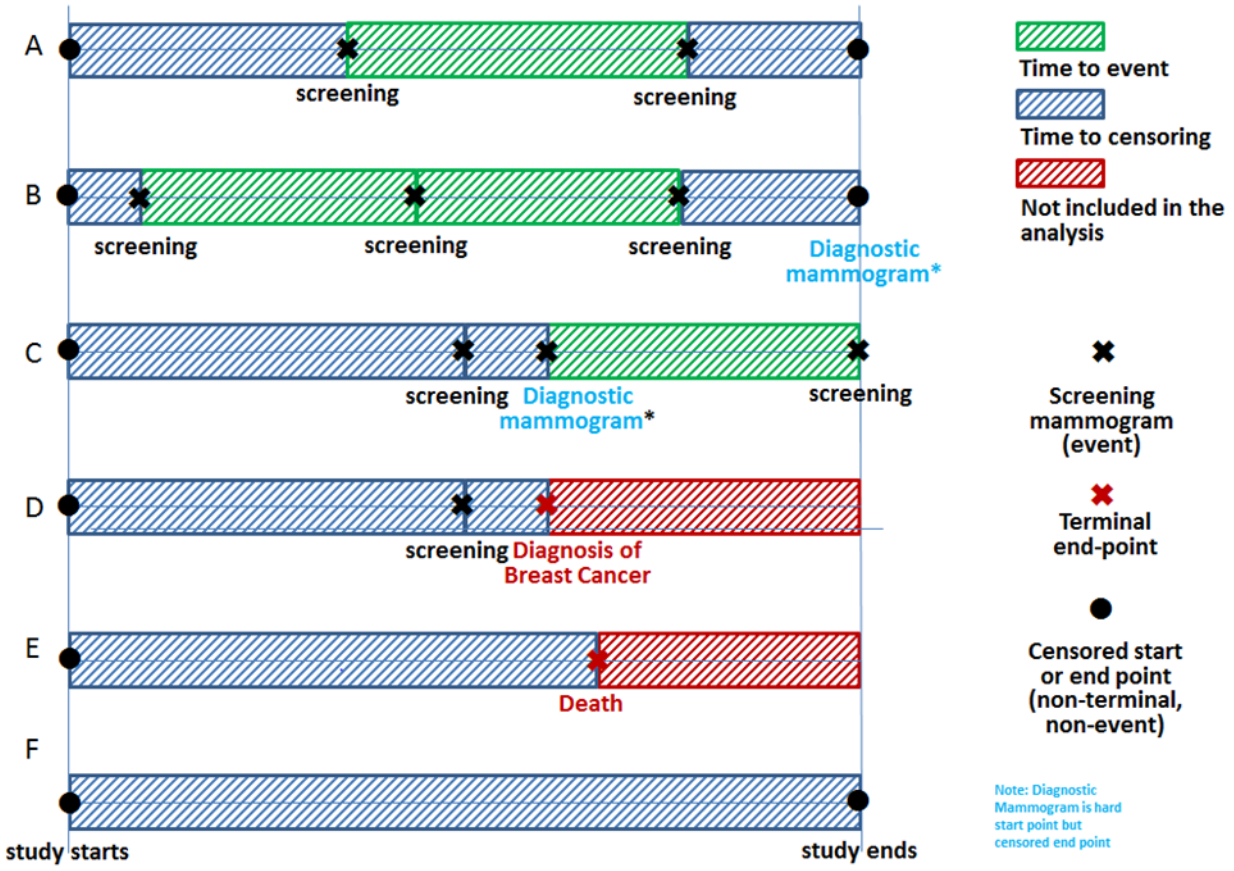
Figure 2-8. Screening Mammograms Outcome Variable for Survival Analysis

Average **Time Without Lipid Test** (Months) – average time without lipid test. (Note that this will include the Time-To-Event situation below and the Time-To-Event (Censored).	
Time-Without-Lipid Test Modeling	**Definition**
Time-to-event ("Screening Gap"- Definite)	A gap in between a "Hard" Start Point and "Hard" End Point (these would be the only events included in the **"Screening Gap")**
Time-to-event (censored) (Indefinite time-to-event)	A period between a "Hard" Start and "Censored" End Point (right censored) **OR** A period between a "Censored" Start Point and "Hard" End Point (left censored) **OR** A period between a "Censored" Start Point and "Censored" End Point (both sides censored)
Not Included in analysis	(1) any period following a **CVD diagnosis** or **death** (woman's follow-up time ends at this point)

Note: any 2 screenings within 14 days were counted as 1 lipid test.

START POINTS		END POINTS	
"Hard" Start Points	**"Censored" Start Points**	**"Hard" End Points**	**"Censored" End Points**
Lipid Test	Study Start	Lipid Test	Study End
			CVD Diagnosis
			(Death)

Figure 2-9. Lipid Screenings Outcome Variable for Survival Analysis



Example sketch of included time durations for modeling in screening mammograms cohort, as well as events and non-events for survival analysis.

Figure 2-10. Time-Without-Screening and Survival Analysis

LOT-R: Life-Orientation Test (Revised)
In uncertain times, I usually expect the best
Overall, I expect more good things to happen to me than bad
I'm always optimistic about my future
If something can go wrong for me it will
I hardly ever expect things to go my way
I rarely count on good things happening to me

Figure 2-11. Life-Orientation Test (Revised). Developed by Scheier et. al.

Cook-Medley Questionnaire Cynicism Subscale items
I have often had to take orders from someone who did not know as much as I did.
I think a great many people make a lot of their bad luck in order to gain the sympathy and help of others.
It takes a lot of argument to convince most people of the truth.
I think most people would lie to get ahead.
Most people are honest mainly through fear of being caught.
Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.
No one cares much what happens to you.
It is safer to trust nobody.
Most people make friends because friends are likely to be useful to them.
Most people inwardly do not like putting themselves out to help other people.
I have often met people who were supposed to be experts who were no better than I.

Figure 2-12. continued below

People often demand more respect for their own rights than they are willing to allow for others.
A large number of people are guilty of bad sexual behavior.

Figure 2-12. Cook-Medley Cynical Hostilty Subscale Items

Table 2-5. Modeling Steps for GLM and Survival Analysis

Main effects

Model 1: $Attitude_i$ = *Race/Ethnicity + Income + Education + Covariates*

Model 2: $Screenings_i$ = *Race/Ethnicity + Income + Education + Covariates*

Model 3: $Screenings_i$ = *Optimism + Cynical Hostility + Covariates*

Mediation:

Model 4: $Screenings_i$ = Optimism + Cynical Hostility + Race/Ethnicity + Income + Education + Covariates

Moderation

Model 5: $Screenings_i$ = *Optimism + Cynical Hostility + Race/Ethnicity + Income + Education + Optimism*Race/Ethnicity + Optimism*Income + Optimism*Education + + Hostility*Race/Ethnicity + Hostility*Income + Hostility*Education + Covariates*

i = { *screening mammograms*; *lipid screenings* } j = { *optimism (quartiles)*; *cynical hostility (quartiles)* }

Model 1 was conducted using GLM ordinal logistic regression models in SAS 9.2.
Models 2-5 were conducted using Repeated Events Survival Modeling (SAS 9.2, PHREG procedure).

3.0 OPTIMISM, CYNICAL HOSTIITY, AND STRENUOUS PHYSICAL ACTIVITY IN OLDER WOMEN OVER TIME

3.1 INTRODUCTION

The American Heart Association and American College of Sports Medicine recommend that healthy adults should get at least 20 minutes of vigorous PA (PA) three days per week or more (or 30 minutes of moderate intensity aerobic activity five days per week or more), in order to promote and maintain health.[130] Many women report declines in PA during and after menopause[131], despite the fact that PA during and after menopause helps to improve cardiorespiratory fitness,[132] mood, and quality of life, [133] helps prevent bone loss,[134] and reduces perceived severity of menopause symptoms.[135] This decline in energy expenditure at the onset of menopause also predisposes women to weight gain.[131] Factors known to protect against age-related decline in vigorous PA include lower BMI, not smoking, having excellent general health, and having a higher socioeconomic status (SES). [136] Uncovering additional factors which protect against drops in PA during menopause may lead to novel strategies to help women maintain their PA levels during this period of their lives.

Lower optimism (positive future expectation)[137] and higher cynical hostility (strong mistrust of others) [122] are independent risk factors for incident coronary heart disease (CHD), CHD-related mortality, and mortality[138] and one possible mechanism is through increased PA. [60]

These psychological factors influence health outcomes via several mechanisms, including direct (e.g., psycho-physiologic processes)[30-32,111-113] and indirect pathways (health behaviors, adherence). [139,140] Women with more optimistic attitudes tend to be healthier and practice better self-care, including healthy behaviors such as adherence to dietary modification, [141] increased smoking cessation,[142] and exercising. [48] Optimism has been associated with greater brisk walking and vigorous PA in a small community sample of 128 men and women aged 65-80 years old. [59] A cross-sectional Finnish survey-based study found similar results: individuals who exercised more frequently reported less depression, anger, and cynical distrust (also at times called cynical hostility). [143] The longitudinal association of cynical hostility and higher CVD morbidity and mortality in men is moderated by PA and other behavioral factors. [144] In the Women's Health Initiative (WHI, the largest longitudinal study of post-menopausal women in the United States), least optimistic and most cynically hostile women were the least active as compared to their more optimistic and less hostile peers. [48]

Recreational PA in the WHI is stable over 8 years of follow-up, [145] but declines in vigorous physical activity and the role of attitudes as potential modifiers of this decline have not been characterized. Our analysis examines whether psychological attitudes are associated with strenuous PA 3 times or more per week for WHI women at age 18, 35, 50, and at study baseline, and years 3 and 6 of follow-up. We include Women's Health Initiative participants who were in the Observational Study (OS) or Clinical Trial (CT) Control groups, and who had never had cancer or CVD at baseline, as well as were not missing data on optimism, cynical hostility, or baseline PA (n = 73,485).

3.2 METHODS

3.2.1 Study Population

The Women's Health Initiative recruited 161,809 postmenopausal women ages 50-79 from 24 states and the District of Columbia from diverse racial, ethnic, and socioeconomic backgrounds into one of two longitudinal study branches between 1994 and 1998: the clinical trial (CT; n=68,133) or the observational study (OS; n=93,676).[68] WHI exclusion criteria relevant to the current study included: any substance abuse (aside from smoking or alcohol), mental illness, dementia, life expectancy less than three years, participation in other randomized trails, and plans to move from current area within 3 years, as well as further restrictions for CT participants, which have been described elsewhere .[68] Participants gave informed consent at each center and materials used were approved by each center's institutional review board.

The current analysis is restricted to women from either the OS or CT Control Participants, who did not have CVD or Cancer at baseline, and with no missing data at baseline for optimism , cynical hostility, or PA (n=73,845). Only control participants from the clinical trials were included to avoid any possible influence of the interventions on PA. Optimism and cynical hostility were assessed at baseline enrollment in the WHI, while strenuous PA for ages 18, 35, 50 and baseline was assessed at study entry in WHI. Follow-up strenuous PA was also assessed by self-report.

3.2.2 Optimism and Cynical Hostility

The WHI's Behavioral Health Committee selected optimism, pessimism, and cynical hostility for inclusion in baseline psychological questionnaires because of their importance for women's health and their ease of capture using brief and reliable tests.[69]

Optimism is characterized by positive expectations for the future: "In uncertain times I usually expect the best". Pessimism, on the other hand, is characterized by negative future expectations: "I rarely count on good things happening to me."[55] Optimism was measured by the Life Orientation Test–Revised (LOT-R), a widely-used and validated 6-item scale, producing scores from 6 to 30 (higher scores signal greater optimism; lower scores greater pessimism). Full scale optimism was treated as a categorical measure by quartiles of score which assesses clinically-meaningful differences: low (6-21), mid-low (22-23), mid-high (24-26), and high (>27).

Cynical hostility (deep mistrust of others) was measured with the cynicism subscale of the Cook-Medley Questionnaire[17,70] consisting of 13 true/false items such as "It is safer to trust nobody." Higher scores indicate greater cynical hostility. Scores were treated as continuous measures and as categorical measures by quartiles of score: low (0-1), mid-low (2-3), mid-high (4-5), and high (6 and above).

3.2.3 Strenuous Physical Activity: Retrospective, Baseline, and Prospective

Women completed self-report surveys of strenuous PA at baseline which asked them to recall whether they participated in strenuous PA three times or more per week (Y/N) at ages 18, 35, 50 (defined for survey participants as including "exercise that was long enough to work up a sweat

and make your heart beat fast." Women were also asked about strenuous PA at baseline and follow-up years 3 and 6: here women were asked to identify the number of days per week they participated in strenuous exercise, with the same definition as given for the past-recall PA questions but with the addition of example exercises ("aerobics, aerobic dancing, jogging, tennis, swim laps"). We dichotomized the baseline and year 3 and 6 results to match the recall questions so that strenuous PA is consistently measured as a dichotomous variable indicating whether or not a woman was strenuously physically active three times or per week at each time point.

3.2.4 Covariates and Potential Confounders

Individual characteristics associated with attitudes or PA were measured by self-report at baseline and included as covariates, including age[136], race and ethnicity, education level high school or equivalent (y/n), annual family income (<$20,000 annually, $20,000-$49,999, $50,000-$74,999, or $75,000 and above), marital status (never married, divorced, widowed, married or married-like relationship), hypertension ever (y/n), diabetes ever (y/n), depressive symptoms (short form CES-D, cut-offs of 0.06 indicating depressive symptoms), obesity (y/n), cancer since WHI enrollment (y/n), arthritis ever (y/n), broken bone ever (y/n), any alcohol consumption (y/n), average nightly sleep at baseline (<5 hours, 6-7, 8-9, or 10+ hours), daily calories (kcal), insurance at baseline (y/n), regular source of healthcare (y/n), social support score, standardized physical health and mental health scales the SF-36.

3.2.5 Statistical Methods

3.2.5.1 Baseline Characteristics

Baseline characteristics for our sample of 73,485 women were compared across quartiles of score for optimism and cynical hostility, including the covariates and potential confounders outlined above. Chi-square tests were used to compare categorical variables, and continuous variables were assessed using analysis of variance (ANOVA).

3.2.5.2 Strenuous PA At Each Time Point

To describe the pattern of strenuous PA over the lifetime and how this pattern differs based on quartile of attitude score, we first plotted the raw rates of strenuous PA at each time point for all women, and then for the most vs. least optimistic and most vs. least hostile women. Chi-square tests were used to assess whether rates of strenuous PA differed significantly at each time point based on quartile of attitude score.

Logistic regression models were used to assess whether attitude predicted participation in strenuous PA at each time point: age 18, 35, 50, WHI baseline, and years 3 and 6 after baseline (PROC LOGISTIC, SAS 9.4). Optimism and cynical hostility were modeled separately, first adjusted for baseline age (**Model 1**), and then adjusting for all baseline factors outlined above (**Model 2)**.

3.2.5.3 Longitudinal Analysis

Generalized linear mixed models (GLMM) were used to assess the influence of optimism and cynical hostility on strenuous PA (PA) from baseline through year 6 (**Models 3, 4, and 5,** SAS 9.4 PROC GLIMMIX). The GLIMMIX procedure is ideal for fitting generalized mixed models

to non-normal data with repeated events (outcomes correlated at the individual unit of analysis).[146] **Model 3** adjusts for baseline age only, **Model 4** corrects for previous strenuous PA at ages 18, 35, and 50, and **Model 5** includes the covariates outlined above.

3.3 RESULTS

3.3.1 Baseline Characteristics

All baseline characteristics were statistically significant when stratified by quartiles of optimism or cynical hostility. Compared with the least optimistic women, those with optimism scores in the top quartile tended to be younger at baseline, were less often in minority racial/ethnic groups, tended to have higher incomes, and were less likely to have been divorced. **(Table 3-1)** They were less likely to report hypertension, diabetes, arthritis, depressive symptoms, fractures, obesity, or smoking at baseline. Their social support, physical health, and mental health scores tended to be higher and they were less likely to report very short (<5 hours) or very long (>10 hours) average sleep duration. Most optimistic women were more likely to report strenuous PA at baseline.

In contrast, women with higher levels of cynical hostility were more likely to identify with minority racial/ethnic groups, to have lower-incomes, and to not be married. The most cynically hostile women were more likely to report diabetes, depressive symptoms, obesity, and smoking at baseline. Most cynically hostile women were also less likely to have a regular source of health care, and had lower scores for social support, and lower scores on the physical and

mental health scales of the SF-36. Most cynically hostile women were less likely to report strenuous PA at baseline.

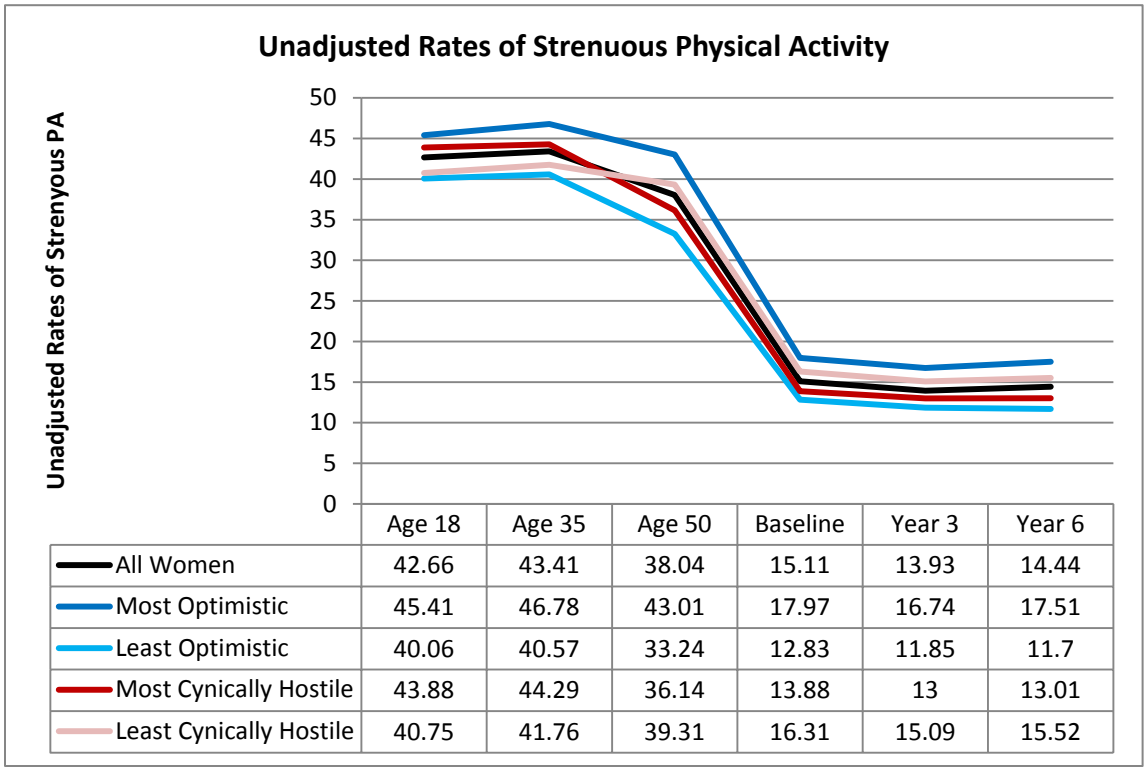
Table 3-1. Baseline Characteristics of Study Cohort

Baseline Characteristics by Quartiles of Optimism and Cynical Hostility % or Mean (SD)	All	Optimism					Cynical Hostility				
	n=73485	n= 14126 most (27-30)	n= 22257 mid-high (24-26)	n= 18038 mid-low (22-23)	n= 19064 least (6-21)	p-value	n= 17259 most (6-13)	n= 16651 mid-high (4-5)	n= 20118 mid-low (2-3)	n= 19457 least (0-1)	p-value
Age at screening	62.4 (7.1)	61.9 (7.0)	62.4 (7.0)	62.7 (7.1)	62.4 (7.2)	<0.0001	62.5 (7.2)	62.4 (7.0)	62.3 (7.0)	62.3 (7. 0)	0.0031
Race/ethnicity											
White	82.9	86.1	85.0	83.6	77.4		74.0	83.1	86.1	87.2	
Black	8.1	8.2	8.0	7.3	9		13.8	8.8	6.3	4.4	
Hispanic	4	2.75	3.1	3.8	6.2		6.4	3.7	3.2	3.0	
Other	4.8	2.8	3.7	5.2	7.1	<0.0001	5.5	4.3	4.1	5.2	<0.0001
U. S. Region											
Northeast	23.4	19.9	22.2	24.3	26.4		24.1	24.2	23.3	22	
South	25.3	25.9	25.7	24.9	25		28.9	25.4	24.4	23.1	
Midwest	21.8	22.0	22.1	22.2	21		20.4	21.2	22.3	23.0	
West	29.5	32.3	30.1	28.7	27.6	<0.0001	26.6	29.1	30.0	31.9	<0.0001
Education: HS or equivalent	94.8	97.5	96.4	94.9	90.8	<0.0001	90.2	95.2	96.4	96.8	<0.0001
Annual Family Income											
Less than $20,000	12.8	8.4	10.4	12.0	19.7		20.1	13.0	10.4	8.6	
$20,000 - $49,999	40.3	36.0	39.8	42.4	42.1		41.4	41.5	40.4	38.2	
$50,000-$74,999	19.8	22.3	20.6	20.0	16.7		16.1	20.2	20.8	21.7	
$75,000 or greater	20.5	27.6	22.9	19.0	13.8	<0.0001	14.4	19.1	22.1	25.3	<0.0001
Marital Status											
Never married	4.5	4.2	4.2	4.4	5.2		4.6	4.5	4.6	4.4	
Divorced	15.6	16.0	14.9	14.1	17.4		17.9	16.1	14.9	13.7	
Widowed	15	13.4	14.0	15.1	17.2		17.4	14.9	14.2	13.8	
Married or (Married-Like)	64.5	66.1	66.5	66.1	59.6	<0.0001	59.5	64.2	66.0	67.7	<0.0001
Hypertension ever (Y)	29.1	24.8	28.2	29.9	32.6	<0.0001	33.3	29.9	27.9	25.9	<0.0001
Diabetes ever (Y)	4.2	3.0	3.6	4.3	5.9	<0.0001	6.5	4.4	3.4	2.9	<0.0001
Depressive symptoms (Y)	10.1	3.6	5.7	8.8	21.4	<0.0001	17.1	10.8	7.9	5.6	<0.0001
Obesity (BMI ≥ 30)	25.9	23.0	24.3	25.5	30.2	<0.0001	32.4	27.3	23.9	20.9	<0.0001
Any Cancer (Y)	9.7	10.0	9.9	9.8	9.1	0.0121	8.9	9.9	9.8	10.0	0.0005
Arthritis ever (Y)	43.6	38.3	41.8	44.9	48.3	<0.0001	47.8	45.4	42.9	38.9	<0.0001
Broke bone ever (Y)	36.4	38.0	37.0	36.2	34.9	<0.0001	34.5	36.7	37.7	36.6	<0.0001
Drank alcohol at baseline	71.8	74.7	74.0	72.3	66.7	<0.0001	64.5	72.6	74.3	75.1	<0.0001
Smoked at baseline	6	5.1	5.3	5.5	7.8	<0.0001	7.2	6.1	5.7	4.9	<0.0001
Average hours sleep nightly											
<5 hours	7.2	4.6	5.9	7.0	10.7		10.3	7.7	6.1	5.1	
6-7 hours	58.6	58.3	59.5	59.9	56.7		55.8	59.5	59.9	59.1	
8-9 hours	24.7	29.0	26.3	24.1	20.3		21	23.9	25.3	28.2	
10+ hours	0.4	0.4	0.4	0.3	0.6	<0.0001	0.6	0.4	0.4	0.3	<0.0001
Calories daily (kcal)	622.8	593.5	594	611.8	687	<0.0001	716.4	608.4	595.5	575.6	<0.0001
Insurance at baseline	95.1	95.7	95.8	95.7	93.3	0.0195	92.4	95.2	96.0	96.4	<0.0001
Regular source of healthcare	93.2	93.6	93.8	93.7	91.6	<0.0001	90.9	93.2	93.9	94.3	<0.0001
Social Support	7.7	6.3	6.8	7.2	8.5	<0.0001	8.6	7.5	7.0	6.7	<0.0001
Physical Health Scale	11.3	9.1	10.0	10.8	12.8	<0.0001	12.9	11.2	10.4	9.7	<0.0001
Mental Health Scale	11.3	8.1	9.3	10.4	13.3	<0.0001	13.3	11.2	10.2	9.2	<0.0001
Strenuous Exercise at Baseline	15.1	18.0	16.0	14.3	12.8	<0.0001	13.9	14.8	15.3	16.3	<0.0001

Significance tests conducted using chi-square for categorical variables and ANOVA for continuous variables.

3.3.2 Strenuous Physical Activity At Each Time Point

Unadjusted rates of strenuous PA were higher for most (vs. least) optimistic women at each time point ($p<0.0001$ by chi-square test for quartiles of optimism at each time point). Rates of strenuous PA were statistically different across quartiles of cynical hostility at each time point (all $p<0.0001$). However, women with most (vs. least) cynical hostility at baseline recalled higher strenuous PA at age 18 and 35, and lower strenuous PA by age 50 and then at baseline and through follow-up year 6 (**Figure 3-1)**.



	Age 18	Age 35	Age 50	Baseline	Year 3	Year 6
All Women	42.66	43.41	38.04	15.11	13.93	14.44
Most Optimistic	45.41	46.78	43.01	17.97	16.74	17.51
Least Optimistic	40.06	40.57	33.24	12.83	11.85	11.7
Most Cynically Hostile	43.88	44.29	36.14	13.88	13	13.01
Least Cynically Hostile	40.75	41.76	39.31	16.31	15.09	15.52

Unadjusted Strenuous PA assessed by recall at ages 18, 35, and 50, and by survey at WHI Baseline, as well as at Follow-Up Year 3 and Follow-Up Year 6.

Figure 3-1: Unadjusted Rates of Strenuous Physical Activity

3.3.2.1 Optimism

In models adjusted for baseline age of women only, most vs. least optimistic women were more likely to report strenuous PA at each time point: ranging from 20% more likely at age 18 to 50% more likely by follow-up year 6 ($p<0.0001$ at each time point). **(Table 3-2)** After adjusting for all covariates, these relationships held only for Age 18, 35, 50 ($p<0.0001$) and baseline ($p=0.0006$), with women at baseline being 16% more likely to report strenuous PA three times or more per week.

3.3.2.2 Cynical Hostility

The most (vs. least) cynically hostile women were more likely to report strenuous PA at ages 18 and 35 (adjusted for baseline age at reporting, $p<0.0001$) but less likely to report strenuous PA at age 50, and WHI baseline through follow-up year 6. Adjusting for age and covariates, the most cynically hostile women were more likely to report strenuous PA at each time point (all $p<0.05$).

Table 3-2. Logistic Regressions for Strenuous Physical Activity at Each Time Point

Modeling Strenuous Exercise at Each Time Point		Optimism		Cynical Hostility	
	Effective sample size	most v Least OR (CL)	p-value	most vs. least OR (CL)	p-value
Model 1 - Strenuous Exercise 3X or more per week (Age adjusted only)	**n=**				
Age 18	71042	1.20 (1.15-1.26)	**<0.0001**	1.19 (1.14-1.24)	**<0.0001**
Age 35	71325	1.22 (1.17-1.28)	**<0.0001**	1.17 (1.12-1.22)	**<0.0001**
Age 50	71906	1.49 (1.43-1.56)	**<0.0001**	0.90 (0.86-0.94)	**<0.0001**
WHI Baseline	73485	1.48 (1.39-1.57)	**<0.0001**	0.83 (0.78-0.88)	**<0.0001**
Follow Up Year 3	65833	1.42 (1.33-1.51)	**<0.0001**	0.90 (0.85-0.96)	**0.0005**
Follow up Year 6	65658	1.50 (1.41-1.59)	**<0.0001**	0.87 (0.82-0.92)	**<0.0001**
Model 2 - Strenuous Exercise 3X or more per week (fully adjusted)					
Age 18	50974	1.30 (1.23-1.38)	**<0.0001**	1.11 (1.05-1.17)	**0.0003**
Age 35	51196	1.31 (1.23-1.39)	**<0.0001**	1.10 (1.04-1.16)	**0.0009**
Age 50	51440	1.19 (1.12-1.26)	**<0.0001**	1.09 (1.03-1.15)	**0.0025**
WHI Baseline	52272	1.05 (0.97-1.13)	0.2617	1.12 (1.04-1.21)	**0.0020**
Follow Up Year 3	50910	1.01 (0.93-1.09)	0.8074	1.17 (1.08-1.25)	**<0.0001**
Follow up Year 6	48948	1.04 (0.96-1.13)	0.2870	1.17 (1.0-1.26)	**<0.0001**

Logistic regression of strenuous PA at each time point by optimism and cynical hostility.

3.3.3 Longitudinal Analysis

3.3.3.1 Optimism

When modeled longitudinally and considering only strenuous PA at baseline through year 6 as our outcome, most optimistic women were 47% more likely to report strenuous PA three times or more per week in models adjusted for age only (Model 3, OR 1.47, 95% CL 1.42-1.52, p<0.0001), 30% more likely to do so in models adjusted for age and past PA (Model 4, OR 1.30, 95% CL 1.25-1.35, p<0.0001), and not different from their peers in fully adjusted models (Model 5, OR 0.99, 95% CL 0.94-1.04p=0.5392), **Table 3-3**.

3.3.3.2 Cynical Hostility

Unlike with optimism, the direction of the relationship with cynical hostility changed depending on how the models were adjusted. When adjusting for only a woman's age at baseline or her age and her past strenuous PA, the most (vs. least) cynically hostile women were 10 to 14% less likely to report strenuous PA at baseline through year 6 (Model 3 OR 0.86, 95% CL 0.84-0.89; Model OR 0.90, 95% CL 0.87-0.93; both p<0.0001). However, when the adjusting for all remaining covariates, the opposite was true: the most cynically hostile women were now found to have a 13% higher odds of strenuous PA (Model 5**,** OR 1.13, 95% CL 1.08-1.18, p<0.0001,), **Table 3-3**.

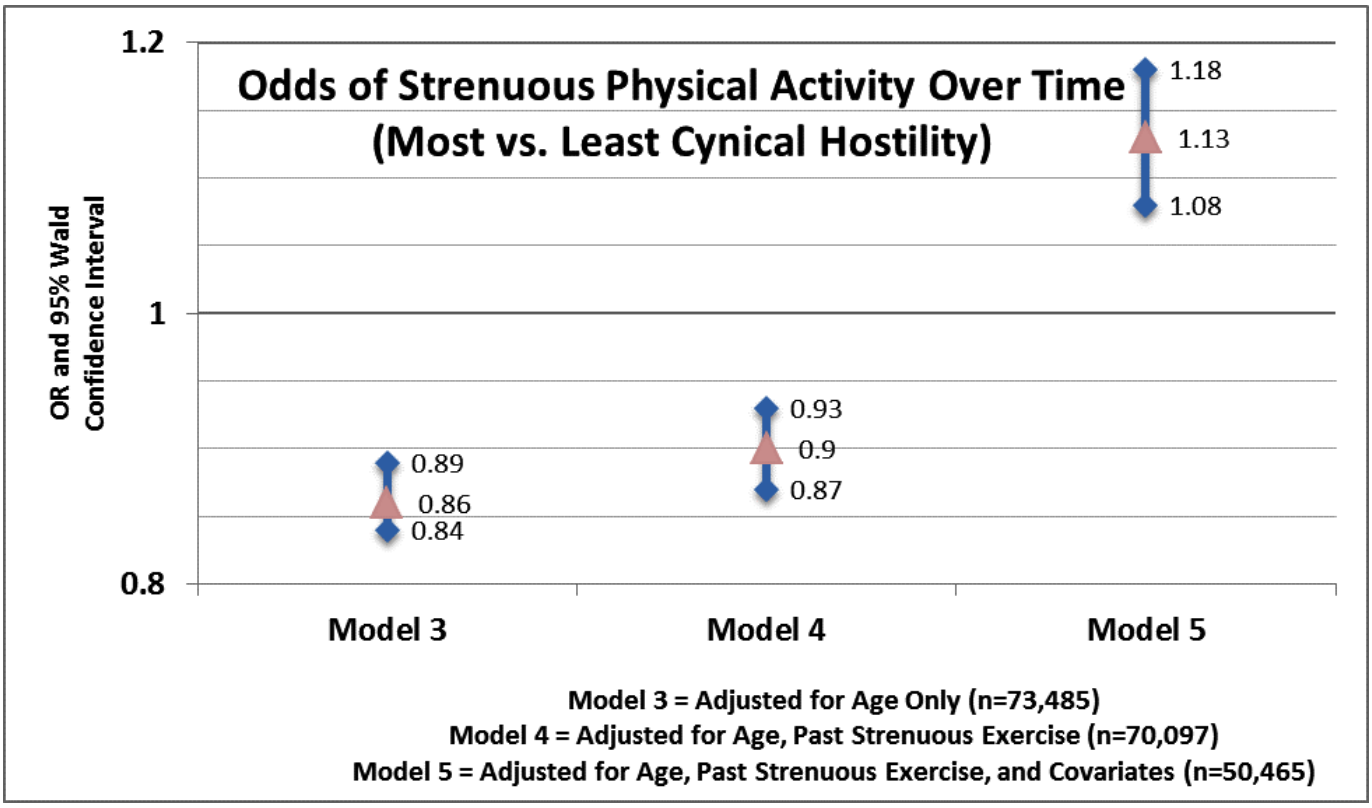
Table 3-3. Glimmix Models for Strenuous Physical Activity - Baseline Through Year 6

Modeling Strenuous Exercise Over Time (Baseline, Year 3, Year 6)	n=	Optimism most vs. least		Cynical Hostility most vs. least	
		OR (CL)	p-value	OR (CL)	p-value
Model 3 - Adjusted for age only	**73485**	1.47 (1.42-1.52)	**<0.0001**	0.86 (0.84-0.89)	**<0.0001**
Model 4 - Adjusted for age and strenuous exercise at ages 18, 35, and 50	**70097**	1.30 (1.25-1.35)	**<0.0001**	0.90 (0.87-0.93)	**<0.0001**
Model 5 - Adjusted for age, strenuous exercise at age 18, 35, and 50, and all covariates	**50465**	0.99 (0.94-1.04)	0.5392	1.13 (1.08-1.18)	**<0.0001**

Longitudinal modeling of strenuous PA at each time point by optimism and cynical hostility (PROC GLIMMIX, SAS 9.4, logit link function).

Factors included in covariate adjustment may play important roles for mediating (in the case of optimism) and moderating (in the case of cynical hostility, **Figure 3-2**) the relationship between attitudes and strenuous PA over time. However, the change in direction of odds ratio for

cynical hostility lead to concern that the observed results may be due to the changing sample size (due to missing data for any of the covariates in Model 5) rather than only the added covariates.



Modeling Odds of Strenuous PA Over Time (Baseline through Year 6), GLIMMIX Models. All p-values <0.0001.

Figure 3-2. Cynical Hostility and Strenuous Physical Activity Over Time

Sensitivity analysis for Model 5 (motivated by the change in direction of odds ratio) revealed that the cohort difference in Model 4 and 5 were not responsible for the different effect of cynical hostility. We re-ran Model 4 using only n=50,465 women originally remaining in Model 5, and the results were nearly identical to the original Model 4 (OR for optimism 1.32, OR for cynical hostility 0.90, both $p<0.0001$, not shown). This result is strong evidence that the mediating effect of covariates on the optimism results, and the moderating effects of covariates on cynical hostility results, are due to covariate adjustment rather than the reduction in sample size.

3.4 DISCUSSION

In descriptive analysis, most (vs. least) optimistic women reported strenuous physical activity from age 18 through study baseline (post-menopause) and through study follow-up year 6. Most (vs. least) optimistic WHI women were more likely to report strenuous physical activity over time before covariate adjustment (OR 1.47, CI 1.42-1.52, $p<0.0001$), but this relationship was mediated by the inclusion of covariates. Most (vs. least) cynically hostile women were less likely to report strenuous physical activity over time before covariate adjustment (OR 0.86, CI 0.84-0.89, $p<0.0001$), but more likely report strenuous physical activity over time when adjusted for covariates (OR 1.13, CI 1.08-1.18, $p<0.0001$).

Optimism and cynical hostility may influence PA in several ways. Optimists are more likely to believe good things will happen to them, and with a positive outlook of the future, may be more likely to invest in health-preserving activities like strenuous PA into older age. Though the inclusion of covariates explained the relationship between optimism and physical activity over time, the response profiles for strenuous PA of most vs. least optimistic women is still worth noting, particularly for the consistent difference between these groups over time. Most optimistic women may be different from their less optimistic peers on these covariates which ultimately determine exercise, but they still exercise more at every time point studied, and therefore likely enjoy the psychological and physical benefits of increased physical activity. Most cynically hostile women were found to exercise more than their less cynically hostile peers after covariate adjustment. Possibly when barriers to physical activity are removed (health

concerns, access to fitness facilities, social factors which dictate activity appropriateness), women with high cynically hostility find some relief or benefit from vigorous exercise in particular. Cynical hostility is typically correlated with greater depression scores (which may undermine motivation, self-efficacy, and coping skills) and with an inability to leverage social support, which would have aligned well with a mediation-type relationship between covariates and cynical hostility. However, the reversal of the relationship between cynical hostility and rates of strenuous PA is cause for further study.

The fact that attitudes prospectively predict follow-up reports of physical activity, but that these relationships disappear or change direction with covariate adjustment, suggests that the relationship between attitudes and physical activity may be highly influenced by barriers such as physical and emotional health, socioeconomic status (SES), social support, and other health behaviors. Future studies should examine the effect of attitudes more directly, for example in trials to increase physical activity among post-menopausal women. Comparing whether attitudes influence adherence to such interventions within specific strata (i.e. high vs. low income, high vs. low disease burden) would help to clarify whether PA interventions in elderly women would benefit by considering attitudes alongside other factors. For example, less optimistic women in the real world who also face higher barriers to exercise may benefit from increased resources or support to aid in maintaining physical activity across the lifetime.

3.5 LIMITATIONS

While the WHI draws from a large, diverse, and representative sample of women in the United States, the WHI sample may limit the generalizability of findings to all persons because the

sample focused on postmenopausal women only (possibly limiting usefulness of the findings for other ages and genders), and because WHI women are typically healthier and more motivated toward healthy behavior than the general population of healthy women. For longitudinal modeling, missing data on covariates resulted in some loss of subjects in fully adjusted models. The women in fully adjusted models were similar on baseline characteristics, and therefore the results are not likely to be skewed. However it is possible the women differ substantially on some unobserved characteristics that influence physical activity, and these results should be interpreted with this mind.

Womens' reports of past physical activity (age 18, 35, and 50) was by self-reported recall only (measured at baseline). These reports may be themselves skewed by optimism or cynical hostility (which were measured at baseline), and this may partially explain the relationship with past (but not future) PA reports. The fact that attitudes were only measured once (at baseline) also precludes our ability to confirm whether attitudes scores at year 3 and year 6 for example are consistent with those reported at baseline. However, attitudes have traditionally been considered trait-like after early adulthood. Optimism scores are correlated at rates of 0.58 to 0.79 over a 3 year period,[55] and remain high (up to 0.71) over a 10-year period.[19] Similarly, even for youths and young adults, hostility scores over 4 years are correlated rates of 0.56. [56] Optimism can waiver when individuals ready themselves to confront a threat,[55] but usually remains stable even in the face of threatening situations such as health shocks, such as when women are given bad news after breast cancer surgery. [147] Therefore it is unlikely that attitudes are changing significantly over the study period.

3.6 CONCLUSIONS

Adjusting for relevant sociodemographic, health, and behavioral covariates explains the relationship between optimism and physical activity, and changes the relationship between cynical hostility and physical activity (with more cynically hostile women showing higher rates of PA over time in adjusted models). This suggests that assessing the barriers introduced by those factors would be more important in behavioral interventions than attempting to modify optimistic or cynically hostile attitudes themselves (which, though stable, have been shown to be modifiable in targeted interventions). [88] Future studies should compare men or women with similar socioeconomic, psychosocial, and health profiles to examine whether the effects of optimism or cynical hostility are more clearly delineated within groups facing similar barriers to PA.

3.7 SUPPLEMENTAL FIGURES AND TABLES

Logistic Models (At each Time Point)
Model 1: Strenuous $PA_{(t)}$ = $Attitude_{(i)}$ + Age
Model 2: Strenuous $PA_{(t)}$ = $Attitude_{(i)}$ + Age + Covariates

t= age 18, age 35, age 50, WHI baseline, Follow-up Year 3, Follow-up Year 6
i = optimism (quartiles) or cynical hostility (quartiles)

Glimmix Models (Repeated Outcome Measure – Modeling Over Time)
Model 3: Strenuous $PA_{(BL, Yr3, Yr6)}$ = $Attitude_{(i)}$ + Age
Model 4: Strenuous $PA_{(BL, Yr3, Yr6)}$ = $Attitude_{(i)}$ + Age + $PastStrenuousPA_{(age\ 18, 35,50)}$
Model 5: Strenuous $PA_{(BL, Yr3, Yr6)}$ = $Attitude_{(i)}$ + Age + $PastStrenuousPA_{(age\ 18, 35,50)}$ + Covariates

i = optimism (quartiles) or cynical hostility (quartiles)

Figure 3-3. Outline of Logistic and GLIMMIX Models for Strenuous Physical Activity

BIBLIOGRAPHY

1. Carter BD, Abnet CC, Feskanich D, et al. Smoking and Mortality — Beyond Established Causes. *New England Journal of Medicine.* 2015;372(7):631-640.
2. Shadel WG, Elliott MN, Haas AC, et al. Clinician advice to quit smoking among seniors. *Prev Med.* Jan 2015;70:83-89.
3. Villablanca AC, McDonald JM, Rutledge JC. Smoking and cardiovascular disease. *Clinics in chest medicine.* Mar 2000;21(1):159-172.
4. Ferrucci L, Izmirlian G, Leveille S, et al. Smoking, physical activity, and active life expectancy. *Am J Epidemiol.* Apr 1 1999;149(7):645-653.
5. Rapuri PB, Gallagher JC, Smith LM. Smoking Is a Risk Factor for Decreased Physical Performance in Elderly Women. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences.* January 1, 2007 2007;62(1):93-99.
6. Hsu HC, Pwu RF. Too late to quit? Effect of smoking and smoking cessation on morbidity and mortality among the elderly in a longitudinal study. *The Kaohsiung journal of medical sciences.* Oct 2004;20(10):484-491.
7. Fillenbaum GG, Burchett BM, Kuchibhatla MN, Cohen HJ, Blazer DG. Effect of cancer screening and desirable health behaviors on functional status, self-rated health, health service use and mortality. *Journal of the American Geriatrics Society.* Jan 2007;55(1):66-74.
8. Persoskie A, Nelson WL. Just blowing smoke? Social desirability and reporting of intentions to quit smoking. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco.* Dec 2013;15(12):2088-2093.
9. Hughes JR, Solomon LJ, Naud S, Fingar JR, Helzer JE, Callas PW. Natural history of attempts to stop smoking. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco.* Sep 2014;16(9):1190-1198.
10. Cigarette smoking among adults--United States, 2000. *MMWR. Morbidity and mortality weekly report.* Jul 26 2002;51(29):642-645.
11. Hughes JR, Keely J, Naud S. Shape of the relapse curve and long-term abstinence among untreated smokers. *Addiction (Abingdon, England).* Jan 2004;99(1):29-38.
12. Smit ES, Hoving C, Schelleman-Offermans K, West R, de Vries H. Predictors of successful and unsuccessful quit attempts among smokers motivated to quit. *Addictive behaviors.* Sep 2014;39(9):1318-1324.
13. Schuck K, Otten R, Kleinjan M, Bricker JB, Engels RC. Predictors of cessation treatment outcome and treatment moderators among smoking parents receiving quitline counselling or self-help material. *Prev Med.* Dec 2014;69:126-131.
14. LaCroix AZ, Omenn GS. Older adults and smoking. *Clinics in geriatric medicine.* Feb 1992;8(1):69-87.

15. Ossip-Klein DJ, McIntosh S, Utman C, Burton K, Spada J, Guido J. Smokers Ages 50+: Who Gets Physician Advice to Quit? *Preventive Medicine.* 10// 2000;31(4):364-369.
16. Scheier M, Carver C, Bridges M. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J. Pers Soc Psychol.* 1994;67:1063-1078.
17. Cook WW, Medley DM. Proposed hostility and Pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology.* 1954;38(6):414-418.
18. Nabi H, Koskenvuo M, Singh-Manoux A, et al. Low pessimism protects against stroke: the Health and Social Support (HeSSup) prospective cohort study. *Stroke; a journal of cerebral circulation.* Jan 2010;41(1):187-190.
19. Matthews KA, Raikkonen K, Sutton-Tyrrell K, Kuller LH. Optimistic attitudes protect against progression of carotid atherosclerosis in healthy middle-aged women. *Psychosom Med.* Sep-Oct 2004;66(5):640-644.
20. Rasmussen HN, Scheier MF, Greenhouse JB. Optimism and physical health: a meta-analytic review. *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine.* Jun 2009;37(3):239-256.
21. Shepperd JA MJ, Pbert LA. Dispositional Optimism as a Predictor of Health Changes among Cardiac Patients. *Journal of Research in Personality.* 1996;30:517-534.
22. Grewen K, Girdler SS, West SG, Bragdon E, Costello N, Light KC. Stable pessimistic attributions interact with socioeconomic status to influence blood pressure and vulnerability to hypertension. *Journal of women's health & gender-based medicine.* Oct 2000;9(8):905-915.
23. Kubzansky LD SD, Vokonas P, Kawachi I. Is the Glass Half Empty or Half Full? A Prospective Study of Optimism and Coronary Heart Disease in the Normative Aging Study. *Psychosomatic Medicine.* 2001;63:910-916.
24. Giltay EJ GJ, Ztiman FG, Hoekstra T, Schouten EG. Dispositional Optimism and All-Cause and Cardiovascular Mortality in a Prospective Cohort of Elderly Dutch Men and Women. *Arch Gen Psychiatry.* 2004;61:1126-1135.
25. Kubzansky LD DK, Rozanski A. The Clinical Impact of Negative Psychological States: Expanding the Spectrum of Risk for Coronary Artery Disease. *Psychosomatic Medicine.* 2005;67(Supplement 1):S10-S14.
26. Giltay EJ KM, Kalmijn S, Zitman FG, Kromhout D. Dispositional Optimism and the Risk of Cardiovascular Death. *Arch Intern Med.* 2006;166:431-436.
27. Ikeda A, Schwartz J, Peters JL, et al. Optimism in relation to inflammation and endothelial dysfunction in older men: the VA Normative Aging Study. *Psychosom Med.* Oct 2011;73(8):664-671.
28. Fergusson DM, Horwood LJ, Ridder EM, Beautrais AL. Subthreshold Depression in Adolescence and Mental Health Outcomes in Adulthood. *Arch Gen Psychiatry.* January 1, 2005 2005;62(1):66-72.
29. Burford TI, Low CA, Matthews KA. Night/Day Ratios of Ambulatory Blood Pressure Among Healthy Adolescents: Roles of Race, Socioeconomic Status, and Psychosocial Factors. *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine.* Apr 3 2013.

30. Räikkönen K, Matthews KA, Kuller LH, Reiber C, Bunker CH. Anger, hostility, and vesceral adipose tissue in healthy postmenopausal women. *Metabolism.* 1999;48(9):1146-1151.
31. K R, KA M, JD F, JF O, BB G. Effects of Optimism, Pessimism, and Trait Anxiety on Ambulatory Blood Pressure and Mood During Everyday Life. *Journal of Personality and Social Psychology.* 1999;76(1):104-113.
32. Räikkönen K, Matthews KA. Do Dispositional Pessimism and Optimism Predict Ambulatory Blood Pressure During Schooldays and Nights in Adolescents? *Journal of Personality.* 2008;76(3):605-630.
33. Scheier MF MK, Owens JF, Magovern GJ, Lefebvre RC, Abbot RA, Carver CS. Dispositional Optimism and Recovery from Coronary Artery Bypass Surgery: The Beneficial Effects on Physical and Psychological Well-Being. *Journal of Personality and Social Psychology.* 1989;57(6):1024-1040.
34. Tindle H BB, Hum DB, Houck P, Mazumdar S, Scheier MF, Matthews KA, He F, Rollman B. Optimism, Response to Treatment of Depression, and Rehospitalization After Coronary Artery Bypass Graft Surgery. *Psychosomatic Medicine.* 2012;74:200-207.
35. Scheier MF, Carver CS. Dispositional Optimism an Physical Well-Being: The Influence of Generalized Outcome Expectancies on Health. *Journal of Personality.* 1987;55(2):169-210.
36. Scheier MF, Carver CS. Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research.* 1992;16(2):201-228.
37. Cougle JR, Zvolensky MJ, Hawkins KA. Delineating a Relationship Between Problematic Anger and Cigarette Smoking: A Population-Based Study. *Nicotine & Tobacco Research.* January 1, 2013 2013;15(1):297-301.
38. L W, RC OC, RE OC. Type-D personality mechanisms of effect: the role of health-related behavior and social support. *J Psychosomatic Research.* 2008;64(63-69).
39. Roy B, Diez-Roux AV, Seeman T, Ranjit N, Shea S, Cushman M. Association of optimism and pessimism with inflammation and hemostasis in the Multi-Ethnic Study of Atherosclerosis (MESA). *Psychosom Med.* Feb 2010;72(2):134-140.
40. Scherwitz LW, Perkins LL, Chesrtey MA, Hughes GH, Sidney S, Manolio TA. Hostility and Health Behaviors in Young Adults: The CARDIA Study. *American Journal of Epidemiology.* July 15, 1992 1992;136(2):136-145.
41. Walitzer KS, Dearing RL. Characteristics of Alcoholic Smokers, Nonsmokers, and Former Smokers: Personality, Negative Affect, Alcohol Involvement, and Treatment Participation. *Nicotine & Tobacco Research.* January 1, 2013 2013;15(1):282-286.
42. Beutel ME, Wiltink J, Till Y, et al. Type D personality as a cardiovascular risk marker in the general population: results from the Gutenberg health study. *Psychotherapy and psychosomatics.* 2012;81(2):108-117.
43. Hendriksen ES, Pettifor A, Lee SJ, Coates TJ, Rees HV. Predictors of condom use among young adults in South Africa: the Reproductive Health and HIV Research Unit National Youth Survey. *Am J Public Health.* Jul 2007;97(7):1241-1248.
44. Zak-Place J, Stern M. Health belief factors and dispositional optimism as predictors of STD and HIV preventive behavior. *Journal of American college health : J of ACH.* Mar-Apr 2004;52(5):229-236.

45. Ylostalo P, Ek E, Knuuttila M. Coping and optimism in relation to dental health behaviour--a study among Finnish young adults. *European journal of oral sciences.* Dec 2003;111(6):477-482.
46. Tinker LF, Rosal MC, Young AF, et al. Predictors of Dietary Change and Maintenance in the Women's Health Initiative Dietary Modification Trial. *Journal of the American Dietetic Association.* 2007;107(7):1155-1165.
47. Brunner R, Dunbar-Jacob J, Leboff MS, et al. Predictors of adherence in the Women's Health Initiative Calcium and Vitamin D Trial. *Behavioral medicine (Washington, D.C.).* Winter 2009;34(4):145-155.
48. Tindle HA, Chang Y-F, Kuller LH, et al. Optimism, Cynical Hostility, and Incident Coronary Heart Disease and Mortality in the Women's Health Initiative. *Circulation.* August 10, 2009 2009.
49. Sachs-Ericsson N, Schmidt NB, Zvolensky MJ, Mitchell M, Collins N, Blazer DG. Smoking cessation behavior in older adults by race and gender: the role of health problems and psychological distress. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco.* Apr 2009;11(4):433-443.
50. Kubzansky LD, Kawachi I. Going to the heart of the matter: do negative emotions cause coronary heart disease? *Journal of psychosomatic research.* 2000;48(4–5):323-337.
51. Giltay Ej KMHKSZFGKD. Dispositional optimism and the risk of cardiovascular death: The zutphen elderly study. *Archives of Internal Medicine.* 2006;166(4):431-436.
52. Chapman B, Duberstein P, Tindle HA, et al. Personality predicts cognitive function over 7 years in older persons. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry.* Jul 2012;20(7):612-621.
53. Duberstein PR, Chapman BP, Tindle HA, et al. Personality and risk for Alzheimer's disease in adults 72 years of age and older: a 6-year follow-up. *Psychology and aging.* Jun 2011;26(2):351-362.
54. Peterson C, Seligman ME, Vaillant GE. Pessimistic explanatory style is a risk factor for physical illness: A thirty-five-year longitudinal study. *Journal of Personality and Social Psychology.* 1988;55(1):23-27.
55. Carver CS, Scheier MF, Segerstrom SC. Optimism. *Clinical Psychology Review.* 2010;30(7):879-889.
56. Woodall KL, Matthews KA. Changes in and stability of hostile characteristics: Results from a 4-year longitudinal study of children. *Journal of Personality and Social Psychology.* 1993;64(3):491-499.
57. Weiss JW, Mouttapa M, Chou C-P, et al. Hostility, depressive symptoms, and smoking in early adolescence. *Journal of Adolescence.* 2005;28(1):49-62.
58. Lipkus IM, Barefoot JC, Williams RB, Siegler IC. Personality measures as predictors of smoking initiation and cessation in the UNC Alumni Heart Study. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association.* Mar 1994;13(2):149-155.
59. Steptoe A, Wright C, Kunz-Ebrecht SR, Iliffe S. Dispositional optimism and health behaviour in community-dwelling older people: Associations with healthy ageing. *British Journal of Health Psychology.* 2006;11(1):71-84.

60. Giltay EJ, Geleijnse JM, Zitman FG, Buijsse B, Kromhout D. Lifestyle and dietary correlates of dispositional optimism in men: The Zutphen Elderly Study. *J Psychosom Res.* Nov 2007;63(5):483-490.
61. Carvajal SC, Wiatrek DE, Evans RI, Knee CR, Nash SG. Psychosocial determinants of the onset and escalation of smoking: cross-sectional and prospective findings in multiethnic middle school samples. *Journal of Adolescent Health.* 2000;27(4):255-265.
62. Scheier MF, Weintraub JK, Carver CS. Coping with stress: Divergent strategies of optimists and pessimists. *Journal of Personality and Social Psychology.* 1986;51(6):1257-1264.
63. Srivastava S, McGonigal KM, Richards JM, Butler EA, Gross JJ. Optimism in close relationships: How seeing things in a positive light makes them so. *Journal of Personality and Social Psychology.* 2006;91(1):143-153.
64. Lepore SJ. Cynicism, social support, and cardiovascular reactivity. *Health Psychology.* 1995;14(3):210-216.
65. Jamner LD, Shapiro D, Jarvik ME. Nicotine reduces the frequency of anger reports in smokers and nonsmokers with high but not low hostility: an ambulatory study. *Experimental and clinical psychopharmacology.* Nov 1999;7(4):454-463.
66. Kahler CW, Spillane NS, Leventhal AM, Strong DR, Brown RA, Monti PM. Hostility and Smoking Cessation Treatment Outcome in Heavy Social Drinkers. *Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors.* 2009;23(1):67-76.
67. Kahler CW, Strong DR, Niaura R, Brown RA. Hostility in smokers with past major depressive disorder: Relation to smoking patterns, reasons for quitting, and cessation outcomes. *Nicotine & Tobacco Research.* October 1, 2004 2004;6(5):809-818.
68. Hays J, Hunt JR, Hubbell FA, et al. The women's health initiative recruitment methods and results. *Annals of Epidemiology.* 2003;13(9, Supplement):S18-S77.
69. Matthews KA, Shumaker SA, Bowen DJ, et al. Women's Health Initiative: Why now? What is it? What's new? *American Psychologist.* 1997;52(2):101-116.
70. Tindle H CY-F, Kuller LH, Manson JE, Robinson JG, Rosal MC, Siegle GJ, Matthews KA. Optimism, Cynical Hostility, and Incident Coronary Heart Disease and Mortality in the Women's Health Initiative. *Circulation.* 2009;120:656-662.
71. Fagerstrom K-O, Schneider N. Measuring nicotine dependence: A review of the Fagerstrom Tolerance Questionnaire. *Journal of behavioral medicine.* 1989/04/01 1989;12(2):159-182.
72. Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom K-O. The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction.* 1991;86(9):1119-1127.
73. Tindle H. The major impact of smoking on risk of cardiovascular disease and mortality in postmenopausal women. . (WHI Approved Manuscript #1118).
74. Faseru B, Nollen NL, Mayo MS, et al. Predictors of cessation in African American light smokers enrolled in a bupropion clinical trial. *Addictive behaviors.* Mar 2013;38(3):1796-1803.
75. Hymowitz N, Cummings KM, Hyland A, Lynn WR, Pechacek TF, Hartwell TD. Predictors of smoking cessation in a cohort of adult smokers followed for five years. *Tobacco control.* January 1, 1997 1997;6(suppl 2):S57.

76. Lucan SC, Katz DL. Factors associated with smoking cessation counseling at clinical encounters: the Behavioral Risk Factor Surveillance System (BRFSS) 2000. *American journal of health promotion : AJHP.* Sep-Oct 2006;21(1):16-23.
77. Arnold HJ. Moderator variables: A clarification of conceptual, analytic, and psychometric issues. *Organizational Behavior and Human Performance.* 4// 1982;29(2):143-174.
78. Lawton R, Conner M, McEachan R. Desire or reason: predicting health behaviors from affective and cognitive attitudes. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association.* Jan 2009;28(1):56-65.
79. Sirois FM. Who Looks Forward to Better Health? Personality Factors and Future Self-Rated Health in the Context of Chronic Illness. *International journal of behavioral medicine.* Jan 27 2015.
80. Bell TM, Bayt D, Zarzaur BL. "Smoker's Paradox" in Patients Treated for Severe Injuries: Lower Risk of Mortality after Trauma Observed in Current Smokers. *Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco.* Feb 2 2015.
81. Carver CS, Smith RG, Antoni MH, Petronis VM, Weiss S, Derhagopian RP. Optimistic Personality and Psychosocial Well-Being During Treatment Predict Psychosocial Well-Being Among Long-Term Survivors of Breast Cancer. *Health Psychology.* 2005;24(5):508-516.
82. Scheier MF, Carver CS. Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology.* 1985;4(3):219-247.
83. Shekelle RB, Gale M, Ostfeld AM, Paul O. Hostility, risk of coronary heart disease, and mortality. *Psychosom Med.* May 1983;45(2):109-114.
84. Haukkala A, Uutela A, Vartiainen E, McAlister A, Knekt P. Depression and smoking cessation: The role of motivation and self-efficacy. *Addictive behaviors.* 3// 2000;25(2):311-316.
85. Gallo LC, Matthews KA. Understanding the association between socioeconomic status and physical health: do negative emotions play a role? *Psychological bulletin.* Jan 2003;129(1):10-51.
86. Chapman BP, Roberts B, Duberstein PR. Personality and Longevity: Knowns, Unknowns, and Implications for Public Health and Personalized Medicine. *Journal of Aging Research.* 2011;2011:1-24.
87. Donnellan MB, Conger KJ, McAdams KK, Neppl TK. Personal Characteristics and Resilience to Economic Hardship and Its Consequences: Conceptual Issues and Empirical Illustrations. *Journal of Personality.* 2009;77(6):1645-1676.
88. Samuelson M, Carmody J, Kabat-Zinn J, Bratt MA. Mindfulness-Based Stress Reduction in Massachusetts Correctional Facilities. *The Prison Journal.* June 1, 2007 2007;87(2):254-268.
89. Borders A, Earleywine M, Jajodia A. Could mindfulness decrease anger, hostility, and aggression by decreasing rumination? *Aggressive Behavior.* 2010;36(1):28-44.
90. Chen JY, Diamant A, Pourat N, Kagawa-Singer M. Racial/Ethnic Disparities in the Use of Preventive Services Among the Elderly. *American journal of preventive medicine.* 2005;29(5):388-395.

91. Sambamoorthi U, McAlpine DD. Racial, ethnic, socioeconomic, and access disparities in the use of preventive services among women. *Preventive Medicine.* 2003;37(5):475-484.
92. Dutton DB. Explaining the Low Use of Health Services by the Poor: Costs, Attitudes, or Delivery Systems? *American Sociological Review.* 1978;43(3):348-368.
93. Reichard A, Fox MH. Using population-based data to examine preventive services by disability type among dually eligible (Medicare/Medicaid) adults. *Disability and health journal.* Apr 2013;6(2):75-86.
94. Bhagavatula P, Xiang Q, Szabo A, Eichmiller F, Kuthy RA, Okunseri CE. Rural-urban differences in dental service use among children enrolled in a private dental insurance plan in Wisconsin: analysis of administrative data. *BMC oral health.* 2012;12:58.
95. Martin AB, Hardin JW, Veschusio C, Kirby HA. Differences in dental service utilization by rural children with and without participation in head start. *Pediatric dentistry.* Sep-Oct 2012;34(5):107-111.
96. Treanor C, Donnelly M. An international review of the patterns and determinants of health service utilisation by adult cancer survivors. *BMC health services research.* 2012;12:316.
97. Nadpara PA, Madhavan SS, Khanna R, Smith M, Miller LA. Patterns of cervical cancer screening, diagnosis, and follow-up treatment in a state medicaid fee-for-service population. *Population health management.* Dec 2012;15(6):362-371.
98. Chaudhari M, Hubbard R, Reid RJ, et al. Evaluating components of dental care utilization among adults with diabetes and matched controls via hurdle models. *BMC oral health.* 2012;12:20.
99. Koroukian SM, Bakaki PM, Golchin N, Tyler C, Loue S. Mental illness and use of screening mammography among Medicaid beneficiaries. *Am J Prev Med.* Jun 2012;42(6):606-609.
100. Cox B. The effect of service screening on breast cancer mortality rates. *European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation (ECP).* Aug 2008;17(4):306-311.
101. Rogers KC, Wallace JP, Foster SL, Finks SW. Annual influenza vaccination: offering protection beyond infection. *Southern medical journal.* Jul 2012;105(7):379-386.
102. Gillespie CD, Keenan NL, Miner JB, Hong Y. Screening for lipid disorders among adults--National Health and Nutrition Examination Survey, United States, 2005-2008. *MMWR. Morbidity and mortality weekly report.* Jun 15 2012;61 Suppl:26-31.
103. Abdus S, Selden TM. Adherence With Recommended Well-Child Visits Has Grown, But Large Gaps Persist Among Various Socioeconomic Groups. *Health Affairs.* March 1, 2013 2013;32(3):508-515.
104. Benjamins MR. Race/Ethnic Discrimination and Preventive Service Utilization in a Sample of Whites, Blacks, Mexicans, and Puerto Ricans. *Medical care.* 2012;50(10):870-876 810.1097/MLR.1090b1013e31825a31828c31863.
105. Valencia A, Damiano P, Qian F, Warren JJ, Weber-Gasparoni K, Jones M. Racial and Ethnic Disparities in Utilization of Dental Services Among Children in Iowa: The Latino Experience. *American Journal of Public Health.* 2012/12/01 2012;102(12):2352-2359.

106. Pu J, Chewning B. Racial difference in diabetes preventive care. *Research in social & administrative pharmacy : RSAP.* 2012.
107. Burgess DJ, Gravely AA, Nelson DB, et al. A National Study of Racial Differences in Pain Screening Rates in the VA Health Care System. *The Clinical Journal of Pain.* 2013;29(2):118-123 110.1097/AJP.1090b1013e31826a31886ae.
108. Screening for breast cancer: U.S. Preventive Services Task Force Recommendation Statement. *Annals of internal medicine.* 2009;151:716-726.
109. Robb KA, Simon AE, Wardle J. Socioeconomic disparities in optimism and pessimism. *International journal of behavioral medicine.* 2009;16(4):331-338. 110. Gallo LC, de Los Monteros KE, Shivpuri S. Socioeconomic Status and Health: What is the role of Reserve Capacity? *Curr Dir Psychol Sci.* Oct 2009;18(5):269-274.
111. Räikkönen K, Matthews KA, Flory JD, Owens JF. Effects of hostility on ambulatory blood pressure and mood during daily living in healthy adults. *Health Psychology.* 1999;18(1):44-53.
112. Räikkönen K, Matthews KA, Salomon K. Hostility predicts metabolic syndrome risk factors in children and adolescents. *Health Psychology.* 2003;22(3):279-286.
113. Demaree HA, Harrison DW. Physiological and neuropsychological correlates of hostility. *Neuropsychologia.* 1997;35(10):1405-1411.
114. Chapman BP, Shah M, Friedman B, Drayer R, Duberstein PR, Lyness JM. Personality traits predict emergency department utilization over 3 years in older patients. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry.* Jun 2009;17(6):526-535.
115. Halpin LS, Barnett SD. Preoperative State of Mind Among Patients Undergoing CABG: Effect on Length of Stay and Postoperative Complications. *Journal of Nursing Care Quality.* 2005;20(1):73-80.
116. Michal M, Wiltink J, Grande G, Beutel ME, Brahler E. Type D personality is independently associated with major psychosocial stressors and increased health care utilization in the general population. *Journal of affective disorders.* Nov 2011;134(1-3):396-403.
117. Stanton MV, Jonassaint CR, Bartholomew FB, et al. The Association of Optimism and Perceived Discrimination With Health Care Utilization in Adults With Sickle Cell Disease. *Journal of the National Medical Association.* 2010;102(11):1056. 118. Force USPST. Screening for Breast Cancer: Recommendations and Rationale. *Annals of internal medicine.* 2002;137(5):344-346.
119. Force USPST. Screening for Lipid Disorders in Adults: Recommendations and Rationale: U.S. Preventive Services Task Force. *The Internet Journal of Internal Medicine.* 2002;3(2).
120. Expert Panel on D, Evaluation, and Treatment of High Blood Cholesterol in A. EXecutive summary of the third report of the national cholesterol education program (ncep) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (adult treatment panel iii). *JAMA.* 2001;285(19):2486-2497.
121. Services CfMaM. Fact Sheet: Medicare's Proposed Regulation to Implement New Preventive Services Under Medicare Modernization Act In: Services CfMaM, ed. Baltimore, MD: Centers for Medicare and Medicaid Services; 2004.
122. Cook W, Medley D. Proposed hostility and Pharisaic-virtue scales for the MMPI. *J. Appl. Psychol.* 1954;38(6):414-418.

123. Burnam MA, Wells KB, Leake B, Landsverk J. Development of a Brief Screening Instrument for Detecting Depressive Disorders. *Medical care.* 1988;26(8):775-789.
124. Weissman MM, Sholomskas D, Pottenger M, Prusoff BA, Locke BZ. Assessing Depressive Symptoms in Five Psychiatric Populations: A Validation Study. *American Journal of Epidemiology.* September 1, 1977 1977;106(3):203-214.
125. Sherbourne CD, Stewart AL. The MOS social support survey. *Social Science & Medicine.* 1991;32(6):705-714.
126. Rook KS. The negative side of social interaction: Impact on psychological well-being. *Journal of Personality and Social Psychology.* 1984;46(5):1097-1108.
127. Prentice RL, Williams BJ, Peterson AV. On the Regression Analysis of Multivariate Failure Time Data. *Biometrika.* 1981;68(2):373-379.
128. Tindle H, Belnap BH, Houck PR, et al. Optimism, Response to Treatment of Depression, and Rehospitalization After Coronary Artery Bypass Graft Surgery. *Psychosomatic Medicine.* February-March 2012 2012;74(2):200-207.
129. Khallad Y. Dispositional optimism and physical wellbeing: The relevance of culture, gender, and socioeconomic status. *International journal of psychology : Journal international de psychologie.* Jul 24 2012.
130. Haskell WL LI-M, Pate R, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A. Physical Activity and Public Health: Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Circulation.* 2007;116:1081-1093.
131. Champagne CM, de Jonge L, Lovejoy JC, Smith SR, Xie H. Increased visceral fat and decreased energy expenditure during the menopausal transition. *International Journal of Obesity.*2008;32:949.
132. Church TS, Earnest CP, Skinner JS, Blair SN. Effects of different doses of physical activity on cardiorespiratory fitness among sedentary, overweight or obese postmenopausal women with elevated blood pressure: A randomized controlled trial. *JAMA.* 2007;297(19):2081-2091.
133. Elavsky S, McAuley E. Physical Activity and Mental Health Outcomes During Menopause: A Randomized Controlled Trial. *Annals of Behavioral Medicine.* 2007;33(2):132-142.
134. Wallace BA, Cumming RG. Systematic Review of Randomized Trials of the Effect of Exercise on Bone Mass in Pre- and Postmenopausal Women. *Calcif Tissue Int.* 2000/07/01 2000;67(1):10-18.
135. Elavsky S, McAuley E. Physical activity, symptoms, esteem, and life satisfaction during menopause. *Maturitas.* 11// 2005;52(3–4):374-385.
136. Evenson KR, Wilcox S, Pettinger M, Brunner R, King AC, McTiernan A. Vigorous leisure activity through women's adult life: the Women's Health Initiative Observational Cohort Study. *Am J Epidemiol.* Nov 15 2002;156(10):945-953. 137. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J. Pers. Soc. Psychol.* Dec 1994;67(6):1063-1078.
138. Tindle HA, Chang YF, Kuller LH, et al. Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. *Circulation.* Aug 25 2009;120(8):656-662.

139. Scheier MF, Weintraub JK, Carver CS. Coping with stress: divergent strategies of optimists and pessimists. *J. Pers. Soc. Psychol.* Dec 1986;51(6):1257-1264.
140. Srivastava S, McGonigal KM, Richards JM, Butler EA, Gross JJ. Optimism in close relationships: How seeing things in a positive light makes them so. *J. Pers. Soc. Psychol.* Jul 2006;91(1):143-153.
141. Hingle MD, Wertheim BC, Tindle HA, et al. Optimism and Diet Quality in the Women's Health Initiative. *Journal of the Academy of Nutrition and Dietetics.* 2014(0).
142. Progovac A, Chang Y, Matthews K, et al. Psychological Attitudes Predict Smoking Cessation Over Time in the Women's Health Initiative (WHI). *Abstract Published for Poster Presentation, Society for Research on Nicotine and Tobacco. Boston, MA* 2013.
143. Hassmén P, Koivula N, Uutela A. Physical Exercise and Psychological Well-Being: A Population Study in Finland. *Preventive Medicine.* 2000;30(1):17-25.
144. Everson SA, Kauhanen J, Kaplan GA, et al. Hostility and Increased Risk of Mortality and Acute Myocardial Infarction: The Mediating Role of Behavioral Risk Factors. *American Journal of Epidemiology.* July 15, 1997 1997;146(2):142-152.
145. Nguyen HQ, Herting JR, Kohen R, et al. Recreational physical activity in postmenopausal women is stable over 8 years of follow-up. *Journal of physical activity & health.* Jul 2013;10(5):656-668.
146. Schaebenberger O. Introducing the GLIMMIX Procedure for Generalized Linear Mixed Models. *NorthEast SAS Users Group, Inc. Proceedings.* 2005;196(30):1-20.
147. Schou I, Ekeberg O, Sandvik L, Ruland CM. Stability in Optimism-Pessimism in Relation to Bad News: A Study of Women With Breast Cancer. *Journal of Personality Assessment.* 2005/04/01 2005;84(2):148-154.